Gala TECHNOLOGY

Cluster Meeting of Gala Technology 2023

Date: May 17-19, 2023
Venue: Hyatt Regency Osaka Hotel, Japan

8th Annual Conference of AnalytiX
(AnalytiX-2023)

10th Congress of Nano Science and Technology
(Nano-S&T-2023)

Smart Devices Symposium
(SDS-2023)

World Congress of Physics Frontier
(WCPF-2023)

Inaugurate World Chemistry Congress
(IWCC-2023)

9th World Energy Congress
(WEC-2023)

Conference Handbook

Gala Technology Frontier 2024

AnalytiX

10th Annual Conference of AnalytiX

Time: April 22-24, 2024
Place: Nagoya, Japan

Nano-S&T

13th Annual World Congress of Nano Science &Technology

Time: May 20-22, 2024
Place: Osaka, Japan

10th World Congress of Advanced Materials

Time: May 20-22, 2024
Place: Osaka, Japan

01 Conference Highlights

- Big Party to Celebrate with 500+ Participants
- Integrating 5 Parallel Scientific Meetings
- Impressive Distinguished Experts from the Globe to Be Invited
- 1-to-1 Networking with Fellow Colleagues and Scientists
- Diversified Social and Cultural Events
- Matching Opportunities, Submit Your Project Info

02 Recruiting

- Session Chairs, Speakers and Visitors
- Poster Presenters
- Exhibitors & Sponsors
- Partners & Advertisers

03 Coordinators Contact

Ms. Stella for Nano-S&T

Email: stella.nano@gala-tek.com

Ms. Elsa for WCAM

Email: elsa-wcam@eventcomittee.com

Ms. Mia for AnalytiX

Email: mia-analytix@eventcomittee.com

Hosting Organization

World High Technology Society

Supporting Organizations

American Elements

Lukasiewicz – PIAP Institute

Operating Organization

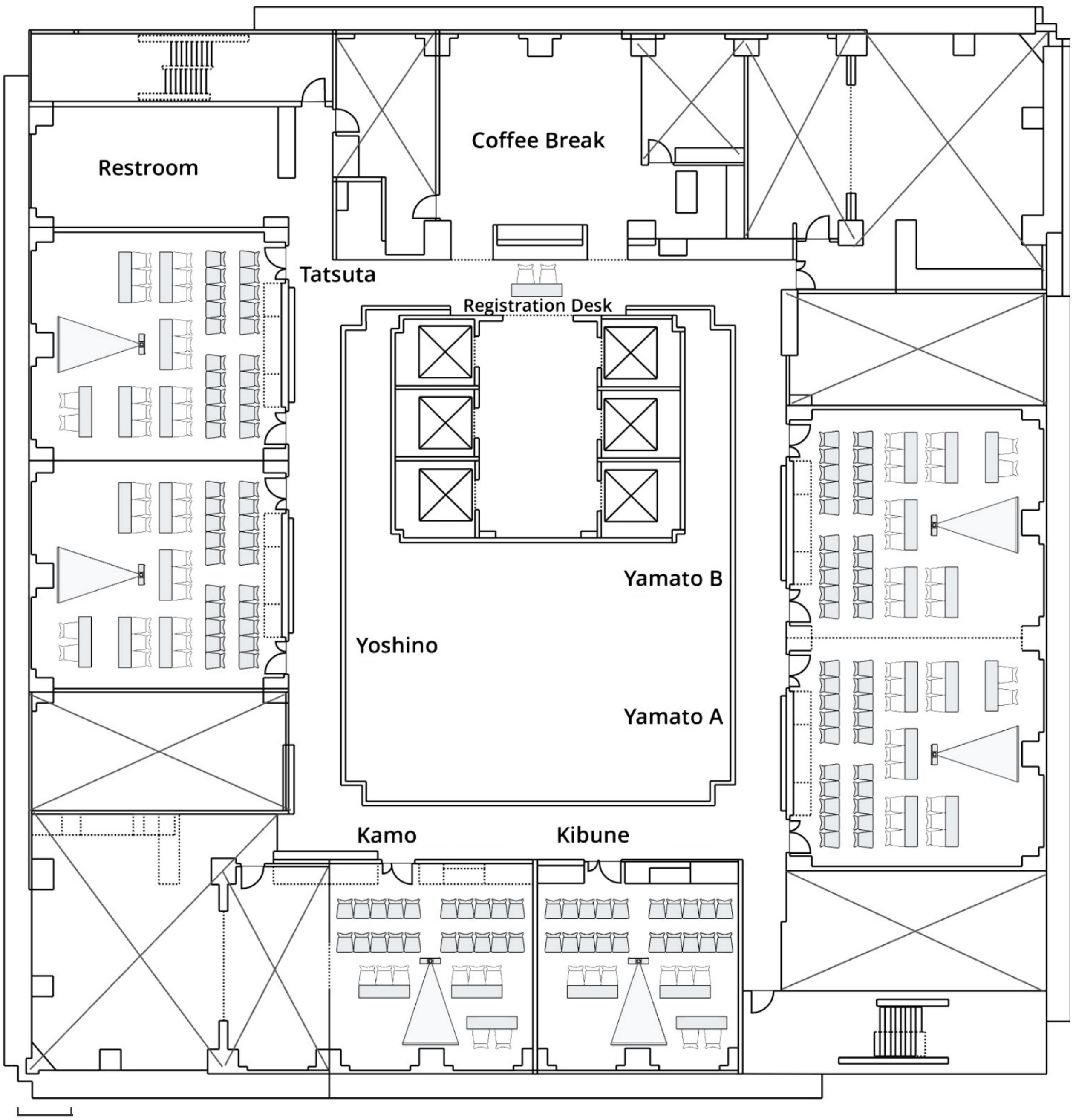
BIT Congress Inc.

Exhibitor

Neware Technology Limited

Floor Plan

5F



Program Committee

Honorary Chairmen

Dr. Norman C. Beaulieu, President, Special Recruited Professor of Beijing University of Posts and Telecommunications, China; Fellow of The Royal Society of Canada; Fellow of Canadian Academy of Engineering; IEEE Fellow, Fellow of the British Society of Engineering and Technology
Dr. Reiko Kuroda, Professor, Chubu University; Emeritus Professor of the University of Tokyo, Japan

Executive Chair

Dr. Xiaodan Mei, President, BIT Group Global Ltd., China

Scientific Advisory Board Members (In Alphabetic Order of Names)

The 8th Annual Conference of AnalytiX-2023

Dr. Ephraim Suhir, Research Professor, Portland State University, USA
Dr. Federico Marini, Professor, University of Rome "La Sapienza", Italy
Dr. Holger L. Meyerheim, Senior Scientist, Max-Planck-Institute for Microstructure Physics in Halle, Germany
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Dr. Uta Klement, Professor, Chalmers University of Technology, Sweden
Dr. William Andrew Maher, Professor, University of Canberra, Australia

The 10th Annual Congress of Nano Science and Technology-2023

Dr. Abdou Djouadi, Professor, University of Nantes, France
Dr. Alexey A. Vereshchaka, Assistant Professor & Leading Researcher, Moscow State Technological University STANKIN, Russia
Dr. Bozena Zgardzinska, Vice-Director, Institute of Physics, Maria Curie-Sklodowska University, Poland
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Dr. Hans Leuenberger, Professor Emeritus, University of Basel, Switzerland; Adjunct Professor, University of Central Florida, USA
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Dr. Jamal Khatib, Professor of Civil Engineering (Construction Materials), University of Wolverhampton, UK
Dr. Jacek Tyczkowski, Professor, Lodz University of Technology, Poland
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Dr. Peng-Sheng Wei, Xi-Wan Chair Professor, National Sun Yat-Sen University, Taiwan
Dr. Qing Wang, Professor, Shandong University of Science and Technology, China
Dr. Shosuke Sasaki, Guest Professor, Osaka University, Japan
Dr. Shuki Yeshurun, Founder, Tortech Nanofibers, Israel
Dr. Somenath Mitra, Professor, New Jersey Institute of Technology, USA
Dr. Somnath Bhattacharyya, Head, Nano-Scale Transport Physics Laboratory, School of Physics, University of the Witwatersrand, South Africa
Dr. Wengang Bi, Distinguished Professor, Hebei University of Technology, China
Dr. Yuichiro Abe, Product Manager, Springer Nature, Japan

Smart Devices Symposium 2023

Dr. Albena Mihovska, Associate Professor, Aarhus University, Denmark
Dr. Alireza Heidari, Professor, California South University, Irvine, USA
Dr. Besim Ben-Nissan, Professor, University of Technology Sydney, Australia
Dr. Damien Deleruyelle, Professor, Claude Bernard University Lyon 1, France
Dr. David Humphrey, Principal Research Scientist, National Physical Laboratory, UK
Dr. Ehsan Asadi, Control Systems Engineer, Scrum Master and Work Assignment Manager, General Motors, Canada
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Dr. Renato de Castro, CEO, SmartUp Consulting Firm, Italy
Dr. Roberto Sabatini, Professor and Head, RMIT University, Australia
Dr. Shaomin Wu, Professor, University of Kent, UK
Dr. Stephan Reiff-Marganiec, Head of Computing, University of Derby, UK
Dr. Wei Liu, Professor, Georgia Gwinnett College, USA
Dr. Zhaoyang (Joe) Dong, Professor, University of New South Wales, Australia (IEEE Fellow)
Dr. Zhengchun Peng, Endowed Professor and Director of Center for Stretchable Electronics and Nanodevices, Shenzhen University, China
Mr. Bechtold Franz, CEO, VIA Electronic GH, Germany
Mr. Eric Prevost, Vice President, Oracle, France
Mr. John David, CEO and Founder, Amnick, UK

The Inaugurate World Chemistry Congress 2023

Dr. Alexander V. Vakhrushev, Professor, Kalashnikov Izhevsk State Technical University, Russia
Dr. Ayan Samanta, Principal Investigator, Polymer Chemistry, Uppsala University, Sweden
Dr. Cande Rogert, Senior Director, Illumina, USA
Dr. Christine Hahn, Chair & Associate Professor, Department of Chemistry, Texas AM University-Kingsville, USA
Dr. Huijun Zhao, Professor & Director of Centre for Clean Environment and Energy, Griffith University, Australia
Dr. Igor Zhitomirsky, Distinguished Engineering Professor, McMaster University, Canada
Dr. Ilya G. Kaplan, Professor, National Autonomous University of Mexico, Mexico
Dr. Jang-Kyo Kim, Chair Professor of Mechanical and Aerospace Engineering, Hong Kong University of Science & Technology, Hong Kong, China
Dr. John Zhou, Professor, University of Technology Sydney, Australia
Dr. Junsuk Rho, Professor, Pohang University of Science and Technology (POSTECH), South Korea
Dr. Manuel P. Soriaga, Principal Investigator, California Institute of Technology (Caltech), USA
Dr. Marcel Van De Voorde, Fellow, WAAS; Professor, University of Technology Delft, The Netherlands
Dr. Michael J. Heller, Professor, University of California San Diego, USA
Dr. Osman Adiguzel, Professor, Firat University, Turkey
Dr. Owen J. Guy, Professor, Head of Chemistry, Swansea University, USA
Dr. Renal Backov, Professor, Massachusetts Institute of Technology, USA

Dr. Richard M. De La Rue, Fellow of the Royal Academy of Engineering; Honorary Professor of Optoelectronics, University of Glasgow, UK
Dr. Terence Goh, Regional Energy Storage Consultant & Advisor, Sunseap Group; Associate Professor, ECE, National University of Singapore, Singapore
Dr. Vladimir Tsukruk, APS, MRS, ACS Fellow; Distinguished Professor, Georgia Institute of Technology, USA
Dr. Vladislav Sadykov, Head of lab, Professor, Boreskov Institute of Catalysis, Russia
Dr. Wei Sun, Professor, Drexel University, USA

World Congress of Physics Frontier 2023

Dr. Ashraf Uddin, Professor, University of New South Wales, Australia
Dr. Inge S. Helland, Professor Emeritus, University of Oslo, Norway
Dr. Ioannis N. Velonakis, University of Athens, Greece
Dr. Koen Bertels, Professor, 2QBeeX, Belgium
Dr. Luba Tchertanov, Research Director, Centre Borelli, ENS Paris-Saclay, France
Dr. Sergey Alexandrovich Serov, Leading Researcher, Institute of Theoretical and Mathematical Physics, Russian Federal Nuclear Center, Russia
Dr. Yoshihisa Kitazawa, Professor, KEK, Japan
Prof. Yury Stepanyants, Professor, University of Southern Queensland, Australia

The 9th World Energy Congress 2023

Dr. Ali Cheknane, Professor, Amar Telidji University of Laghouat, Algeria
Dr. Bin Yang, Associate Professor, Washington State University, USA
Dr. Biplab Rakshi, Managing Director, Atomic Acquisitions, UK
Dr. Cengiz S. Ozkan, Professor, University of California-Riverside, USA
Dr. Gento Mogi, Associate Professor, The University of Tokyo, Japan
Dr. Gordon Huang, Fellow, Canadian Academy of Engineering; Canada Research Chair & Professor, University of Regina, Canada
Mr. Hang Yue, CEO/Founder, Engineering Intelligence on You (EIonU); Healthcare Data Analyst, Healthcare Data Practical Science, Johns Hopkins Healthcare LLC, USA
Dr. Maciej Dzikuc, Researcher, University of Zielona Gora, Poland
Dr. Marcantonio Catelani, Professor, University of Florence, Italy
Mr. Ray Noble, Operations Director, Welink Energy, UK
Dr. Renal Backov, Professor, CRPP-UPR CNRS University of Bordeaux, France
Dr. Rocio Perez de Prado, Associate Professor, University of Jaen, Spain
Dr. Sam Goldman, CEO, D.light, USA
Dr. Shixue Dou, Distinguished Professor, University of Wollongong, Australia
Dr. Zhao Ma, Professor, China Electric Power Research Institute, China

Conference Coordinators

Ms. Mia Lee for AnalytiX, Ms. Stella Wang for Nano S&T, Ms. Judy Du for SDS, Ms. Snowy Liang for WCPF, Ms. Cathy Ma for IWCC, Ms. Belinda Wang for WEC

Welcome Remark

Dear Friends and Colleagues,

It is our great pleasure to welcome you to participate and share your expertise in Cluster Meeting of Gala Technology 2023 (Galatech-2023), which is now being held through May 17-19, 2023 in Hyatt Regency Osaka Hotel, Japan.

Galatech-2023 will last for three days and focuses on a variety of hot topics on analytical chemistry, Nano R&D, smart devices, physics, new energy and sustainable world. It has attracted impressive distinguished experts and scientists from all over the world to reunite during the pandemic period so as to reactivate the international communication face to face. The world has dramatically changed since the COVID-19 broke out, but our scientists never stop their steps in exploration and research of nature and life. As you know, COVID-2019 brought so many financial difficulties to us and caused pain-taking in organizing in-person events. But as long as we remain united and resolute, we'll overcome it.

And eventually, we make it happen by integrating six conferences together, which are The 8th Annual Conference of AnalytiX-2023, The 10th Annual Congress of Nano Science and Technology-2023, Smart Devices Symposium 2023, The Inaugurate World Chemistry Congress 2023, World Congress of Physics Frontier 2023, and The 9th World Energy Congress 2023. With persistence and hard-work, we fortunately have gathered over 350 outstanding speakers to Osaka to the cluster meeting. There is no doubt that such a diversified program can rebuild our community for the research experts to present their success and continue to promote the international cooperation.

Apart from the exciting program, this meeting provides an unique opportunity for you to explore Osaka, which is the second largest city of Japan after Tokyo and has an international reputation for very friendly people. I hope you have fun in Osaka.

Finally, we are very happy to have you all with us, and enjoy the conference.

Sincerely yours,

Dr. Xiaodan Mei
Executive Chair
Galatech-2023, Osaka, Japan

Table of Content

Introduction to Program
List of Organizations and Event Organizers
Welcome Remark
Table of Content
Event Schedule

Keynote Forum
Speakers' Profiles
Dr. Reiko Kuroda, Dr. Hans Leuenberger, Dr. Young-Seok Shon, Dr. M. Saiid Saiidi, Dr. Peter B. Harrington, Dr. Georgi Dimitrov Todorov, Dr. Sergei V. Shabanov

The 8th Annual Conference of AnalytiX-2023

AnalytiX 01: Frontiers in Microscopy and Molecular Imaging
Speakers' Profiles
Dr. Santiago Gomez, Dr. Jay Theodore Cremer, Dr. Daniel Dziob, Dr. Anna E. Walkiewicz, Dr. Knut Moeller, Dr. Asuka Sakamoto, Dr. Ilona Mullerova, Dr. Paulo Ferreira

AnalytiX 02: Crystallography and Crystal Engineering
Speakers' Profiles
Dr. Masatomo Yashima, Dr. Soshu Kirihara, Dr. Yuzuru Miyazaki, Dr. Kenji Yoza, Dr. Toru Asaka, Dr. Marzena Rams-Baron, Dr. Daisuke Urushihara, Dr. Yoshitake Masuda, Dr. Junko Habasaki

AnalytiX 03: Environmental & Pharmaceutical Analysis
Speakers' Profiles
Dr. Hubert Zipper, Dr. Yang-Wei Lin, Dr. Erik R. Christensen, Dr. Ciprian Draganescu, Dr. Magdalena Maj-Zurawska, Dr. Herlina Abdul Rahim, Dr. Michael G. Tovey, Dr. Shashi Ram

AnalytiX 04: Mass Spectrometry, Raman & NMR & IR Spectroscopy
Speakers' Profiles
Dr. Shoji Yamamoto, Dr. Michel Mermoux, Dr. David Jenkins, Dr. Zenzaburo Tozuka, Dr. Eriks Kupce, Dr. Gianluca Grenci, Dr. Ciprian Mihai Cirtiu, Dr. Anthony Nonell

AnalytiX 05: Novel Bioanalysis Method & Technology
Speakers' Profiles
Dr. Makoto Sawano, Dr. Ming-Tsang Wu, Dr. Lea Pogacnik, Dr. Nitza Davidovitch, Dr. Mai Thanh Duc, Dr. Yoshihide Tokunou, Dr. Daisuke Ishikawa, Dr. John J. Kasianowicz

AnalytiX 06: X-ray Spectroscopy and Gamma Spectroscopy
Speakers' Profiles
Dr. Masahito Uchikoshi, Dr. Wataru Yashiro, Dr. Jun-ichi Yoshimura, Dr. Kiyoaki Tanaka, Dr. Hirokazu Fukidome, Dr. Anna Jasinska, Dr. Miroslaw Wachowiak, Dr. Ofelia Popescu and Dr. Nicoleta Leonte

AnalytiX 07: Bioanalysis in Human Diseases & Infectious Diseases
Speakers' Profiles
Dr. Ji Yong Lee, Dr. Avraham Dayan, Dr. Anna Picca, Dr. Matteo Tosato, Dr. Makoto Kano, Dr. Sunil Palchaudhuri, Dr. Hai-Shan Zeng, Dr. John Miles

AnalytiX 08: Terahertz Spectroscopy and Laser Spectroscopy
Speakers' Profiles
Dr. Masatoshi Kajita, Dr. Jay Theodore Cremer, Dr. Kohei Yoshimatsu, Dr. Herve Piombini, Dr. Victor Pavlov

AnalytiX 09: Chemometrics and Chromatography
Speakers' Profiles
Dr. Peter B. Harrington, Dr. Federico Marini, Dr. Jean-Michel Roger, Dr. Gabriel Vivo-Truyols, Dr. Riccardo Calvani, Dr. Johan Hultman, Dr. Xanel Vecino Bello, Dr. Letricia Barbosa-Pereira, Dr. Nilesh K. Joshi

AnalytiX 10: Materials in Analytical Chemistry
Speakers' Profiles
Dr. Jianing Sun, Dr. Christian J. Engelsen, Mr. Mitsuru Nishikawa, Dr. Ichiro Imae, Dr. Mariusz Pietrzak, Dr. Alexandre Carella, Dr. K. M. Imran Bashir

AnalytiX 11: Sensors and Microarrays
Speakers' Profiles
Dr. Mohsen Razzaghi, Dr. Takahiro Tsukahara, Dr. Weiwei Dang, Dr. Robert Sundberg, Dr. Yasuhiro Iida, Dr. Chih-Ching Huang, Dr. Monica Florescu, Dr. Gabay Isahar

AnalytiX 12: Frontiers in Analytical Chemistry
Speakers' Profiles
Dr. Luc Moens, Dr. Masashi Nojima, Dr. Joel B. Tellinghuisen, Dr. Yuji Yamashita, Dr. Stepan Urban, Dr. Yasutake Toyoshima, Dr. Rafi Shikler, Dr. Takayuki Morokuma

AnalytiX 13: Video Forum
Speakers' Profiles
Dr. Konstantin N. Mikhelson, Dr. Michael I. Petelin, Dr. Vladimir Matveevich Gruznov, Dr. Shengyong Xu, Dr. Amitesh Paul, Dr. Eteng E. Ofem, Dr. Liudmila Kveglis, Dr. Andrey Novikov-Borodin, Dr. Victor Dyomin

The 10th Annual Congress of Nano Science and Technology-2023

NANO 01: Nanotech for Applications
Speakers' Profiles
Dr. Yoshitake Masuda, Dr. Wilhelm-Alexander Buesgen, Dr. Kofi Adu, Dr. Janez Trontelj, Dr. Sylvain Blayac, Dr. Sandra Bischof, Dr. Claudia Riccardi

NANO 02: New Nanomaterials (I)
Speakers' Profiles
Dr. Rachel Desfeux, Dr. Jean-Louis Bobet, Dr. Daniel Qi Tan, Dr. Soyeon Kim, Dr. Qing Wang

NANO 03: New Nanomaterials (II)
Speakers' Profiles
Dr. Takayoshi Ishimoto, Dr. Alessandra Pinna, Dr. Anil Kumar, Dr. Laleh Alisaraie, Dr. Kun Deng, Dr. Xin Shi, Dr. Lin-Jun Wang, Dr. Loi Tonthat

NANO 04: Nanomedicine and Nanobiotechnology
Speakers' Profiles
Dr. Aude Iwaniec, Dr. Christelle Monville, Dr. Shuki Yeshurun, Dr. Anyanee Kamkaew, Dr. Yuzhen Ouyang

NANO 05: Breaking Research of Nano Science and Technology
Speakers' Profiles
Dr. Jie Du, Dr. Shuji Ogata, Dr. Jingtao Sun, Dr. Yu-Tai Tao, Dr. Rugiyya Aliyeva, Dr. Rasika N. Dhavse

NANO 06: New Nanomaterials (III)
Speakers' Profiles
Dr. Antoine Barbier, Dr. Xizu Wang, Dr. Shuki Yeshurun, Dr. Yuanmin Du, Dr. Rachel Desfeux, Dr. Chisato Takahashi

NANO 07: Nano Electronics, Nano Optics, Nano Photonics and Nanomagnetism
Speakers' Profiles
Dr. Chenglong Jia, Dr. Ken Morita, Dr. Satoru Yoshimura, Dr. Masaaki Imamura, Dr. Makiko Kobayashi, Dr. Feihong Jia, Dr. Yan Li

NANO 08: Video Forum
Speakers' Profiles
Dr. Francesco Romano, Dr. Valentyn Nastasenko, Dr. Xin Li, Dr. Yiwen Zhang, Dr. Shiling Zhang, Dr. Gianluca Memoli, Dr. Zulkhair Mansurov

Smart Devices Symposium 2023

SDS 01: Intelligent Materials for Smart Devices
Speakers' Profiles
Mr. Filippo Di Giovanni, Dr. Alicja Krella, Dr. Ichiro Imae, Dr. M. Saiid Saiidi

SDS 02: Technology Innovation in Smart Devices
Speakers' Profiles
Dr. Maciej Cader, Prof. Stephan Reiff-Marganiec, Dr. Jacek Kolacz, Dr. Luca Muratore, Dr. Aaron Bramson, Dr. Ayahiko Niimi, Dr. Albena Mihovska, Marc Bechtold, Dr. Nada Nasser Said Al Subhi, Dr. Antti Rasila

SDS 03: Smart Devices and Smart World Applications
Speakers' Profiles
Dr. Evangelos Bekiaris, Dr. Harald Schwarz, Dr. Felix T. S. Chan, Mr. Pai-En Yang, Dr. Yukiko Nakata, Dr. Rui Cortesao, Dr. Cheng-Yuan Ho, Mr. Zeev Bohbot, Dr. Michal Szermer

SDS 04: Video Forum
Speakers' Profiles
Dr. Kelvin Tan, Dr. Rahul Kalyankar, Dr. Atul Patil, Dr. Andrey Pavlychev, Dr. Carlos Frajuca

The Inaugurate World Chemistry Congress 2023

IWCC 01: Chemistry and Catalysis Science
Speakers' Profiles
Dr. Xian Chen, Dr. Edwin J. Routledge, Dr. Wenliang Zhu, Dr. Timor Baasov, Dr. Anton Friedl, Dr. Christine Hahn, Dr. Yiannis Deligiannakis, Dr. Maria Louloudi, Dr. Mariya Trifonova, Dr. Kenji Takahashi, Dr. Johan G. Alauzun, Dr. Redouane Borsali

IWCC 02: Video Forum
Speakers' Profiles
Dr. Lydia Bondareva, Dr. Sheng-Kuei Chiu

The World Congress of Physics Frontier 2023

WCPF 01: Video Forum
Speakers' Profiles
Dr. Inge S. Helland, Dr. Yoshihisa Kitazawa, Dr. Luba Tchertanov, Dr. Ioannis N. Velonakis, Dr. E. M. Ibragimova

The 9th World Energy Congress 2023

WEC 01: Latest Perspectives on Global Energy Policies and Utilization
Speakers' Profiles
Dr. Janet Xuanli Liao, Dr. Yong Chen, Dr. Daniela Werlich, Dr. Yavor Petrov Sofronov, Dr. Gene Hinkle, Dr. Tiande Mo, Dr. Di Yun, Ms. Sarah Eaton, Mr. Juha Poikola

WEC 02: Novel Technologies on Green Energy and Energy Storage
Speakers' Profiles
Dr. Hideaki Kasai, Dr. Jana Vejpravova, Dr. Martin Kalbac, Mr. Tjerk Reijenga, Dr. Rositsa Velichkova, Dr. Hua Tian, Ms. Ya-Wen Lin

WEC 03: Video Forum
Speakers' Profiles
Dr. Glen Currie, Dr. Theo Tzedakis, Dr. K. S. Saritha, Mr. Nirmal Halder, Ms. Katarzyna Wypychewicz

Posters & Papers
Speakers' Profiles
Dr. Elzbieta Malinowska, Dr. Frantisek Kacik, Dr. Yu-Cing Li, Dr. Xanel Vecino Bello, Dr. Stefanie Gartner, Dr. Dmitry Markielovich Aronbaev, Dr. Valentyn Nastasenko, Dr. Jianhua Dai, Dr. Jianzhi Hu, Dr. Vladimir G. Tkachenko, Hisham Hassan Ahmed Mohammedkhair, Dr. Letricia Barbosa-Pereira, Dr. Zhengping Fang, Dr. Venceslav Kaucic, Nurul Kusuma Wardani, Ms. Taina Nicolau de Campos, Dr. Ghada Nabil Hassanein, Dr. Kae-Long Lin, Dr. Yanfang Gao, Dr. Zhiwei-Wang, Dr. Xiaoqi Zhao, Dong Wang, Dr. Ju-Yin Liu

Event Schedule

Time: May 17-19, 2023

Venue: Hyatt Regency Osaka, Japan

Date	Time	Program	Place
May 16, 2023 (Tuesday)	09:00-21:00	**Registration**	Lobby, 1F
May 17, 2023 (Wednesday)	09:00-09:10	**Opening Ceremony**	Sapphire+ Crystal, 2F
	09:10-12:10	**Keynote Forum**	
	12:30-13:30	**Lunch**	Regency DE, 3F
	14:00-17:40	**AnalytiX 01:** Frontiers in Microscopy and Molecular Imaging	Tatsuta, 5F
	14:00-18:05	**AnalytiX 02:** Crystallography and Crystal Engineering	Yoshino, 5F
	14:00-17:40	**AnalytiX 03:** Environmental & Pharmaceutical Analysis	Kamo, 5F
	14:00-17:15	**NANO 01:** Nanotech for Applications	Yamato A, 5F
	14:00-16:25	**NANO 02:** New Nanomaterials (I)	Yamato B, 5F
	14:00-18:20	**IWCC 01:** Chemistry and Catalysis Science	Kibune, 5F
	18:30-20:30	**Welcome Banquet**	Crystal Ballroom, 2F
May 18, 2023 (Thursday)	09:00-12:40	**AnalytiX 04:** Mass Spectrometry, Raman & NMR & IR Spectroscopy	Tatsuta, 5F
	09:00-12:40	**AnalytiX 05:** Novel Bioanalysis Method & Technology	Yoshino, 5F
	09:00-12:40	**AnalytiX 06:** X-ray Spectroscopy and Gamma Spectroscopy	Kamo, 5F
	09:00-12:40	**NANO 03:** New Nanomaterials (II)	Yamato A, 5F
	09:00-11:10	**NANO 04:** Nanomedicine and Nanobiotechnology	Yamato B, 5F
	09:00-12:20	**WEC 01:** Latest Perspectives on Global Energy Policies and Utilization	Kibune, 5F
	12:30-13:30	**Lunch**	Regency DE, 3F
	14:00-17:40	**AnalytiX 07:** Bioanalysis in Human Diseases & Infectious Diseases	Tatsuta, 5F
	14:00-16:10	**AnalytiX 08:** Terahertz Spectroscopy and Laser Spectroscopy	Yoshino, 5F
	14:00-18:05	**AnalytiX 09:** Chemometrics and Chromatography	Kamo, 5F
	14:00-15:45	**SDS 01:** Intelligent Materials for Smart Devices	Yamato A, 5F
	16:00-18:10	**NANO 05:** Breaking Research of Nano Science and Technology	
	14:00-16:50	**NANO 06:** New Nanomaterials (III)	Yamato B, 5F
	14:00-17:40	**SDS 02:** Technology Innovation in Smart Devices	Kibune, 5F
May 19, 2023 (Friday)	09:00-12:15	**AnalytiX 10:** Materials in Analytical Chemistry	Tatsuta, 5F
	09:00-12:40	**AnalytiX 11:** Sensors and Microarrays	Yoshino, 5F
	09:00-12:40	**AnalytiX 12:** Frontiers in Analytical Chemistry	Kamo, 5F
	09:00-12:15	**NANO 07:** Nano Electronics, Nano Optics, Nano Photonics and Nanomagnetism	Yamato A, 5F
	09:00-12:20	**SDS 03:** Smart Devices and Smart World Applications	Yamato B, 5F
	09:00-12:15	**WEC 02:** Novel Technologies on Green Energy and Energy Storage	Kibune, 5F
	12:30-13:30	**Lunch**	Regency DE, 3F
May 17-19, 2023	09:00-17:30	Posters & Exhibition	5F

Note: 2F=2nd Floor, 5F=5th Floor

Program

Time: May 17-19, 2023

Venue: Hyatt Regency Osaka, Japan

Registration

Time: 09:00-21:00, May 16, 2023 (Tuesday); Place: Lobby, 1F, Hyatt Regency Osaka

Opening Ceremony

Time: 09:00-09:10, May 17, 2023 (Wednesday); Place: Sapphire + Crystal, 2F, Hyatt Regency Osaka

Keynote Forum

Time: 09:10-12:10, May 17, 2023 (Wednesday); Place: Sapphire + Crystal, 2F, Hyatt Regency Osaka

Moderator	***Dr. Peter B. Harrington,*** Professor, Ohio University, USA
09:10-09:15	**Moderator's Introduction**
09:15-09:40	***Title:*** *Chiroptical Spectroscopy in the Solid State* ***Dr. Reiko Kuroda,*** Professor, Chubu University; Emeritus Professor of the University of Tokyo, Japan
09:40-10:05	***Title:*** *The Virtual Patient to Test Drugs In-silico* ***Dr. Hans Leuenberger,*** Professor Emeritus, University of Basel, Switzerland
10:05-10:30	***Title:*** *Catalytic Activity and Colloidal Stability of Lipid-Palladium Nanoparticle Assemblies in Water* ***Dr. Young-Seok Shon,*** Professor, California State University, USA
10:30-10:55	***Title:*** *Integrating Smart Metals and Damage Resistant Materials in Replaceable Components for Bridges of the Future* ***Dr. M. Saiid Saiidi,*** Professor Emeritus, University of Nevada, Reno, USA
10:55-11:20	***Title:*** *Machine Learning Opportunities for Chemical Analysis* ***Dr. Peter B. Harrington,*** Professor, Ohio University, USA
11:20-11:45	***Title:*** *Strategy of Hybrid Concept for the Sustainable "Coal-to Green Energy Transition" - Plan 2050 in Bulgaria* ***Dr. Georgi Dimitrov Todorov,*** Professor, Head of CoE "Mechatronics and Clean Technologies", Dean of the Faculty of Industrial Technology, Technical University of Sofia, Bulgaria
11:45-12:10	***Title:*** *Bound States in the Continuum and Non-linear Wave Phenomena* ***Dr. Sergei V. Shabanov,*** Professor, University of Florida, USA (Video)

The 8th Annual Conference of AnalytiX-2023

AnalytiX 01: Frontiers in Microscopy and Molecular Imaging

Time: 14:00-17:40, May 17, 2023 (Wednesday); Place: Tatsuta, 5F, Hyatt Regency Osaka

Chair	***Dr. Jay Theodore Cremer,*** Chief Scientist, Adelphi Technology, Inc., USA
Co-Chair	***Dr. Knut Moeller,*** Professor for Medical Informatics, Furtwangen University, Germany
14:00-14:05	**Chair's Introduction**
14:05-14:30	***Title:*** *Polarized Red Laser 650 nm Microscopy: Imaging Thick Sections of Teeth* ***Dr. Santiago Gomez,*** Professor, University of Cadiz, Spain

14:30-14:55	***Title:*** *Polarized, Cold Neutron Microscopy with Magnetic Compound Refractive Lenses* ***Dr. Jay Theodore Cremer,*** Chief Scientist, Adelphi Technology, Inc., USA
14:55-15:20	***Title:*** *Microscope Stage for Cells Live Measurements under Constant Magnetic Force - Design, Develop and Research* ***Dr. Daniel Dziob,*** Jagiellonian University Medical College, Poland
15:20-15:45	***Title:*** *Ultrathin Metal Coatings as a Solution for Successful SEM Imaging of Nano-electrospinning Fibers* ***Dr. Anna E. Walkiewicz,*** Application Specialist, Quorum Technologies Limited, UK
15:45-16:00	***Coffee Break***
16:00-16:25	***Title:*** *Real-Time Lung Perfusion Monitoring with Electrical Impedance Tomography* ***Dr. Knut Moeller,*** Professor for Medical Informatics, Furtwangen University, Germany
16:25-16:50	***Title:*** *Changes in Pelvic Alignment in a Woman Before and After Childbirth, Using Three-Dimensional Pelvic Models Based on Magnetic Resonance Imaging: A Longitudinal Observation Case Report* ***Dr. Asuka Sakamoto,*** Lecturer, Nishikyusyu University, Japan
16:50-17:15	***Title:*** *Low Energy Electron Microscopy for Advanced Materials* ***Dr. Ilona Mullerova,*** Director, Institute of Scientific Instruments, Czech Academy of Sciences, Czech Republic
17:15-17:40	***Title:*** *Understanding Catalyst Nanoparticles for Energy Conversion by Advanced Electron Microscopy* ***Dr. Paulo Ferreira,*** Full Professor, Department of Mechanical Engineering at IST, University of Lisbon, Portugal

AnalytiX 02: Crystallography and Crystal Engineering

Time: 14:00-18:05, May 17, 2023 (Wednesday); Place: Yoshino, 5F, Hyatt Regency Osaka

Chair	***Dr. Yuzuru Miyazaki,*** Professor, Tohoku University, Japan
Co-Chair	***Dr. Toru Asaka,*** Associate Professor, Nagoya Institute of Technology, Japan
14:00-14:05	**Chair's Introduction**
14:05-14:30	***Session Keynote Speech*** ***Title:*** *Structural Analysis and Design of Novel Ion Conductors* ***Dr. Masatomo Yashima,*** Professor, Tokyo Institute of Technology, Japan
14:30-14:55	***Title:*** *Stereolithographic Additive Manufacturing of Dielectric Microlattices in Photonic Crystals for Terahertz Wave Control* ***Dr. Soshu Kirihara,*** Professor, Osaka University, Japan
14:55-15:20	***Title:*** *Superspace Approach to the Incommensurate Crystal Structure of Higher Manganese Silicide-Based Thermoelectric Materials* ***Dr. Yuzuru Miyazaki,*** Professor, Tohoku University, Japan
15:20-15:45	***Title:*** *A New Method to Co-crystallize Organics with Chaperone Compounds* ***Dr. Kenji Yoza,*** Application Scientist, Bruker, Japan
15:45-16:00	***Coffee Break***

16:00-16:25 ***Title:*** *Crystal Structure and Magnetocrystalline Anisotropy in Hexaferrites, Examined by Electron Microscopy and Diffraction Techniques*
Dr. Toru Asaka, Associate Professor, Nagoya Institute of Technology, Japan

16:25-16:50 ***Title:*** *Unusual Dielectric Response of Sizable-Glass Formers with Polar Rotors*
Dr. Marzena Rams-Baron, Associate Professor, University of Silesia in Katowice, Poland

16:50-17:15 ***Title:*** *High Pressure Synthesis and Structural Phase Transition of the Strontium Tungstate* $Sr_3W_2O_9$
Dr. Daisuke Urushihara, Assistant Professor, Nagoya Institute of Technology, Japan

17:15-17:40 ***Title:*** *Liquid Phase Crystal Growth of Metal Oxide Nanostructures and Their Gas/Molecular Sensing -*SnO_2*,* TiO_2*, ZnO-*
Dr. Yoshitake Masuda, Senior Research Scientist, National Institute of Advanced Industrial Science and Technology, Japan

17:40-18:05 ***Title:*** *Structural Changes in Porous Lithium Disilicate and Lithium Metasilicate Systems during Formation of Voids and Self-healing Processes Examined by Molecular Dynamics Simulations*
Dr. Junko Habasaki, Assistant Professor, Tokyo Institute of Technology, Japan

AnalytiX 03: Environmental & Pharmaceutical Analysis

Time: 14:00-17:40, May 17, 2023 (Wednesday); Place: Kamo, 5F, Hyatt Regency Osaka

Chair ***Dr. Erik R. Christensen,*** Distinguished Professor Emeritus, University of Wisconsin-Milwaukee, USA

Co-Chair ***Dr. Magdalena Maj-Zurawska,*** Professor, University of Warsaw, Poland

14:00-14:05 **Chair's Introduction**

14:05-14:30 ***Title:*** *Qualitative Screening for Fungicide Dithiocarbamates Using QuEChERS Methodology*
Dr. Hubert Zipper, Research Manager, CVUA Stuttgart, Germany

14:30-14:55 ***Title:*** *Enhanced Catalytic Performance of* $CuFeS_2$ *Chalcogenides for Activation of Persulfate towards Decolorization and Disinfection of Pollutant in Water*
Dr. Yang-Wei Lin, Professor, Department of Chemistry, National Changhua University of Education, Taiwan

14:55-15:20 ***Title:*** *Sources of Organic Pollutants and Trace Elements in the Environment*
Dr. Erik R. Christensen, Distinguished Professor Emeritus, University of Wisconsin-Milwaukee, USA

15:20-15:45 ***Title:*** *Controversies, Consensus and Collaboration in the Use of -I-131 Therapy in the Differentiated Thyroid Cancer*
Dr. Ciprian Draganescu, Head of Nuclear Medicine Department, University Hospital of Martinique, France

15:45-16:00 ***Coffee Break***

16:00-16:25 ***Title:*** *Voltammetric and Spectrophotometric Studies on DNA Interacting with Dauno and Doxorubicin and Their Amidino Derivatives*
Dr. Magdalena Maj-Zurawska, Professor, University of Warsaw, Poland

16:25-16:50 ***Title:*** *Understanding Microbial Contaminants Occurrences in Domestic Water Supply Systems Using Non-Invasive Spectroscopic Techniques*
Dr. Herlina Abdul Rahim, Professor, University Technology of Malaysia, Malaysia

16:50-17:15 ***Title:*** *A Novel Bioassay with Improved Sensitivity, Dynamic Range and Serum Tolerance for the Quantification of the ADCC Activity of Therapeutic Antibodies*
Dr. Michael G. Tovey, Managing Director, Svar Life Science, France

17:15-17:40 ***Title:*** *Sustainability (CSR): Energy Efficiency in Building Sector and Its Environmental Impact*
Dr. Shashi Ram, Assistant Professor, National Institute of Technology Warangal, India

AnalytiX 04: Mass Spectrometry, Raman & NMR & IR Spectroscopy

Time: 09:00-12:40, May 18, 2023 (Thursday); Place: Tatsuta, 5F, Hyatt Regency Osaka

Chair ***Dr. Michel Mermoux,*** Research Director, LEPMI-CNRS, France
Co-Chair ***Dr. Ciprian Mihai Cirtiu,*** Head of Trace Metals Division, Institut National de Sante Publique du Quebec, Canada

09:00-09:05 **Chair's Introduction**

09:05-09:30 ***Session Keynote Speech***
Title: *Possible Ring Exchange and Chiral Spin Fluctuations in Quasiperiodic Planar Antiferromagnets: Raman Observations*
Dr. Shoji Yamamoto, Professor, Hokkaido University, Japan

09:30-09:55 ***Title:*** *High Temperature Oxidation of Zircaloy-4 under Conditions Simulating a Loss of Cooling Accident in Nuclear Plants Spent Fuel Pools Examined with Raman Imaging and 18O Tracer Techniques*
Dr. Michel Mermoux, Research Director, LEPMI-CNRS, France

09:55-10:20 ***Title:*** *Detecting Falsified Oral Contraceptives with Visual Assessment and Diffuse Reflectance Spectroscopy: A Need to Supplement Traditional Pharmacopeia Techniques*
Dr. David Jenkins, Scientist II, Product Quality and Compliance, FHI 360, USA

10:20-10:45 ***Title:*** *Microdose Pharmacogenetic Study and MIST Evaluation of 14C- Tolubutamide in Healthy Subjects by Utility of Mass Spectrometry*
Dr. Zenzaburo Tozuka, Professor, Osaka University, Japan

10:45-11:00 ***Coffee Break***

11:00-11:25 ***Title:*** *Design of NMR Supersequences: Ten 2D Spectra in a Single Measurement*
Dr. Eriks Kupce, Principal Scientist, Bruker BioSpin, UK

11:25-11:50 ***Title:*** *IR Imaging/Spectroscopy on Biological Samples*
Dr. Gianluca Grenci, Research Assistant Professor, National University of Singapore, Singapore

11:50-12:15 ***Title:*** *Progress in the Analysis of Metal Nanoparticles to Assess Human Exposure*
Dr. Ciprian Mihai Cirtiu, Head of Trace Metals Division, Institut National de Sante Publique du Quebec, Canada

12:15-12:40 ***Title:*** *Determination of the $^{144}Ce/^{238}U$ Ratio in Spent Nuclear Fuel Samples by Double Spike Isotope Dilution Mass Spectrometry*
Dr. Anthony Nonell, Researcher, Paris-Saclay University, CEA, France

AnalytiX 05: Novel Bioanalysis Method & Technology

Time: 09:00-12:40, May 18, 2023 (Thursday); Place: Yoshino, 5F, Hyatt Regency Osaka

Chair	***Dr. Ming-Tsang Wu,*** Distinguished Professor and Director, Research Center for Precision Environmental Medicine, Kaohsiung Medical University, Taiwan
Co-Chair	***Dr. Mai Thanh Duc,*** Associate Professor, University Paris Saclay, France
09:00-09:05	**Chair's Introduction**
09:05-09:30	***Title:*** *Analysis of Non-Volatile Compounds in Exhaled Breath: Clinical Applications of Exhaled Breath Condensate Analysis* ***Dr. Makoto Sawano,*** Professor, Saitama Medical University, Japan
09:30-09:55	***Title:*** *Combination of Analytical Method and Epidemiological Design to Unravel the Exposure Source of Arsenic in Residents Next to One Heavy-Industrial Area* ***Dr. Ming-Tsang Wu,*** Distinguished Professor and Director, Research Center for Precision Environmental Medicine, Kaohsiung Medical University, Taiwan
09:55-10:20	***Title:*** *Polyphenols from Knotweed and Their Bioactivities* ***Dr. Lea Pogacnik,*** Professor, Biotechnical Faculty, University of Ljubljana, Slovenia
10:20-10:45	***Title:*** *Lecturers' Perceptions about Challenges and Ways of Dealing with the New Era in Higher Education During Covid-19 Pandemic* ***Dr. Nitza Davidovitch,*** Professor, Ariel University, Israel
10:45-11:00	***Coffee Break***
11:00-11:25	***Title:*** *Lab-in-Droplet for Biomarker Analysis: From Instrumental Conception towards Diagnostic Applications* ***Dr. Mai Thanh Duc,*** Associate Professor, University Paris Saclay, France
11:25-11:50	***Title:*** *Three-Dimensional Imaging of NADH/NAD+ Ratio in Bacterial Colonies* ***Dr. Yoshihide Tokunou,*** Assistant Professor, University of Tsukuba, Japan
11:50-12:15	***Title:*** *Soft Mechanochemistry Based on Interfacial Anisotropy* ***Dr. Daisuke Ishikawa,*** Lecturer, Institute of Biomaterials and Bioengineering, Tokyo Medical and Dental University, Japan
12:15-12:40	***Title:*** *Towards the Detection of Biomarkers at the Single Molecule Limit* ***Dr. John J. Kasianowicz,*** Physical Scientist, National Institute of Standards and Technology, USA

AnalytiX 06: X-ray Spectroscopy and Gamma Spectroscopy

Time: 09:00-12:40, May 18, 2023 (Thursday); Place: Kamo, 5F, Hyatt Regency Osaka

Chair	***Dr. Wataru Yashiro,*** Professor, Tohoku University, Japan
09:00-09:05	**Chair's Introduction**
09:05-09:30	***Title:*** *Determination of Distributions and Structures of Cupric-Chloro Complexes in Hydrochloric Acid Solutions by UV-Vis and X-ray Absorption Spectroscopy and AB Initio Calculation* ***Dr. Masahito Uchikoshi,*** Associate Professor, Tohoku University, Japan
09:30-09:55	***Title:*** *Recent Advance and Future Potential in Grating-based X-ray Interferometry* ***Dr. Wataru Yashiro,*** Professor, Tohoku University, Japan

09:55-10:20 ***Title:*** *Theoretical Study of the Properties of X-ray Diffraction Moire Fringes*
Dr. Jun-ichi Yoshimura, Former Researcher, High Energy Accelerator Research Organization, Japan

10:20-10:45 ***Title:*** *From X-ray Diffraction to MOs: XMO Analysis of Diformohydrazide*
Dr. Kiyoaki Tanaka, Senior Researcher, Nagoya Industrial Science Research Institute, Japan

10:45-11:00 ***Coffee Break***

11:00-11:25 ***Title:*** *Operando X-ray Nanospectroscopy Observation of Devices Using 2D Channel Layers*
Dr. Hirokazu Fukidome, Associate Professor, Tohoku University, Japan

11:25-11:50 ***Title:*** *The Group of Professors Portraits from the Collection of Collegium Maius Painted by Jan Trycjusz. The Significance of Technological Research and X-ray Examinations in the Attribution of These Portraits*
Dr. Anna Jasinska, Curator, Museum of Jagiellonian University, Poland

11:50-12:15 ***Title:*** *Grounds of the 19th and 20th Century Paintings as a Tool of Authentication of the Works of Art*
Dr. Miroslaw Wachowiak, Assistant Professor, Nicolaus Copernicus University in Torun, Poland

12:15-12:40 ***Title:*** *Development of Spatio-Temporal Orientation of Children with Down Syndrome through Educational Platforms after Roumanian Pandemic Lockdown*
Dr. Ofelia Popescu, Lecturer, Polytechnic University of Bucharest, Romania
Dr. Nicoleta Leonte, Assistant Professor, Polytechnic University of Bucharest, Romania

AnalytiX 07: Bioanalysis in Human Diseases & Infectious Diseases
Time: 14:00-17:40, May 18, 2023 (Thursday); Place: Tatsuta, 5F, Hyatt Regency Osaka

Chair ***Dr. Avraham Dayan,*** Professor, Tel Aviv University, Israel
Co-Chair ***Dr. Makoto Kano,*** Former Professor of Physics, Tokyo University of Science, Japan

14:00-14:05 **Chair's Introduction**

14:05-14:30 ***Title:*** *Walk-Through Screening System for COVID-19*
Dr. Ji Yong Lee, Director, Division of Infectious Disease, H Plus Yangji Hospital, South Korea

14:30-14:55 ***Title:*** *Cancer Targeted Treatment by RGD-Modified Dihydrolypoamide Dehydrogenase*
Dr. Avraham Dayan, Professor, Tel Aviv University, Israel

14:55-15:20 ***Title:*** *Gut Microbial, Inflammatory and Metabolic Signatures in Older People with Physical Frailty and Sarcopenia: Results from the BIOSPHERE Study*
Dr. Anna Picca, Associate Professor, LUM University, Casamassima, Italy

15:20-15:45 ***Title:*** *Effects of L-Arginine Plus Vitamin C Supplementation on Physical Performance, Endothelial Function and L-Arginine Metabolism in Adults with Long COVID*
Dr. Matteo Tosato, Assistant Professor, Catholic University of Rome, Italy

15:45-16:00 ***Coffee Break***

16:00-16:25 ***Title:*** *The Necessity of Environmental Scientific Literacy for Dealing with Corona Pandemic*
Dr. Makoto Kano, Former Professor of Physics, Tokyo University of Science, Japan

16:25-16:50	***Title:*** *Strptococcus Pneumoniae and Its Family Planning with Five Carbon Sugar Alcohol Xylitol* ***Dr. Sunil Palchaudhuri,*** Professor, Wayne State University, USA
16:50-17:15	***Title:*** *In Vivo Raman Spectroscopy Analysis for Improving Clinical Skin Cancer Detection* ***Dr. Hai-Shan Zeng,*** Professor, University of British Columbia Cancer Research Centre, Canada
17:15-17:40	***Title:*** *Using Blood-Derived Immune Cells in Inform on Human Disease* ***Dr. John Miles,*** Professor, James Cook University, Australia

AnalytiX 08: Terahertz Spectroscopy and Laser Spectroscopy

Time: 14:00-16:10, May 18, 2023 (Thursday); Place: Yoshino, 5F, Hyatt Regency Osaka

Chair	***Dr. Jay Theodore Cremer,*** Chief Scientist, Adelphi Technology, Inc., USA
14:00-14:05	**Chair's Introduction**
14:05-14:30	***Title:*** *Precision Measurement of Molecular Vibrational Transition Frequencies* ***Dr. Masatoshi Kajita,*** Senior Researcher, National Institute of Information and Communications Technology, Japan
14:30-14:55	***Title:*** *Superconducting Wollaston Prism for Spin Echo Scattering Angle Measurement* ***Dr. Jay Theodore Cremer,*** Chief Scientist, Adelphi Technology, Inc., USA
14:55-15:20	***Title:*** *Electronic Structures of Ti_2O_3 Films Revealed by Soft X-ray Angle-Resolved Photoemission Spectroscopy* ***Dr. Kohei Yoshimatsu,*** Associate Professor, Tohoku University, Japan
15:20-15:45	***Title:*** *Means to Understand the Laser Damage* ***Dr. Herve Piombini,*** Senior Engineer, CEA Le Ripault, France
15:45-16:10	***Title:*** *Optical Harmonics Spectroscopy of Semiconductors and Dielectrics* ***Dr. Victor Pavlov,*** Chief Researcher, Ioffe Institute, Russian Academy of Sciences, Russia

AnalytiX 09: Chemometrics and Chromatography

Time: 14:00-18:05, May 18, 2023 (Thursday); Place: Kamo, 5F, Hyatt Regency Osaka

Chair	***Dr. Federico Marini,*** Professor, University of Rome "La Sapienza", Italy
Co-Chair	***Dr. Riccardo Calvani,*** Research Associate, Catholic University of the Sacred Heart in Rome, Italy
14:00-14:05	**Chair's Introduction**
14:05-14:30	***Session Keynote Speech*** ***Title:*** *An Automated Support Vector Elastic Net for Calibration and Classification for Chemotyping Complex Materials* ***Dr. Peter B. Harrington,*** Professor, Ohio University, USA
14:30-14:55	***Title:*** *Rethinking SIMCA for One and Multiple Blocks* ***Dr. Federico Marini,*** Professor, University of Rome "La Sapienza", Italy
14:55-15:20	***Title:*** *Variable Sorting for Normalization* ***Dr. Jean-Michel Roger,*** Senior Researcher, INRAE Montpellier Centre, France
15:20-15:45	***Title:*** *Automation of (Big) Data Processing in Analytical Chemistry Using Bayesian Statistics: Why, When and How* ***Dr. Gabriel Vivo-Truyols,*** CEO and Founder, Tecnometrix, Spain
15:45-16:00	***Coffee Break***

16:00-16:25 ***Title:*** *Biomarkers for Aging-Related Conditions: The Role of Chemometrics*
Dr. Riccardo Calvani, Research Associate, Catholic University of the Sacred Heart in Rome, Italy

16:25-16:50 ***Title:*** *Data Analytics, Driving the Digital Revolution*
Dr. Johan Hultman, Manager OEM & Embedded Solutions, Sartorius Data Analytics, Sweden

16:50-17:15 ***Title:*** *Evaluation of Different Analytical Tools for Studying the Performance of Extraction and Membrane Processes During Biosurfactant Refinery*
Dr. Xanel Vecino Bello, Postdoc Researcher, University of Vigo, Spain

17:15-17:40 ***Title:*** *Development and Validation of HPLC-DAD-MS/MS Analytical Methods for the Chemical Characterization of Hop and Related Products*
Dr. Letricia Barbosa-Pereira, Associate Researcher, University of Santiago de Compostela, Spain

17:40-18:05 ***Title:*** *Systematic Chiral Method Development Approach for Early Phase Product Development*
Dr. Nilesh K. Joshi, Assistant General Manager, Syngene Amgen Research and Development Centre, Syngene International Ltd., India

AnalytiX 10: Materials in Analytical Chemistry
Time: 09:00-12:15, May 19, 2023 (Friday); Place: Tatsuta, 5F, Hyatt Regency Osaka

Chair ***Dr. Christian J. Engelsen,*** Senior Scientist, SINTEF Building and Infrastructure, Norway
Co-Chair ***Dr. Mariusz Pietrzak,*** Associate Professor, Faculty of Chemistry, Warsaw University of Technology, Poland

09:00-09:05 **Chair's Introduction**

09:05-09:30 ***Title:*** *Spectroscopic Ellipsometry: Thin Film Solutions from Deep Ultra-Violet to Terahertz*
Dr. Jianing Sun, Applications Engineer, J. A. Woollam Co., Inc., USA

09:30-09:55 ***Title:*** *New Method to Directly Measure the CO_2-Binding to Cementitious Materials*
Dr. Christian J. Engelsen, Senior Scientist, SINTEF Building and Infrastructure, Norway

09:55-10:20 ***Title:*** *Numerical Analysis and Investigation of Surfaces with Protrusions*
Mr. Mitsuru Nishikawa, Production Technology Engineer, Production Technology Center, Asahi Kasei Corporation, Japan

10:20-10:45 ***Title:*** *Electrochemical Analysis of Correlation Between Doping Level and Electrical Properties of Conducting Polymers*
Dr. Ichiro Imae, Associate Professor, Hiroshima University, Japan

10:45-11:00 ***Coffee Break***

11:00-11:25 ***Title:*** *Application on Multifunctional Nanoparticles in Modern Immunoassays*
Dr. Mariusz Pietrzak, Associate Professor, Faculty of Chemistry, Warsaw University of Technology, Poland

11:25-11:50 ***Title:*** *Colorimetric Papers for the Selective Detection of Novichok Agents*
Dr. Alexandre Carella, Senior Researcher, French Alternative Energies & Atomic Energy Commission, France

11:50-12:15 ***Title:*** *Narrow-Gap Rheometry - A Tool to Characterize Mechanical Properties of Biological Samples*
Dr. K. M. Imran Bashir, Postdoctoral Researcher, LSTME Busan, South Korea

AnalytiX 11: Sensors and Microarrays

Time: 09:00-12:40, May 19, 2023 (Friday); Place: Yoshino, 5F, Hyatt Regency Osaka

Chair	***Dr. Weiwei Dang,*** Associate Professor, Baylor College of Medicine, USA
Co-Chair	***Dr. Yasuhiro Iida,*** Professor, Kanagawa Institute of Technology, Japan

09:00-09:05	**Chair's Introduction**
09:05-09:30	***Session Keynote Speech*** ***Title:*** *Fractional Calculus and Hybrid Functions in Optical Spectral of Solids and Photonic Sensors* ***Dr. Mohsen Razzaghi,*** Giles Distinguished Professor & Head of Department of Mathematics and Statistics, Mississippi State University, USA
09:30-09:55	***Title:*** *Photoactivated Capillary Flow for Advanced Droplet Manipulation: A Numerical Study* ***Dr. Takahiro Tsukahara,*** Professor, Tokyo University of Science, Japan
09:55-10:20	***Title:*** *High Throughout Replicative Aging Analysis for Budding Yeast* ***Dr. Weiwei Dang,*** Associate Professor, Baylor College of Medicine, USA
10:20-10:45	***Title:*** *Simulated Hyperspectral Imagery for Remote Sensing Algorithm Design* ***Dr. Robert Sundberg,*** President Emeritus, Spectral Sciences, Inc., USA
10:45-11:00	***Coffee Break***
11:00-11:25	***Title:*** *Development of Novel DNA Methylation Analysis Method in Combination with Recombinant Dnmt1 and Bisulfite Sequence* ***Dr. Yasuhiro Iida,*** Professor, Kanagawa Institute of Technology, Japan
11:25-11:50	***Title:*** *Formation of Metal Cluster Ions in Laser Desorption/Ionization Mass Spectrometry for the Biosensing Applications* ***Dr. Chih-Ching Huang,*** Professor, Department of Bioscience and Biotechnology, National Taiwan Ocean University, Taiwan
11:50-12:15	***Title:*** *Spectroelectrochemical Evaluation of the Interaction of Pharmaceutical Compounds with Serum Proteins and Liposomes for Drug Delivery Systems* ***Dr. Monica Florescu,*** Associate Professor, Transilvania University of Brasov, Romania
12:15-12:40	***Title:*** *2D Mono Detection Spatially Super Resolved RF Imaging for Radar Applications* ***Dr. Gabay Isahar,*** Researcher, Bar-Ilan University of Ramat Gan, Israel

AnalytiX 12: Frontiers in Analytical Chemistry

Time: 09:00-12:40, May 19, 2023 (Friday); Place: Kamo, 5F, Hyatt Regency Osaka

Chair	***Dr. Joel B. Tellinghuisen,*** Emeritus Professor, Vanderbilt University, USA
Co-Chair	***Dr. Stepan Urban,*** Professor, University of Chemistry and Technology, Czech Republic

09:00-09:05	**Chair's Introduction**
09:05-09:30	***Session Keynote Speech*** ***Title:*** *Comparison of Mobile State-of-the-Art Raman Instruments and New Perspectives in Cultural Heritage Studies* ***Dr. Luc Moens,*** Professor, Ghent University, Belgium
09:30-09:55	***Title:*** *The Possibilities of Mass Selected Ion Beam* ***Dr. Masashi Nojima,*** Junior Associate Professor, Tokyo University of Science, Japan

09:55-10:20 ***Title:*** *Calibration: Detection, Quantification, and Confidence Limits Are (Almost) Exact When the Data Variance Function Is Known*
Dr. Joel B. Tellinghuisen, Emeritus Professor, Vanderbilt University, USA

10:20-10:45 ***Title:*** *Characterization of Surfactant Amphiphilicity by Chromatography*
Dr. Yuji Yamashita, Associate Professor, Chiba Institute of Science, Japan

10:45-11:00 ***Coffee Break***

11:00-11:25 ***Title:*** *Forensic Identification of Persons Using the Scent Trace*
Dr. Stepan Urban, Professor, University of Chemistry and Technology, Czech Republic

11:25-11:50 ***Title:*** *Surface Reaction Mechanism in a-Si:H Growth at High Temperature*
Dr. Yasutake Toyoshima, Invited Senior Researcher, National Institute of Advanced Industrial Science and Technology, Japan

11:50-12:15 ***Title:*** *Phase Separation Dynamics in an Annealed Polymer: Fullerene Blend Analyzed Using the Critical Point Model of the Permittivity*
Dr. Rafi Shikler, Associate Professor, Ben Gurion University of the Negev, Israel

12:15-12:40 ***Title:*** *Experimental Investigation of Liquid Film Thickness Between Coalescing Air Bubbles*
Dr. Takayuki Morokuma, Assistant Professor, Kanagawa University, Japan

AnalytiX 13: Video Forum

1 ***Title:*** *Ionophore-Based Ion-Selective Electrodes: Analysis in Non-zero Current Modes*
Dr. Konstantin N. Mikhelson, Professor, St. Petersburg State University, Russia

2 ***Title:*** *The Gyrotron - Quasi-Optical Relativistic Cyclotron Resonance Maser*
Dr. Michael I. Petelin, Professor, Institute of Applied Physics, Russia

3 ***Title:*** *The Art of Detecting Traces of Explosives*
Dr. Vladimir Matveevich Gruznov, Chief Researcher, Trophimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of Russian Academy of Sciences, Russia

4 ***Title:*** *A Platform of Micro-Thermocouple Array for Single-Cell Temperature Measurement*
Dr. Shengyong Xu, Professor, Peking University, China

5 ***Title:*** *Topologically Stabilized Spin Configurations in Rare-Earth-Based Systems Using Polarized Neutron Scattering*
Dr. Amitesh Paul, Senior Research Scientist, Guangdong-Technion Israel Institute of Technology, China

6 ***Title:*** *The Impact of Heavy Metals on Plants and Soil Samples in Camp2 Quarry Site Akamkpa Local Government Area, Cross River State Nigeria*
Dr. Eteng E. Ofem, Lecturer, Department of Biochemistry, Federal University of Agriculture, Nigeria

7 ***Title:*** *Lorentz Microscopy Methods for Magnetic Domain Structure Study*
Dr. Liudmila Kveglis, Professor, Sarsen Amanjolov East Kazakhstan University, Russia

8 ***Title:*** *Reconstruction of Experimental Data and Images Using Shift Methods*
Dr. Andrey Novikov-Borodin, Senior Scientist, Institute for Nuclear Research, Russian Academy of Sciences, Russia

9 ***Title:*** *Reconstruction of LTI System Signals Using Test Measurements*
Dr. Andrey Novikov-Borodin, Senior Scientist, Institute for Nuclear Research, Russian Academy of Sciences, Russia

AnalytiX 13: Video Forum

10	***Title:*** *Combined Hyperspectral and Holographic Diagnostics of Volume Defects in Optical Materials* ***Dr. Victor Dyomin,*** Lab Head, National Research Tomsk State University, Russia

The 10th Annual Congress of Nano Science and Technology-2023

NANO 01: Nanotech for Applications

Time: 14:00-17:15, May 17, 2023 (Wednesday); Place: Yamato A, 5F, Hyatt Regency Osaka

Chair	***Dr. Kofi Adu,*** Associate Professor, Penn State University, USA
14:00-14:05	**Chair's Introduction**
14:05-14:30	***Title:*** *Nano Science of Metal Oxide and Their Sensor Applications* ***Dr. Yoshitake Masuda,*** Research Group Leader, National Institute of Advanced Industrial Science and Technology, Japan
14:30-14:55	***Title:*** *3D Textiles for Technical Applications – State of the Art and Future Prospects* ***Dr. Wilhelm-Alexander Buesgen,*** Professor, Niederrhein University of Applied Sciences, Germany
14:55-15:20	***Title:*** *Binderless Carbon Nanotube Flexible Membranes: Architecture, Device and Energy Applications* ***Dr. Kofi Adu,*** Associate Professor, Penn State University, USA
15:20-15:45	***Title:*** *Multisensory Nanotech System for Farming Optimisation* ***Dr. Janez Trontelj,*** Professor, University of Ljubljana, Slovenia
15:45-16:00	***Coffee Break***
16:00-16:25	***Title:*** *Triboelectric Energy Harvesting Devices and How Nanoscale Structures Impact Macroscale Devices Conversion Efficiency* ***Dr. Sylvain Blayac,*** Center of Microelectronics in Provence, France
16:25-16:50	***Title:*** *Green Synthesys of Si and Al Nanoparticles by Pulsed Laser Ablation in Water for Spartium Junceum L. Fibres Modification* ***Dr. Sandra Bischof,*** Head, Textile Science Research Centre, Croatia
16:50-17:15	***Title:*** *Plasma Etching Techniques for New Nanostructured Fractal Surfaces* ***Dr. Claudia Riccardi,*** Professor, Milano Bicocca University, Italy

NANO 02: New Nanomaterials (I)

Time: 14:00-16:25, May 17, 2023 (Wednesday); Place: Yamato B, 5F, Hyatt Regency Osaka

Chair	***Dr. Jean-Louis Bobet,*** Professor, Universie de Bordeaux, France
Co-Chair	***Dr. Rachel Desfeux,*** Professor, University of Artois, France
14:00-14:05	**Chair's Introduction**
14:05-14:30	***Title:*** *Microstructure, Macro- and Nanoscale Piezoelectric Properties in Ba0.85Ca0.15Ti0.9Zr0.1O3 (BCTZ) Thin Films Grown by Pulsed Laser Deposition on Various Substrates for Energy Harvesting* ***Dr. Rachel Desfeux,*** Professor, University of Artois, France

14:30-14:55	***Title:*** *New Magnesium Rich Alloys: Structure, Magnetic and H Sorption Properties. Possible Application for "Light Mobility"* ***Dr. Jean-Louis Bobet,*** Professor, University of Bordeaux, France
14:55-15:20	***Title:*** *Atomic Layer Deposition for Nanocomposite Electrodes for Supercapacitors* ***Dr. Daniel Qi Tan,*** Deputy Head, Guangdong Technion - Israel Institute of Technology, China
15:20-15:45	***Title:*** *Enhanced Organic Optoelectronic Devices by Interfacial Engineering* ***Dr. Soyeon Kim,*** Senior Researcher, Korea Institute of Materials Science, South Korea
15:45-16:00	***Coffee Break***
16:00-16:25	***Title:*** *The Role of Nano-scsle Elastic Heterogeneity in Mechanical Tribological Behavior of a Cu-Zr Metallic Glass thin Film During* ***Dr. Qing Wang,*** Professor, Shanghai University, China

NANO 03: New Nanomaterials (II)

Time: 09:00-12:40, May 18, 2023 (Thursday); Place: Yamato A, 5F, Hyatt Regency Osaka

Chair	***Dr. Laleh Alisaraie,*** Associate Professor, Memorial University of Newfoundland, Canada
09:00-09:05	**Chair's Introduction**
09:05-09:30	***Title:*** *Combined Plane Wave and Localized Basis Sets (CPLB) Approach: A Study of H/D Adsorption on Metal Surface* ***Dr. Takayoshi Ishimoto,*** Professor, Hiroshima University, Japan
09:30-09:55	***Title:*** *Inorganic Nanoparticles for Tuberculous Meningitis Treatment* ***Dr. Alessandra Pinna,*** Independent Fellow, Imperial College London, UK
09:55-10:20	***Title:*** *Development of Sustainable Supercapacitor for Superb Electrochemical Performance* ***Dr. Anil Kumar,*** Professor, Indian Institute of Technology Roorkee, India
10:20-10:45	***Title:*** *Nanoparticles and Cytoskeletal Proteins* ***Dr. Laleh Alisaraie,*** Associate Professor, Memorial University of Newfoundland, Canada
10:45-11:00	***Coffee Break***
11:00-11:25	***Title:*** *A Functional Carbon Dots Induce Ferroptosis by Suppressing PLPP4 Activity to Inhibit Glioblastoma Growth* ***Dr. Kun Deng,*** Research Associate, Central South University, China
11:25-11:50	***Title:*** *Structure Design and Properties of Fluorinated Benzodifuranone based Organic Conjugated Nanomaterials* ***Dr. Xin Shi,*** Shaanxi University of Technology, China
11:50-12:15	***Title:*** *Nanostructure Fabrication and Modification on Semiconductor Materials by Focused Ion Beam* ***Dr. Lin-Jun Wang,*** Technological Engineer, University of Science and Technology of China, China
12:15-12:40	***Title:*** *Development of Multifunctional Au-Fe3O4 Nanoparticles for Cancer Therapy* ***Dr. Loi Tonthat,*** Assistant Professor, Tohoku University, Japan

NANO 04: Nanomedicine and Nanobiotechnology

Time: 09:00-11:10, May 18, 2023 (Thursday); Place: Yamato B, 5F, Hyatt Regency Osaka

Chair	***Dr. Christelle Monville,*** Professor, Evry's University, France
09:00-09:05	**Chair's Introduction**
09:05-09:30	***Title:*** *Optimization of Liposome Manufacturing for Improved Sterilizing Filtration in Drug Manufacturing* ***Dr. Aude Iwaniec,*** R&D Team Leader, Pall Corporation, UK
09:30-09:55	***Title:*** *Cell-based Therapy Using Pluripotent Stem Cells for Retinitis Pigmentosa* ***Dr. Christelle Monville,*** Professor, Evry's University, France
09:55-10:20	***Title:*** *Unique Intradermal (Skin) Interface Platform that Can: Improve Vaccines (Immunity, Durability, Safety, Dose Sparing X5) and Enable Novel Higher-Performance, Painless Aesthetic Delivery* ***Dr. Shuki Yeshurun,*** Founder, Nanopass Technologies, Israel
10:20-10:45	***Title:*** *Hybrid Cyanine/Methotrexate Nanoparticles for Synergistic PDT/Chemotherapy* ***Dr. Anyanee Kamkaew,*** Associate Professor, Suranaree University of Technology, Thailand
10:45-11:10	***Title:*** *Serum CCL20 and EGF Detection by SERS as the Promising Tool for Microwave Ablation Outcome Prediction of Hepatocellular Carcinoma Patients* ***Dr. Yuzhen Ouyang,*** Scholar, Central South University, China

NANO 05: Breaking Research of Nano Science and Technology

Time: 16:00-18:10, May 18, 2023 (Thursday); Place: Yamato A, 5F, Hyatt Regency Osaka

Chair	***Dr. Shuji Ogata,*** Professor, Nagoya Institute of Technology, Japan
16:00-16:05	**Chair's Introduction**
16:05-16:25	***Title:*** *Cationic Comb-Type Copolymer Assisted Aptamer-patterned DNA Hydrogels* ***Dr. Jie Du,*** Professor, Hainan University, China
16:25-16:45	***Title:*** *DFT-based Simulations on Protonation Free-Energy and Adhesion Strength of Epoxy Resin in Moist Environment* ***Dr. Shuji Ogata,*** Professor, Nagoya Institute of Technology, Japan
16:45-17:05	***Title:*** *A Co-evolution Construction Framework for Base Transfer Learning Model Selection in Edge/Cloud Infrastructure Systems* ***Dr. Jingtao Sun,*** Senior Researcher, Hitachi, Ltd., Japan
17:05-17:25	***Title:*** *Alignment of Organic Semiconductors by Solution-Shearing in Active Layer Preparation for Organic Filed-Effect Transistors* ***Dr. Yu-Tai Tao,*** Distinguished Research Fellow, Institute of Chemistry, Academia Sinica, Taiwan
17:25-17:45	***Title:*** *SERS-based Aptasensors for Detection of Viruses, Cells and Small Molecules* ***Dr. Rugiyya Aliyeva,*** Researcher, Moscow State University, Russia
17:45-18:10	***Title: -*** *Room Temperature Operation of Single Electron Transistors and Their Hybridization with CMOS* ***Dr. Rasika Dhavse,*** Associate Professor, Department of Electronics Engineering, Sardar Vallabhbhai National Institute of Technology, India

NANO 06: New Nanomaterials (III)

Time: 14:00-16:50, May 18, 2023 (Thursday); Place: Yamato B, 5F, Hyatt Regency Osaka

Chair	***Dr. Shuki Yeshurun,*** CEO, Tortech Nanofibers, Israel
Co-Chair	***Dr. Rachel Desfeux,*** Professor, University of Artois, France

14:00-14:05	**Chair's Introduction**
14:05-14:30	***Title:*** *Ferroelectric BaTiO3 and Self-oxidized N: BaTiO3 Oxynitride Epitaxial Heterostructures for Water-Splitting and Spintronics Applications* ***Dr. Antoine Barbier,*** Research Director, C.E.A., France
14:30-14:55	***Title:*** *Thermal and Electrical Properties of Energy Materials in Controlled Nanoparticles* ***Dr. Xizu Wang,*** Senior Scientist, Institute of Materials Research and Engineering (IMRE), Singapore
14:55-15:20	***Title:*** *Unique Properties of Ultra-Long Carbon Nano Tube (ULCNT) that Can Open New Opportunities in the World of Materials* ***Dr. Shuki Yeshurun,*** CEO, Tortech Nanofibers, Israel
15:20-15:45	***Title:*** *Large-Scale Growth of Transition Metal Dichalcogenide Materials and Its Application for Resistive Switching Memories* ***Dr. Yuanmin Du,*** Senior Research Fellow, Nanyang Technological University, Singapore
15:45-16:00	***Coffee Break***
16:00-16:25	***Title:*** *Nanoscale Ferroelectricity in Innovative Ln2WO6 (Ln = La, Pr and Nd) Thin Films* ***Dr. Rachel Desfeux,*** Professor, University of Artois, France
16:25-16:50	***Title:*** *Liquid Cell Transmission Electron Microscopy Technique for Polymeric Nanoparticles* ***Dr. Chisato Takahashi,*** Senior Researcher, National Institute of Advanced Industrial Science and Technology, Japan

NANO 07: Nano Electronics, Nano Optics, Nano Photonics and Nanomagnetism

Time: 09:00-12:15, May 19, 2023 (Friday); Place: Yamato A, 5F, Hyatt Regency Osaka

Chair	***Dr. Ken Morita,*** Professor, Chiba University, Japan

09:00-09:05	**Chair's Introduction**
09:05-09:30	***Title:*** *Ultrafast Magnetic Vortex Control for Energy Saving Spintronics* ***Dr. Chenglong Jia,*** Professor, Lanzhou University, China
09:30-09:55	***Title:*** *Higher-order Spin States Generated by Focused Higher-order States of Photon* ***Dr. Ken Morita,*** Professor, Chiba University, Japan
09:55-10:20	***Title:*** *Development of BiFeO3-based Multiferroic Thin Films with Large Magneto-Optical Kerr Effect for Spatial Light Modulator Driven by Electric Field* ***Dr. Satoru Yoshimura,*** Professor, Akita University, Japan
10:20-10:45	***Title:*** *Magneto-optical Properties of Wider Gap Magnetic Semiconductor Films Prepared by MBE, and an Inquiry into the Practicality of These Films* ***Dr. Masaaki Imamura,*** Emeritus Professor, Fukuoka Institute of Technology, Japan
10:45-11:00	***Coffee Break***

11:00-11:25 ***Title:*** *Piezoelectricity Temperature Limits of Sol-gel Composite Materials*
Dr. Makiko Kobayashi, Professor, Kumamoto University, Japan

11:25-11:50 ***Title:*** *Synergistic Effect of P Doping and Mo-Ni-based Heterostructure Electrocatalyst for Overall Water Splitting*
Dr. Feihong Jia, Shaanxi University of Technology, China

11:50-12:15 ***Title:*** *Ultrathin MoS_2 Nanosheets Decorated on NiSe Nanowire Arrays as Advanced Trifunctional Electrocatalyst for Overall Water Splitting and Urea Electrolysis*
Dr. Yan Li, Shaanxi University of Technology, China

NANO 08: Video Forum

1 ***Title:*** *Interstitial Flow: Two Elucidating Examples of First-principle Modeling Applied to Microscale Bioflows*
Dr. Francesco Romano, Associate Professor, Arts et Metiers, Campus of Lille, France

2 ***Title:*** *Substantiation of the Initial Level of Material World*
Dr. Valentyn Nastasenko, Professor, Kherson State Maritime Academy, Ukraine

3 ***Title:*** *Femtosecond Laser Micro/Nano Fabrication*
Dr. Xin Li, Professor, Beijing Institute of Technology, School of Mechanical Engineering Laser Micro/Nano Fabrication Laboratory, China

4 ***Title:*** *Molecularly Imprinted Polymer Solid Phase Extraction Coupled with Liquid Chromatography-High Resolution Mass Spectrometry for the Detection of Gonyautoxins 2&3 in Seawater*
Dr. Yiwen Zhang, Lecturer, Dalian University of Technology, China

5 ***Title:*** *The Effects of Nanoscale Graphite Powders on Organic-Inorganic Composite Cross-Linked Polyacrylamide Gel*
Dr. Shiling Zhang, Engineer, CNPC Engineering Technology R&D Company Limited, China

6 ***Title:*** *Sound Localization in Web-based 3D Environments*
Dr. Gianluca Memoli, University of Sussex, UK

7 ***Title:*** *Nanocarbon Materials for Different Application*
Dr. Zulkhair Mansurov, Councilor of the General Director, Institute of Combustion Problems, Kazakhstan

Smart Devices Symposium 2023

SDS 01: Intelligent Materials for Smart Devices

Time: 14:00-15:45, May 18, 2023 (Thursday); Place: Yamato A, 5F, Hyatt Regency Osaka

Chair ***Dr. Alicja Krella,*** Professor, Institute of Fluid-Flow Machinery Polish Academy of Science, Poland

14:00-14:05 **Chair's Introduction**

14:05-14:30 ***Title:*** *Innovative Packaging Concepts Boost Silicon Carbide (SiC) Power Semiconductor Performance and Efficiency*
Mr. Filippo Di Giovanni, Strategic Marketing Manager, STMicroelectronics SRL, Italy

14:30-14:55 ***Title:*** *Influence of Deposition Techniques on the Resistance of PVD Coatings to Cavitation Erosion*
Dr. Alicja Krella, Professor, Institute of Fluid-Flow Machinery Polish Academy of Science, Poland

14:55-15:20	***Title:*** *Development of Novel Conducting Polymers for the Application to the Thermoelectric Devices* ***Dr. Ichiro Imae,*** Associate Professor, Hiroshima University, Japan
15:20-15:45	***Title:*** *Potential of Fe-SMA Bars in Controlling Bridge Column Permanent Drift under Near-Fault Earthquakes* ***Dr. M. Saiid Saiidi,*** Professor Emeritus, University of Nevada, Reno, USA
15:45-16:00	***Coffee Break***

SDS 02: Technology Innovation in Smart Devices

Time: 14:00-17:40, May 18, 2023 (Thursday); Place: Kibune, 5F, Hyatt Regency Osaka

Chair	***Prof. Stephan-Reiff-Marganiec,*** Head of School Computing and Engineering, University of Derby, UK
Co-Chair	***Dr. Albena Mihovska,*** Associate Professor, Aarhus University, Denmark
14:00-14:05	**Chair's Introduction**
14:05-14:25	***Title:*** *Technologies from Lukasiewicz-PIAP Institute Focused on Mobile Robots for Special Purposes, as Well as Automatization of Industrial Tasks and Processes* ***Dr. Maciej Cader,*** Deputy Director for Research, Lukasiewicz - PIAP Institute, Poland
14:25-14:45	***Title:*** *Service Computing and Data Processing Architectures: The Foundations of Smart Devices* ***Prof. Stephan Reiff-Marganiec,*** Head of School Computing and Engineering, University of Derby, UK
14:45-15:05	***Title:*** *Advanced Sorting Systems with Smart Sensors Utilizing X-ray and IR hyperspectral Imaging* ***Dr. Jacek Kolacz,*** CEO, Comex Group, Poland
15:05-15:25	***Title:*** *Autonomous and Adaptive Behaviors for Robotics* ***Dr. Luca Muratore,*** Techonologist, Italian Institute of Technology, Italy
15:25-15:45	***Title:*** *Growing Need for Belief Representation Interoperability* ***Dr. Aaron Bramson,*** AI Principal Researcher, GA Technologies Inc., Japan
15:45-16:00	***Coffee Break***
16:00-16:20	***Title:*** *Data Mining and Smart Devices* ***Dr. Ayahiko Niimi,*** Associate Professor, Future University Hakodate, Japan
16:20-16:40	***Title:*** *Enabling Smart Environments through Artificial Intelligence* ***Dr. Albena Mihovska,*** Associate Professor, Aarhus University, Denmark
16:40-17:00	***Title:*** *Ceramic Based Packaging Solutions for High Performance Sensors with Focus on X-Ray Detectors* ***Marc Bechtold,*** VIA Electronic GmbH, Germany
17:00-17:20	***Title:*** *The Power of Experience Journey in a Digital Era (Video)* ***Dr. Nada Nasser Said Al Subhi,*** Lecturer, Higher College of Technology, Oman
17:20-17:40	***Title:*** *Optimization of Cellular Phone Networks with Numerical Conformal Mappings* ***Dr. Antti Rasila,*** Associate Professor, Guangdong Technion - Israel Institute of Technology, China

SDS 03: Technology Innovation in Smart Devices

Time: 09:00-12:20, May 19, 2023 (Friday); Place: Yamato B, 5F, Hyatt Regency Osaka

Chair	***Dr. Harald Schwarz,*** Professor, The Brandenburg University of Technology Cottbus–Senftenberg, Germany
09:00-09:05	**Chair's Introduction**
09:05-09:25	***Title:*** *Towards the Intelligent Road-Vehicle Integration through Nano/Micro Sensors Road Strips* ***Dr. Evangelos Bekiaris,*** Director, Hellenic Institute of Transport, Centre for Research and Technology Hellas, Greece
09:25-09:45	***Title:*** *The Possible Contribution of Smart Grids to a Secured and Nationwide Power Supply* ***Dr. Harald Schwarz,*** Professor, The Brandenburg University of Technology Cottbus–Senftenberg, Germany
09:45-10:05	***Title:*** *Scheduling Multiple Maintenances and Production Scheduling through a Three-Level Particle Swarm Optimization Algorithm* ***Dr. Felix T. S. Chan,*** Professor and Vice Dean, Macau University of Science and Technology, Macao, China
10:05-10:25	***Title:*** *Stress Comparison Between Working and Relaxing with Woman's Wearable Smart Underwear* ***Mr. Pai-En Yang,*** Associate Research Fellow, Taiwan Textile Research Institute, Taiwan
10:25-10:45	***Title:*** *Management of Thyroid Dysfunction Induced by Anti-Cancer Agents Used for the Cancer Therapy of Other Organs* ***Dr. Yukiko Nakata,*** Director, Osaka-Kizugawa Health Co-operative Association, Minato Seikyo Clinic, Japan & Specially Appointed Associate Professor, Osaka University, Japan
10:45-11:00	***Coffee Break***
11:00-11:20	***Title:*** *Robotic-Assisted Tele-Echography* ***Dr. Rui Cortesao,*** Professor, University of Coimbra, Portugal
11:20-11:40	***Title:*** *High Efficient Data Center in Smart City: A Survey of TCP Incast Solutions to Improve Data Center Network Performance* ***Dr. Cheng-Yuan Ho,*** Associate Professor, National Taiwan University, Taiwan
11:40-12:00	***Title:*** *Designing Streets for Autonomous Vehicles, A Survey of Possible Changes in Stockholm* ***Mr. Zeev Bohbot,*** Lecturer, KTH Royal Institute of Technology, Sweden
12:00-12:20	***Title:*** *Medipost as a Smart Electronic System Dedicated to Imbalance Disorders Monitoring* ***Dr. Michal Szermer,*** Assistant Professor, Lodz University of Technology, Poland

SDS 04: Video Forum

1	***Title:*** *Gerontechnology with Social Robots* ***Dr. Kelvin Tan,*** Senior Lecturer, Singapore University of Social Sciences, Singapore
2	***Title:*** *Advance Power Supply Units for the Structural Health Monitoring of the Bridges* ***Dr. Rahul Kalyankar,*** Engineering Specialist, Loram Technologies Inc. USA
3	***Title:*** *Ultra High Performance Concrete: A Solution for Accelerated Bridge Pier Cap Rehabilitation and Replacement* ***Dr. Atul Patil,*** Structural Engineer, HNTB Corporation, USA

SDS 04: Video Forum

4	***Title:*** *Smart Adaptation of Bone Tissue at the Nanoscale within Hierarchical Organization of the Skeleton*
	Dr. Andrey Pavlychev, Professor, Saint Petersburg State University, Russia
5	***Title:*** *Maraging Steel Reinforced with Carbon Fiber for Flywheel Rotors*
	Dr. Carlos Frajuca, Professor, Instituto Federal de Sao Paulo, Brazil

The Inaugurate World Chemistry Congress 2023

IWCC 01: Chemistry and Catalysis Science

Time: 14:00-18:20, May 17, 2023 (Wednesday); Place: Kibune, 5F, Hyatt Regency Osaka

Chair	***Dr. Edwin J. Routledge,*** Associate Professor of Aquatic Ecotoxicology, Brunel University London, UK
Co-Chair	***Dr. Christine Hahn,*** Associate Professor, Texas A&M University Kingsville, USA
14:00:14:05	**Chair's Introduction**
14:05:14:25	***Title:*** *Targeting Translational Mechanism for Autoimmune Disease Therapeutics*
	Dr. Xian Chen, Professor, Department of Biochemistry and Biophysics, School of Medicine at University of North Carolina (UNC)-Chapel Hill, USA
14:25-14:45	***Title:*** *Towards a Sustainable Chemical Future*
	Dr. Edwin J. Routledge, Associate Professor of Aquatic Ecotoxicology, Brunel University London, UK
14:45-15:05	***Title:*** *Microstructural Analysis of Activated Carbon-based Electrode Materials for Supercapacitors*
	Dr. Wenliang Zhu, Professor, Kyoto Institute of Technology, Japan
15:05-15:25	***Title:*** *To Fix Nature's Mistake: Repairing Human Faulty Genes by Small Molecules*
	Dr. Timor Baasov, Professor, Technion-Israel Institute of Technology, Israel
15:25-15:45	***Title:*** *From Fossil Refineries to Green Refineries*
	Dr. Anton Friedl, Head of Research, TU Wien, Austria
15:45-16:00	***Coffee Break***
16:00-16:20	***Title:*** *Development of an Efficient Acid-Free Palladium(II) Catalyzed Hydroarylation of Acetylene*
	Dr. Christine Hahn, Associate Professor, Texas A&M University Kingsville, USA
16:20-16:40	***Title:*** *Scalable Synthesis of Metal-Oxide Nanocatalysts by Flame-Spray-Pyrolysis Technology: Fine Tuning of Catalytic Efficiency via Control of Nanolattice*
	Dr. Yiannis Deligiannakis, Professor, University of Ioannina, Greece
16:40-17:00	***Title:*** *Hybrid Molecular Catalysts for H2 Production from C1-substates at Near Ambient Conditions: The Challenges of High-Efficiency vs. Cost and Versatility*
	Dr. Maria Louloudi, Professor, University of Ioannina, Greece
17:00-17:20	***Title:*** *The Economics/Supply Chain Bottlenecks in Materials Needed for Wind Turbine Manufacturing*
	Dr. Mariya Trifonova, Assistant Professor, Sofia University, Bulgaria

17:20-17:40 ***Title:*** *Bio-plastic from Banana Pseudo-Stems with Help of Ionic Liquid*
Dr. Kenji Takahashi, Professor, Kanazawa University, Japan

17:40-18:00 ***Title:*** *Synthesis Mesoporous Materials as Catalyst Support by Non-hydrolytic Sol-Gel*
Dr. Johan G. Alauzun, Associate Professor, University Montpellier, France

18:00-18:20 ***Title:*** *Self-assembly of Carbohydrate Block Copolymers: From Glyconanoparticles to Thin Films to Photonic Crystals*
Dr. Redouane Borsali, Research Professor and Director, CNRS, France

IWCC 02: Video Forum

1 ***Title:*** *Pesticide: Analytic, Residue*
Dr. Lydia Bondareva, Leading Researcher, Federal Scientifiec Center of Hygiene Named after F.F. Erisman, Russia

2 ***Title:*** *Enhancing the Photoluminescence of Monolayer MoS2 through Gap-Assisted Synthesis*
Dr. Sheng-Kuei Chiu, Director, Feng Chia University, Taiwan

The World Congress of Physics Frontier 2023

WCPF 01: Video Forum

1 ***Title:*** *Quantum Foundation as Seen by a Statistician*
Dr. Inge S. Helland, Professor Emeritus, University of Oslo, Norway

2 ***Title:*** *Holographic Beta Function in de Sitter Space*
Dr. Yoshihisa Kitazawa, Professor, KEK, Japan

3 ***Title:*** *Allosteric Pathway Identification Through Network Analysis: From Molecular Dynamics Simulations to Interactive 2D/3D Graphs and Beyond*
Dr. Luba Tchertanov, Research Director, Centre Borelli, ENS Paris-Saclay, France

4 ***Title:*** *Efficient Energy Cumulants for the Baxter – Wu Model*
Dr. Ioannis N. Velonakis, University of Athens, Greece

5 ***Title:*** *Effect of Structure Transformations on Generation of Optical Centers in KV and KU Quartz Glasses*
Dr. E. M. Ibragimova, Institute of Nuclear Physics AS RUz, Uzbekistan

The 9th World Energy Congress 2023

WEC 01: Latest Perspectives on Global Energy Policies and Utilization
Time: 09:00-12:20, May 18, 2023 (Thursday); Place: Kibune, 5F, Hyatt Regency Osaka

Chair ***Dr. Georgi Dimitrov Todorov,*** Professor, Head of CoE "Mechatronics and Clean Technologies", Dean of the Faculty of Industrial Technology, Technical University of Sofia, Bulgaria
Co-Chair ***Dr. Janet Xuanli Liao,*** Associate Professor, University of Dundee, UK

09:00-09:05 **Chair's Introduction**

09:05-09:25 ***Title:*** *China's Carbon Neutrality Targets vs. the Use of Coal*
Dr. Janet Xuanli Liao, Associate Professor, University of Dundee, UK

09:25-09:45 ***Title:*** *Development of New Energy Vehicle Transmission System under the Dual Carbon Target*
Dr. Yong Chen, Professor, Guangxi University, China

09:45-10:05 ***Title:*** *Full Speed into the Electric Future: What Can We Expect of Lithium-Ion Technology in Vehicles?*
Dr. Daniela Werlich, CTO, CUSTOMCELLS® Group, Germany

10:05-10:25	***Title:*** *Module Approach and Puzzle of Innovations for Breakthrough in the Batteries Improvement in Benefit of Electric Vehicles Development, Within and Beyond of the European Helios H2020 Project*
	Dr. Yavor Petrov Sofronov, Associate Professor, Faculty of Industrial Technology, Technical University of Sofia, Bulgaria
10:25-10:45	***Title:*** *Decarbonization: The Journey to Carbon-Free Systems*
	Dr. Gene Hinkle, Managing Director, General Electric Energy Consulting, USA
10:45-11:00	***Coffee Break***
11:00-11:20	***Title:*** *Trends and Emerging Technologies for the Development of Electric Vehicles*
	Dr. Tiande Mo, Head of Green and Smart Mobility, Hong Kong Productivity Council, Hong Kong, China
11:20-11:40	***Title:*** *A Novel Metallic Nuclear Fuel Design for High Burn-up Applications in Fast Neutron Reactors*
	Dr. Di Yun, Professor, Xi'an Jiaotong University, China
11:40-12:00	***Title:*** *Canada's Approach to Small Modular Reactor Regulation and International Collaboration*
	Ms. Sarah Eaton, Director, Advanced Reactor Licensing, Canadian Nuclear Safety Commission, Canada
12:00-12:20	***Title:*** *Case Onkalo - Finland Is the Global Leader in Final Disposal*
	Mr. Juha Poikola, Manager, Public Relations, Teollisuuden Voima Oyj, Finland

WEC 02: Novel Technologies on Green Energy and Energy Storage

Time: 09:00-12:15, May 19, 2023 (Friday); Place: Kibune, 5F, Hyatt Regency Osaka

Chair	***Dr. Jana Vejpravova,*** Professor, Charles University, Czech Republic
Co-Chair	***Mr. Tjerk Reijenga,*** Architect Principal, BEAR-iD Sustainable Urban Planners and Architects, The Netherlands

09:00-09:05	**Chair's Introduction**
	Session Keynote Speech
09:05-09:30	***Title:*** *Advances in Computational Materials Design for Energy Conversion*
	Dr. Hideaki Kasai, Professor, Osaka University, Japan
09:30-09:55	***Title:*** *Green Optoelectronics Based on Graphene and Van Der Waals Materials*
	Dr. Jana Vejpravova, Professor, Charles University, Czech Republic
09:55-10:20	***Title:*** *Devices based on Graphene Heterostructures*
	Dr. Martin Kalbac, Professor, J. Heyrovsky Institute of Physical Chemistry of the Czech Academy of Sciences, Czech Republic
10:20-10:45	***Title:*** *How BIPV Will Change the Built Environment*
	Mr. Tjerk Reijenga, Architect Principal, BEAR-iD Sustainable Urban Planners and Architects, The Netherlands
10:45-11:00	***Coffee Break***

11:00-11:25 ***Title:*** *Utilization of Wave Energy by Hybrid System*
Dr. Rositsa Velichkova, Associate Professor, Technical University of Sofia, Bulgaria

11:25-11:50 ***Title:*** *CO_2 Utilization in Advanced Power Generator and Olympic Ice Rink*
Dr. Hua Tian, Professor, Tianjin University, China

11:50-12:15 ***Title:*** *Preparation and Adsorption Properties of Amine Functionalized Mesoporous Humidity Control Material from Light-Emitting Diode Waste Quartz Sand and Granite Sludge*
Ms. Ya-Wen Lin, National Taipei University of Technology, Taiwan

WEC 03: Video Forum

1 ***Title:*** *Pumped Hydro, Solution or Pariah - The Case of Snowy 2.0.*
Dr. Glen Currie, Lecturer, University of Melbourne, Australia

2 ***Title:*** *The Vanadium Redox Flow Battery Operating with Overloaded Electrolytes in Order to Enhance the Stored Energy Density*
Dr. Theo Tzedakis, Professor, Universite Toulouse III - Paul Sabatier, France

3 ***Title:*** *Stability Oriented Optimal Energy Management of Multi-Microgrid Integration with Powergrid and Its Impacts*
Dr. K. S. Saritha, Associate Professor, Sree Narayana Gurukulam College of Engineering, India

4 ***Title:*** *Performance of Biogas Digester to Produce Biogas Implementing Biomass*
Mr. Nirmal Halder, Assistant Professor, Aerospace Engineerig, Sandip University, India

5 ***Title:*** *Energy Storage in Poland: Legal Status, Market Development Potential*
Ms. Katarzyna Wypychewicz, Board Advisor, Polish Energy Storage Association, Poland

Posters & Papers

AnalytiX 01 ***Title:*** *Application of Nanomaterials in (Bio) Sensors*
Dr. Elzbieta Malinowska, Professor, Faculty of Chemistry, Warsaw University of Technology, Poland

AnalytiX 02 ***Title:*** *Nucleic Acids Based Approach in Electrochemical Detection of Metal Ions*
Dr. Elabieta Malinowska, Professor, Faculty of Chemistry, Warsaw University of Technology, Poland

AnalytiX 03 ***Title:*** *Chemical Changes of Oak Wood Polysaccharides during Thermal Degradation*
Dr. Frantisek Kacik, Professor, Technical University in Zvolen, Slovakia

AnalytiX 04 ***Title:*** *Metal-Tag Labeling Coupled with Inductively Coupled Plasma Mass Spectrometry for Quantitation of Graphene Oxide in Biological Tissues*
Dr. Yu-Cing Li, Department of Biomedical Engineering and Environmental Sciences, National Tsing Hua University, Taiwan

AnalytiX 05 ***Title:*** *Use of Fluorescence Spectroscopy as Analytical Methodology to Determine Gramicidin in Corn Steep Water*
Dr. Xanel Vecino Bello, Postdoc Researcher, University of Vigo, Spain

AnalytiX 06 ***Title:*** *Single Crystal X-ray Diffraction Studies on Alkali Metal Thallides*
Dr. Stefanie Gartner, Head of Department X-ray Structure Analysis, Faculty of Chemistry and Pharmacy, University of Regensburg, Germany

AnalytiX 07 ***Title:*** *Strongly Absorbing Materials: How Far Can Structure Determination by X-rays Go?*
Dr. Stefanie Gartner, Head of Department X-ray Structure Analysis, Faculty of Chemistry and Pharmacy, University of Regensburg, Germany

Posters & Papers

AnalytiX 08 ***Title:*** *New Modified Carbon-Graphite Electrode and Their Application for Voltammetric Determination of Biologically Active Substances*

Dr. Dmitry Markielovich Aronbaev, Associate Professor, Samarkand State University, Uzbekistan

AnalytiX 09 ***Title:*** *Determination of Numerical Values of Wave Parameters of the Gravitational Field*

Dr. Valentyn Nastasenko, Professor, Kherson State Maritime Academy, Ukraine

AnalytiX 10 ***Title:*** *Fiber-Optic Raman Spectrum Sensor for Fast Diagnosis of Esophageal Cancer*

Dr. Jianhua Dai, Medicine Doctor, Institute of Digestive Disease, Southwest Hospital, Army Medical University, China

AnalytiX 11 ***Title:*** *Variable Temperature, Pressure Operando MAS NMR for Catalysis and Energy Storage Sciences*

Dr. Jianzhi Hu, Senior Scientist, Pacific Northwest National Laboratory, USA

AnalytiX 12 ***Title:*** *Physical Theory of Useful Strength of Metallic Crystals*

Dr. Vladimir G. Tkachenko, Head of Department, Frantsevich Institute for Problem of Materials Science, Ukraine

AnalytiX 13 ***Title:*** *Arithmetic Progression Way in Calibration STD Curve*

Hisham Hassan Ahmed Mohammedkhair, Faculty of Medical Laboratory Sciences, University of Khartoum, Sudan

AnalytiX 14 ***Title:*** *Dietary Exposure Assessment of the Spanish Population to Cyclo-di-BADGE through the Consumption of Canned Fish*

Dr. Letricia Barbosa-Pereira, Associate Researcher, University of Santiago de Compostela, Spain

NANO 15 ***Title:*** *A Phosphorus-Nitrogen-Functionalized Graphene Oxide for Improving the Fire Safety of Epoxy Resin*

Dr. Zhengping Fang, Professor, Ningbotech University, China

NANO 16 ***Title:*** *Natural Nanoporous Zeolites as Advanced Functional Materials*

Dr. Venceslav Kaucic, Professor, National Institute of Chemistry, Slovenia

NANO 17 ***Title:*** *Annealing-free Hole Transport Layers for Highly-Efficient and Stable Organic Solar Cells*

Nurul Kusuma Wardani, Surface Technology Division, Korea Institute of Materials and Science (KIMS), South Korea

SDS 18 ***Title:*** *The Use of Bamboo as a Sustainable Alternative in Interior and Furniture Design*

Ms. Taina Nicolau de Campos, Interior Designer, Brazil

SDS 19 ***Title:*** *Preliminary Testing of Polymer Dispersed Liquid Crystals of 50% Polymer and 50% Liquid Crystals Content as Slab Waveguide Cladding Material*

Dr. Ghada Nabil Hassanein, Assistant Professor, Taibah University, Saudi Arabia

WEC 20 ***Title:*** *Characterization and Cu^{2+} Adsorption of Ecological Hydroxyapatite Synthesized from Llimestone Sludge*

Dr. Kae-Long Lin, Professor, National of ILan University, Taiwan

Posters & Papers

IWCC 21 ***Title:*** *Hierarchical Porous Electrode Impedance Model based on Diffusion Dynamics and Electrode Morphology and Prediction of Electric Double Layer Structure*
Dr. Yanfang Gao, Director, Inner Mongolia University of Technology, China

IWCC 22 ***Title:*** *Stable Mo/1T−MoS2 Monolith Catalyst with a Metallic Interface for Large Current Water Splitting*
Dr. Zhiwei-Wang, Inner Mongolia University of Technology, China

IWCC 23 ***Title:*** *Rare Earth Metal-Triazine-Based Porous Organic Polymer Catalyzed Oxygen Reduction Reaction*
Dr. Xiaoqi Zhao, Inner Mongolia University of Technology, China

IWCC 24 ***Title:*** *In Situ Synthesis of VNQD@rGO/NC Composites for High-Performance Lithium-Ion Battery Anode Materials*
Dong Wang, Inner Mongolia University of Technology, China

IWCC 25 ***Title:*** *Preparation of Manganese Dioxide and ZIF-67 Derived Porous Carbon Composite Material and Its Application in Supercapacitors*
Dr. Ju-Yin Liu, Inner Mongolia University of Technology, China

Exhibitor

NEWARE

Neware Technology Limited

Company Name: Neware Technology Limited

Brief introduction: Neware was founded in 1998, Neware has been committed to providing reliable battery testing systems. Thus far, Neware has provided flexible, high accuracy battery testing equipment to more than 48,000 customers worldwide ranging from battery manufacturers to R&D institutes. Customers state they love the stable, cost-effective battery testing equipment, along with the great service of Neware.

Website: https://en.neware.com.cn/

Contact person: Zhufeng Liu
Email: liuzhufeng@neware.com.cn

Abstract Book

Keynote Forum

Keynote Forum

Moderator

Dr. Peter B. Harrington, Professor, Ohio University, USA

Time: 09:10-12:10, May 17, 2023 (Wednesday)

Place: Sapphire+Crystal, 2F, Hyatt Regency Osaka

Title: Chiroptical Spectroscopy in the Solid State

Dr. Reiko Kuroda
Designated Professor
Chubu University
Japan

Abstract

Chirality (left and right handedness) is ubiquitous in nature, found from molecules to crystals in the non-biological domain, and from molecules including genes/gene products to individual living organisms in the biological domains. At AnalytiX2023, I shall focus on chiral spectroscopy in crystals, films and gels. Although it can provide rich information necessary to understand the unique and useful solid-state chemistry, it suffers from intrinsic macroscopic anisotropies whose artefact signals are sometime 100 ~ 1,000 times larger than the true CD (circular dichroism) signals. Thus, they cannot be generally measured on commercially available instruments. First, I have devised a method to measure true CD for uniaxial single crystals and developed KBr disc methods for microcrystals, the method now being used all over the world. I have then designed and developed versatile chirotptical spectrophotometers, UCS-1, 2, and 3 (UCS = Universal Chiroptical Spectrophotometer, Patents holding). UCS-2 and 3 house a horizontal sample stage to measure real-time transmittance CD of soft materials which suffer from gravity, as well as an integration sphere to measure diffuse reflectance CD. Applications to organic and inorganic compounds as well as biological samples such as DNA quadruplexes, -amyloids and hornet silk films will be shown.

Biography

Reiko Kuroda, Designated Professor at Frontier Research Institute, Chubu University Japan and Professor Emeritus at The University of Tokyo, obtained Ph.D. in Chemistry from The University of Tokyo and worked at King's College London in the Department of Chemistry and then of Biophysics, as well as at Institute Cancer Research, UK. She is a scientist known for her seminal contributions to left and right asymmetry in chemistry, spectroscopy, crystallography, molecular and developmental biology. Her scientific achievements have been recognized through many prizes and awards. She is a L'Oréal UNESCO Women in Science Laureate and one of 175 past/current chemists featured by the Royal Society of Chemistry UK for its 175th anniversary. Reiko is a foreign member of the Royal Swedish Academy of Sciences.

Title: The Virtual Patient to Test Drugs In-Silico

Dr. Hans Leuenberger
Prof. Emeritus
University of Basel
Switzerland
College of Pharmacy, University of Florida, Department of Pharmaceutics,
Center for Pharmacometrics and Systems Pharmacology
6550 Sanger Road,
Orlando, FL 32827, U.S.A

Abstract

It is the task of translational research to define the concept of the virtual patient. As an example, we can describe the patient as a mechanistic physiological model consisting of different compartments being exposed to an active pharmaceutical ingredient API. Thus, we can determine the fate of an API based on its pharmacokinetics PK and pharmacodynamics PD qualities complemented by population PK/PD modeling and by real world outcomes. The focus of this approach is the fate of a single API such as Nifedipine. On the other hand, we can complete this mechanical model by creating an intelligent robotic type of virtual patient able to replicate & being conscious. A description of such a model is presented and as an example, an in-silico controlled release formulation is administered to the virtual patient. Thus, it is rewarding to first administer to the virtual patient an in-silico API formulation before starting expensive clinical trials.

Biography

Dr Hans Leuenberger studied experimental physics and wrote his PhD thesis in nuclear physics at the University of Basel. He became Research Group leader in the department of Pharmaceutical R&D at Sandoz Pharma (today Novartis). During the 12 years working at Sandoz, he spent a sabbatical at the University of Michigan. He wrote a habilitation thesis in Pharmaceutics and was Head of Pharmaceutical R&D Sandoz, Spain before he was elected as full professor in Pharmaceutical Technology at the University of Basel in 1982. He received numerous awards, (see awards gallery at https://www.ifiip.ch) and served as President of the Scientific Council of the Swiss Academy of Engineering Sciences (SATW) and as Vice President of SATW. Hans mentored over 120 PhD students at the University of Basel, the majority later working in the pharmaceutical industry. He is affirmed inventor in 12 patent families of the Glatt Group, one patent first owned by Asulab, and one patent belongs to the University of Iowa. He served as president of the Swiss Society of Pharmaceutical Sciences (today: Swiss Academy of Pharmaceutical Sciences) and he is a member of the American Association of Pharmaceutical Scientists, Member of the Royal Academy of Pharmacy of Spain, Member of the Russian Academy of Engineering and Honorary Member of the Swiss Academy of Engineering Sciences (SATW). As professor emeritus he moved to Florida and became a member of the adjunct faculty of the college of Pharmacy of the University of Florida, Orlando Campus at Lake Nona.

Title: Catalytic Activity and Colloidal Stability of Lipid-Palladium Nanoparticle Assemblies in Water

Dr. Young-Seok Shon*, Dominick Ortega, Nicholas Pavlakovich, and Saba Dalaub
Professor of Chemistry
Department of Chemistry and Biochemistry
California State University Long Beach
United States

Abstract

The lipid-nanoparticle assemblies (LNAs) of 1,2-distearoyl-sn-glycero-3-phosphocholine (DSPC) lipids and Pd nanoparticles (PdNP) are prepared using a thin film hydration method. This process produces LNAs with a hydrophobic bilayer region that contains the hydrophobic PdNP catalysts. The structure-property relationships of LNAs on colloidal stability and catalytic activity are also studied by manipulating the lipid composition and/or reaction temperature. The studies of LNAs using dynamic light scattering (DLS), differential scanning calorimetry (DSC), and transmission electron microscopy (TEM) show decreased colloidal stability with the incorporation of PdNPs compared to their counterpart 1,2-distearoyl-sn-glycero-3-phosphocholine (DSPC) liposomes without PdNPs. The incorporation of cholesterol is found to mostly negate the negative influence of embedded PdNPs on the colloidal stability of LNAs. The catalysis results indicate that the presence of a hydrophobic bilayer allows the facile diffusion of substrates and hydrogen gas molecules near the catalytic sites for the enhanced hydrogenation of alkenes in aqueous environments. The kinetic studies show that the isomerization of terminal alkenes to internal alkenes occurs more favorably in the early stage of the reactions, which is followed by the subsequent hydrogenation of all alkene isomers. A significant increase in the rate of hydrogenation occurs when the reaction temperature increases from 22 (room temperature) to 37 °C (biological temperature). Phase transition of DSPC-PdNP LNAs from gel to liquid crystalline phase changing the fluidity of the bilayer is proposed to be the main reason for dramatic increases in the catalytic activity of the LNAs. The rate of hydrogenation is also found to decrease with the presence of cholesterol in LNAs indicating a negative influence on the diffusion of alkene substrates.

Biography

Dr. Young-Seok Shon is a professor and graduate advisor of chemistry at CSULB. He received his B.Sc. and M.Sc. in chemistry from Sogang University in South Korea. He carried out doctoral research with Dr. T. R. Lee at the University of Houston, United States, where he received his Ph.D. in Chemistry in 1999. Between 1999 and 2001 he held his postdoctoral position at the University of North Carolina at Chapel Hill (with Dr. R. W. Murray). He began his academic career at Western Kentucky University (2001–2006), before continuing at CSULB. He got the Cottrell College Science Award from Research Corporation in 2003 and several Faculty Research or Student Mentoring Awards from WKU (2005) and CSULB (2013, 2018, and 2022). His current main research interests are the study and application of colloidal metal nanoparticles and their hybrid assemblies funded by the National Science Foundation and the Department of Energy. His research has also been supported by the National Institute of Health, Keck Foundation, American Chemical Society-Petroleum Research Fund, etc. He currently serves as a member of the Editorial Advisory Board of *ACS Applied Nano Materials*.

Title: Integrating Smart Metals and Damage Resistant Materials in Replaceable Components for Bridges of the Future

Dr. M. Saiid Saiidi
Professor Emeritus
University of Nevada, Reno
USA

Abstract

With the development of shape memory alloys (SMAs) for civil infrastructure in recent years and the expanding emphasis on resiliency and sustainability, a totally new vision for bridges of the future is developed. The focus of the study to be presented is on seismic response of bridges. To incorporate resiliency in bridges, SMA bars of different types were combined with damage resistant materials such as rubber and engineered cementitious composites (ECC) to develop plastic hinge elements that would keep bridges serviceable even after strong earthquakes with no or minimal repair need. Eliminating or minimizing structural damage by itself helps reduce the carbon footprint of bridge structures. However, the presentation will show that the study expanded the investigation into development of replaceable smart elements for bridges that were designed for deconstruction (DfD). DfD is a new concept that essentially helps recycle bridges that are structurally sound but do not meet the functional requirements of the location. By disassembling and reassembling the bridge at a new, appropriate location, the bridge is reused and is no longer torn down and placed in a landfill. The presentation will include the research and development of the replaceable patented elements, incorporation in large-scale bridge columns and a two-span bridge tested on shake tables, and analytical simulations.

Keywords: Bridges, Earthquake damage, Permanent displacement, Shape memory alloys, Iron-Based, Shake table testing.

Biography

Dr. M. Saiid Saiidi is a Professor Emeritus at the University of Nevada, Reno, a Distinguished Researcher at the University of California, Los Angeles, and a Senior Principal at Infrastructure Innovation, LLC. He has published over 550 papers/reports and given over 450 presentations around the world, many as a keynote speaker. Dr. Saiidi's research has been funded by many national and state agencies in the United States, focusing on experimental and analytical studies of seismic response of reinforced concrete bridges and other structures, seismic retrofit, resiliency with novel materials, seismic analysis and design of precast bridges for accelerated bridge construction, shape memory alloy studies for structural engineering application, and probabilistic seismic damage control in reinforced concrete bridge columns. Dr. Saiidi pioneered the development and utilization of shape memory alloy reinforcement in bridge columns and was the primary drive in implementing this technology in a show case bridge in Seattle, Washington. He has supervised research for over 35 Ph.D. and 65 M.S. research assistants. Dr. Saiidi's accomplishments have been recognized through many awards for his research and publications. He is a fellow of the American Society of Civil Engineers and the American Concrete Institute.

Title: Machine Learning Opportunities for Chemical Analysis

Dr. Peter B. Harrington
Professor
Ohio University
USA

Biography

After graduating with a BS degree in Chemistry from Randolph-Macon College-Ashland, Peter worked for Nabisco as a flavor chemist where he became interested in analytical chemistry, chemometrics, and the forensic analyses of foods. After working for 2 years, he pursued doctoral research in analytical chemistry and machine learning under Tom Isenhour at the University of North Carolina-Chapel Hill. Afterward, he held a Research Assistant Professor appointment at the Colorado School of Mines where he developed algorithms and software for the detection of pathogenic bacteria by pyrolysis-mass spectrometry. In 1989, he began his career at Ohio University. His research involves the areas of chemometric, forensic, metabolomic, and proteomic analysis. Professor Harrington founded the Center of Intelligent Chemical Instrumentation in 1992 to foster automated chemical instruments and assumed the role of Director in 2002. In 2015, he was recognized as a Fellow of the American Academy of Forensic Sciences. In 2016, he earned the Ohio University College of Arts and Sciences Award for Excellence in Research and in 2019 he earned the Eastern Analytical Symposium Award for his Outstanding Contributions to Chemometrics. He is interested in self-optimizing chemometric algorithms and has devised many chemometric methods. He seeks new collaborations with many groups and government agencies on combining state-of-the-art methods in machine learning and artificial intelligence to problem-solving using analytical chemistry.

Title: Strategy of Hybrid Concept for the Sustainable "Coal-to Green Energy Transition" – Plan 2050 in Bulgaria

DSc. Georgi Todorov*, DSc. Ivan Kralov, Dr. Ivaylo Koprev, Dr. Boriana Tzaneva
Professor
Head of CoE "Mechatronics and clean technologies", Dean of the Faculty of Industrial Technology
Technical University of Sofia
Bulgaria

Abstract

A model and strategy for the Coal-to Green Energy Transitionsition of the Republic of Bulgaria, corresponding to the strategic goals of the country and in coordination with energy balances of the European Union, with adequate guarantee of energy security of Bulgaria in a smooth transition to low-carbon and "green" energy and to achieve energy sovereignty – reduction of the country's energy dependence from 40% at present to below 10% by 2050 was developed and discussed with all parties in the process.
A hybrid approach based on the "green" energy with maximum use of local energy resources and energy storage was worked out, as follow:
• Production of green energy by PV plants on the territory of Mini Maritsa Iztok (MMI) - installed capacity from 4 to 9 GWp;
• Construction of new wind farms in suitable areas (including off shore) - with a total capacity of 5 to 7 GWp;
• Envisages short-term storage of green energy in the existing Chaira Hydro Power Plant further developed with the enlaged lower reservoir - 1 GW with a total capacity of 14 GWh;
• New Underground Pumped-storage hydroelectricity - "MMI"- 1 GW, with a total capacity of 12 GWh;
• Two New Nuclear Power Plants - total power of 2 GW.
Proposed energy mix will decrease by the years the value of CO2 emissions in kg/MWh clearly to the value of emissions up to 2050 of about 70 kg/MWh and lower with cost definetely lower then now, as a sustainable composition in a long term perespective.
The developed energy model can be the basis for a long-term strategic project for energy security of Bulgaria in the process of decarbonisation and outlines the possibility for the country to become one of the leading European partners in the development of technologies for hydrogen production and storage, incl. in ECMI. Funding for such a project may be part of the "Recovery and Sustainability Plan", as well as other grant programs of the European Commission, incl. Horizon Europe. It is a significant opportunity to attract interested private investors on a market basis, for example PSH can be built with the participation of interested owners of PV plants, thus achieving economically better overall return on investment and many more.

Biography

Dr. Georgi Todorov, DSc., Professor, Chairman of the general assembly of Technical university of Sofia, Dean of Faculty of industrial technology, Technical university of Sofia. Mr. Todorov obtained Master degree in Mechanical engineering and in Applied Mathematics in TU-Sofia. At 1998 he obtained his Ph.D. degree in the Technical University of Sofia. He complete specializations in engineering analysis at the Staffordshire University, UK (1993&94) and in AOTS, Japan (2003) in Rapid Prototyping and Rapid Tooling technologies. At 2019 he is a Doctor of Sciences. He has successfully completed over 50 international industrial projects for companies such as Chevron (USA), Tyco Electronics (USA), Sensor Nite (Bulgaria), Sensata (Holland), Siguren (France), Nexen Lift Truck (UK), CMS (Italy), Wahler (Germany), LS Yang (Taiwan), Deltica (USA), Visteon / Johnson Controls (Bulgaria, France), Renault (France), VW (Germany) and many others. Dean of the Faculty of Industrial Technology at the Technical University of Sofia 2010-.

Title: Bound States in the Continuum and Non-linear Wave Phenomena

Dr. Sergei V. Shabanov
Professor
University of Florida
USA

Abstract

Bound states in the continuum (BSC) are analyzed in quantum systems, photonics, and elasticity. Explicit analytic examples BSCs are given as resonances with the vanishing width. It is demonstrated that trapped wave modes comprising resonant excitations with a nearly vanishing width have highly non-uniform amplitude, and there are regions where non-linear wave phenomena can be enhanced by several orders in magnitude. As an example, an analytic solution of a second-harmonic generation in a subwavelength grating with non-linear dielectric susceptibility is presented.

References:
[1] D. C. Marinica, A. G. Borisov, and S. V. Shabanov, Phys. Rev. Lett. 100, 183902 (2008)
[2] R.F. Ngandali and S.V. Shabanov, J. Math. Phys. 51, 102901 (2010)
[3] R.F. Ngandali and S.V. Shabanov, Proc. SPIE 8808, Active Photonic Materials V, 88081F, DOI:10.1117/12.2028277 (2013)
[3] O. Haq and S.V. Shabanov, Wave Motion (2021) 103: 102718

Biography

Dr. Sergei V. Shabanov is the Term Professor of University of Florida; Associate Director of Institute for Fundamental Theory (Department of Physics), Faculty Adviser to University Math Society

Areas of Interest/Research

– Photonics, electromagnetic wave scattering;
– Navier-Stokes equations and applications to laser-induced plasmas;
– Constrained systems in quantum theory, path integral formalism, Yang-Mills theories

The 8th Annual Conference of AnalytiX-2023 (AnalytiX-2023)

AnalytiX 01:

Frontiers in Microscopy and Molecular Imaging

Chair

Dr. Jay Theodore Cremer, Chief Scientist, Adelphi Technology, Inc., USA

Dr. Knut Moeller, Professor for Medical Informatics, Furtwangen University, Germany

Time: 14:00-17:40, May 17, 2023 (Wednesday)

Place: Tatsuta, 5F, Hyatt Regency Osaka

Title: Polarized Red Laser 650 nm Microscopy: Imaging Thick Sections of Teeth

Dr. Santiago Gomez
Professor
University of Cadiz
Spain

Abstract

A 1mW red laser 650 nm is used as an afocal illumination source, together with a CCD camera in a finite polarizing microscope to characterize collagen organization in thick sections (50-1000 μm) of tooth. The images captured are monochromatic, in red and black, and when compared to the ordinary polarization image has a higher spatial resolution. The image formation follows the same physical principles that govern monochromatic light (of any wavelength, λ). In particular, the polarized red laser (λ = 650 nm) also experiences constructive and destructive interference and wave amplitude has values of zero for nλ and a maximum for ½ λ. This can be verified by examining a quartz wedge, or similar (e.g. a thin section of a fish otolith which is composed of aragonite, a mineral of high birefringence). When examining these wedges, we will see black fringes separated by exactly 1λ.

Polarized red laser microscopy, currently technically rudimentary, could be an interesting method for the study of hard tissues. Valuable microstructural information can be obtained from thick sections without the use of very expensive equipment.

Biography

Santiago Gomez is a Professor of Anatomic Pathology at the Faculty of Medicine, University of Cadiz, Spain. He has been visiting scientist at University College London, Universita La Sapienza Roma, Cornell University, and New York University. With an initial interest in pathological calcification, in the last 30 years his research has focused on hard tissues with special emphasis on their preparation, imaging and analysis. His excellence in technical work and photomicrography has recognized in winning several Nikon Small World and Buehler Microstructure awards.

Title: Polarized, Cold Neutron Microscopy with Magnetic Compound Refractive Lenses

Dr. Jay Theodore (Ted) Cremer, Jr.
Chief Scientist
Adelphi Technology, Inc.
USA

Abstract

Neutron beams are powerful materials science probe, providing unique information about structure of matter. Presented are theory and experiments with a slow (cold and very cold) neutron microscope, based on magnetic compound refractive lenses (MCRL), comprised of permanent NdFeB magnets. This slow neutron microscope is based on magnetic neutron lenses, which form a two-dimensional, periodic magnetic field, focusing spin-up neutrons and defocusing spin-down neutrons of an incoming neutron beam, and thus acts as a polarized neutron microscope.
Reported are experimental results at Institut Laue-Langevin (ILL) research reactor on ILL pf2 very cold neutron beam line (VCN) and D33 SANS cold neutron beam line. On pf2 VCN, using dominant 45 Å neutrons, are reported experimental results of (1) MCRL focal length and focal spot, (2) simple neutron microscope, an MCRL objective lens with 2-fold magnification, and (3) compound neutron microscope with MCRL condenser lens, providing increased illumination of sample objects, and with MCRL objective lens, producing 3.5-fold magnification.
Also reported, are experimental results on D33 SANS with 16.7 Å neutrons, where (1) magnetic field gradient of 5-period MCRL was measured by raster-scanned pencil beams, (2) one-to-one imaging was obtained, (3) SANS test performed using 9 small beams, 3 x 3 multi-beam, and (4) SANS performed with sample of opal.
Potentially, neutron lenses, acting as wiggler/undulator, could wiggle MeV proton & GeV electron, charged particle beams, producing photons.
Finally reported are results of a magnetic compound refractive prism (MCRP), offset gravity droop in small angle neutron scatter, via a 5 prism-shaped magnetic fields in 2.5 cm wide channel, causing upward deflection and transverse focusing of spin-up neutrons and downward deflection and transverse defocusing of spin-down neutrons.
Keywords:
Microscopy, Neutron Lenses and Prisms, Spin-Polarized Neutron Microscopy, Compound Refractive Magnetic Lenses and Prisms, Periodic Magnetic Field (PMF) Imaging and Focusing of Spin-polarized Particles, PMF Wigglers and Undulators

Biography

Dr. Cremer (B.S. MIT, 1976, Ph.D. Electrical Engineering, U. of Maryland, 1984), chief scientist of Adelphi Technology, has a diverse experimental and theoretical background in applied physics, which includes x-ray/neutron sources, detectors, optics, bioelectric phenomena (artificial skin S.B thesis at MIT), and postdoctoral traineeship in biophysics on cellular electrofusion and electrically mediated gene transfer at University of California at San Francisco, 1984-1986. Dr. Cremer has published 44 peer-reviewed publications, 4 books on neutron and x-ray optics with Academic Press (Elsevier), and 5 issued US patents.

Title: Microscope Stage for Cells Live Measurements under Constant Magnetic Force - Design, Develop and Research

Daniel Dziob[1]*, Jakub Ramian[2], Jan Ramian[3] and Bartosz Lisowski[1]
[1]Jagiellonia University Medical College, Cracow, Poland
[2]AGH University of Science and Technology, Cracow, Poland
[3]Medical University of Silesia, Katowice, Poland

Abstract

Interest in if and how magnetic field impacts living organisms has a long and well documented history. Scientific literature is full of articles trying to answer how magnetic field influences organisms at macro and micro-level. However, significant amount of research was done for static (constant) magnetic fields, whereas magnetic force can act on an object with nonzero magnetic susceptibility only when a gradient of magnetic fields occurs. Force value obviously depends on this gradient. Here we present a set of originally designed microscopic stages, which allow for obtaining homogenous magnetic forces for microparticle manipulation inside living cells or in buffer.

All stages are based on the idea of Halbach array of magnets. We 3d printed and verified several stages, which differ by: (1) the number of magnets, (2) their spatial arrangement, (3) strength and (4) materials from which a given stage was printed. Distribution of magnetic field was verified by measurements of magnetic field components by precise magnetometer (Smart Magnetic Sensor ASONIK SMS-102). Stages were tested for the effects of long-term exposition on temperature, humidity and CO2 concertation, required for observation of living cells. Several experiments were conducted with the use of the stages.

Obtained results show that by design of the microscope stage with Halbach array of magnets one could adjust the magnetic field gradient and the magnetic force acting on magnetic microparticles placed in a small petri dish, in the buffer or inside the cells. The obtained range of forces varies depending on the architecture of the stage, but it is easy to obtain biologically reasonable forces of the order of piconewtons. Measurements of stages behavior under microscope allowed for the choice of optimal materials for 3d printing as well as the Halbach array architecture of magnets mounted on a stage.

Designing and printing of a functional microscopic stage with Halbach array of magnets, which is a source for constant gradient magnetic field, is nondemanding and accessible method for investigating the impact of biologically significant magnetic forces on living cells.

Title: Ultrathin Metal Coatings as a Solution for Successful SEM Imaging of Nano-electrospinning Fibers

Dr. Anna E. Walkiewicz
Application Specialist
Quorum Technologies Limited
UK

Abstract

Electrospinning fibers are used in many fields- from energy storage, environmental engineering to healthcare. Close examination of such tiny polymeric structures is usually carried out by use of Scanning Electron Microscopy. Electrospinning fibers are made of polymers, they form stacks, where individual fibers touch each other but they are not connected. The fibers could have variety of diameters from hundreds to a few nanometers, where usually, the smallest diameters are in preference. They can be smooth or exhibit porosity. In SEM imaging such specimens are the most challenging as fibers gather charge and might move when subjected to the electron beam. For successful SEM imaging of such specimens a layer of conducting coating is a necessity. Such coating has to be made of a metal with excellent SE yield that exhibits very small grain size. Only then the coating can be thin enough not to obscure the discrete morphology of a single fiber and allow for crisp and clear imaging. Gold, iridium, molybdenum and tungsten coatings produced with use of high base vacuum were used to show the impact of a metal grain size and process parameters on coating quality in ultrahigh resolution imaging. PVdF – poly (vinylidene fluoride) electrospinning fibers were chosen as substrates for all metal coatings and subjected to imaging.

Biography

Dr. Anna E. Walkiewicz is the Applications Specialist at Quorum Technologies. She holds a Ph.D. from the University of Birmingham, where she researched the recognition of chirality at nanoscale. During her previous role as Applications Scientist for SEM and AFM products at Keysight Technologies, she acknowledged the extreme importance of proper sample preparation for high resolution imaging. Her main area of interest lays in discovering the outcome of processes occurring at the uppermost part of surfaces.

Title: Real-Time Lung Perfusion Monitoring with Electrical Impedance Tomography

Dr. Knut Moeller*, Dr. Alberto Battistel, Rongqing Chen, and Eric Stein
Professor
Furtwangen University
Germany

Abstract

During COVID pandemic, the value of fast, reliable monitoring of the lung state became even more important than before. Electrical Impedance Tomography (EIT) is a technology, that besides MRI and CT has become more and more popular on Intensiv Care Units and clinical wards world-wide.
In most cases, EIT's clinically important imaging properties may be attributed to: (1) non-invasiveness and non harming sensing (2) ability to provide real-time data of thorax and lungs; (3) ability to distinguish between perfusion and ventilation changes. A number of methods have been developed to overcome problems in the separation of the signals in the measurements and to improve the imaging quality. Methods will be reviewed and their key properties discussed. This will motivate our newest progress based on raw data signal separation and an individualized image reconstruction method.

Biography

Knut Moeller, Chair Medical informatics, Research Professor "Intelligent Systems in Biomedical Engineering", Director Institute of Technical Medicine, Furtwangen University, and Bioengineering Center, University of Canterbury, received his Diploma in Computer Science in 1986, his Phd in Computer Science in 1991 and his MD in Human Medicine in 1992 from University of Bonn, Germany. His research interests are in Medical Decision Support, Automation in Medicine, Intelligent Systems, Physiological Modelling/Digital Twins, and Medical Imaging especially Electrical Impedance Tomography - Methods and Applications, He has received various awards, and recently became van Haarst Fellow of the Royal Society of New Zealand. Since 2020 he serves as Chair of the EMB section of the German Chapter of IEEE.

Title: Changes in Pelvic Alignment in a Woman Before and After Childbirth, Using Three-Dimensional Pelvic Models Based on Magnetic Resonance Imaging: A Longitudinal Observation Case Report

Asuka Sakamoto*, Goro Watanabe, Tsuyoshi Morito, Kimio Katayama, Hajime Kumagai, and Kazuyoshi Gamada
Lecturer
Nishikyusyu university
Japan

Abstract

3-dimensional pelvic models based on magnetic resonance images (MRI) can be used to investigate accuracy and specifics of changing pelvic alignment during pregnancy and after childbirth. Few studies have investigated changes of pelvic alignment during pregnancy and after childbirth using three-dimensional pelvic models. This case report documents the changes of pelvic alignment during late pregnancy and after childbirth using MRI-based three-dimensional (3D) pelvic models. This was a longitudinal observation case report. A woman was imaged with MRI at 28 and 39 gestational weeks, as well as 4 and 72 weeks after childbirth. Greater internal, anterior, and downward rotation of both innominates at week 39 was observed from that at gestation week 28. Decreased internal, anterior, and downward rotation of both innominates at week 4 after child birth was observed compared with that at gestation week 39. We report the first case in Japan of changes of pelvic alignment measured using an MRI-based 3D pelvic alignment model during pregnancy and after child birth. This case suggests that the small changes of pubic area and greater separation of anterior portions of sacroiliac joints. Internal, anterior, and downward rotation of both innominates was observed in a Japanese primipara woman having no pelvic pain.

Biography

Asuka Sakamoto, a physiotherapist & lecturer of faculty of rehabilitation sciences Nishikyusyu University, grew up in Japan and received her bachelor's degree from Bukkyo University in Kyoto in 2001. At the same time she received a physiotherapist national qualification. After over 10 years experoences as the physiotherapist in hospitals and sports clinics, she went to study in La Trobe University Australia. She recieved her master degree in 2015 and doctor's degree from Hiroshima International University in Hiroshima in 2019. Her research forcused on women's health, especially, pelvic alignment and pelvic floor muscles in pregnancy and postpartum women.

Title: Low Energy Electron Microscopy for Advanced Materials

Dr. Ilona Müllerová*, Eliška Materna Mikmeková, Šárka Mikmeková, Luděk Frank, Ivo Konvalina, Benjamin Daniel, and Aleš Paták
Director
Institute of Scientific Instruments
Czech Academy of Sciences
Czech Republic

Abstract

New techniques are necessary for the study of new advanced materials. Low- and very-low energy microscopy was found to be a very sensitive tool for the study of such materials, with the lateral resolution of such instrument being several nm for the landing energy of primary electrons down to zero. Reflected- as well as transmitted-modes are now available, so strong topographical and crystallographic contrasts are available with high lateral and angular resolution when a multichannel detector is used. Modern 2D materials can also be studied in the transmitted and reflected signal. Simulated and measured data obtained from individual atomic layers can be compared. The low-energy electron microscopy method was found to be very useful for the study of precipitates, small crystals, organic impurities, nanocomposite materials, etc. As low-energy electron microscopy can be a very surface-sensitive method, numerous experiments have been conducted in an ultrahigh vacuum system; yet new cleaning methods have been developed to enable imaging and measurements even in a standard vacuum after special cleaning. Parameters, such as the primary beam energy of electrons, electron dose, sample bias, and scanning rate, have been optimised to find the equilibrium between electron stimulated desorption and deposition. A time-of-flight spectrometer was designed for the low-energy electron mode to obtain more quantitative information about thin specimens and matter’s basic behaviour.

Biography

Ilona Müllerová obtained her scientific degree at the Czech Technical University in Prague. She developed the method and applications for low- and very-low energy scanning electron microscopy. She established the low-energy electron microscopy group in 1993 at the Institute of Scientific Instruments (ISI), Brno, Czech Republic, and was the head of the electron optics department from 1999. Ilona Müllerová has been the director of the Institute of Scientific Instruments since 2012. She has solved numerous scientific projects, has contributions regularly published in scientific journals, and has established fruitful cooperation with foreign institutions, such as Prof. Kenji Matsuda’s laboratory at the University of Toyama, Japan.

Title: Understanding Catalyst Nanoparticles for Energy Conversion by Advanced Electron Microscopy

Dr. Paulo Ferreira[1,2,3]
[1]INL – International Iberian Nanotechnology Laboratory, Av. Mestre José Veiga s/n, 4715-330 Braga, Portugal.
[2] Materials Science and Engineering Program, The University of Texas at Austin, Austin, Texas 78712, United States
[3] Mechanical Engineering Department and IDMEC, Instituto Superior Técnico, University of Lisbon, Av. Rovisco Pais, 1049-001 Lisboa, Portugal

Abstract

A thorough knowledge of the atomic structure and composition of catalyst nanoparticles is paramount to the development of advanced materials for energy conversion applications, such proton exchange membrane fuel cells (PEMFC) and gas to liquid (GtL) processes. This is particularly the case to understand the durability of the catalysts as a function of cycling, which remains the main issue for the commercialization of these technologies. In this talk, we will cover some advanced electron microscopy techniques to understand the behaviour of nanocatalysts, in particular 2D and 3D identical location scanning transmission electron microscopy (STEM), electron energy loss spectroscopy (EELS) and in situ transmission electron microscopy (TEM) heating. The experiments show particle migration and coalescence during the initial cycles, whereas the appearance of single atoms and atomic clusters on the surface of the support appear after additional voltage cycling as a result of surface dissolution of the nanocatalysts. For the case of alloyed nanocatalysts, the experiments show a heterogeneous deposition of species.

Biography

Paulo Ferreira is currently the Scientific Coordinator of the Advanced Electron Microscopy, Imaging and Spectroscopy Center at the International Iberian Nanotechnology Laboratory (INL), Portugal and a Full Professor in the Department of Mechanical Engineering at IST, University of Lisbon, Portugal. He is also an Adjunct Professor at the University of Texas at Austin, USA. Before joining INL and IST in Portugal, he was Robert & Jane Mitchell Endowed Faculty in Engineering and Full Professor at the University of Texas at Austin, USA and the Director of Electron Microscopy at the Texas Materials Institute at the University of Texas at Austin. He has a Ph.D in Materials Science and Engineering from the University of Illinois, USA and has done his Post-doctoral work at MIT in Materials Science and Engineering. He concentrates his scientific research in the areas of Materials Science, Nanomaterials and Electron Microscopy applied to alternative energy materials and 2D materials. He is co-author of three books, namely “Materials 2000”, IST Press, 2003, “Investing in the Future: University-Industry Collaborations in USA and Portugal”; and “Nanotechnology for Architects, Designers and Engineers” with co-authors D. Schodek (Harvard University) and Michael Ashby (University of Cambridge, UK). He is also the author of 214 scientific articles published in international journals, conference proceedings and book chapters. Prof. Ferreira has also acted as a special advisor to the Minister of Economics and Innovation, Portugal, on Government Strategy for Science & Technology, and he is part of the Selection Nomination Committee of the Japan Prize. He is also the Vice-President of the Portuguese Society for Microscopy.

AnalytiX 02:

Crystallography and Crystal Engineering

Chair

Dr. Yuzuru Miyazaki, Professor, Tohoku University, Japan

Co-chair

Dr. Toru Asaka, Associate Professor, Nagoya Institute of Technology, Japan

Time: 14:00-18:05, May 17, 2023 (Wednesday)

Place: Yoshino, 5F, Hyatt Regency Osaka

Title: Structural Analysis and Design of Novel Ion Conductors

Dr. Masatomo Yashima
Professor
Tokyo Institute of Technology
JAPAN

Abstract

Oxide-ion and proton conductors have attracted much attention due to numerous applications in various electrochemical devices, such as fuel cells, gas sensors, and separation membranes. In the present keynote talk, I discuss the crystal structure analysis and structural design of novel ion conductors. We have discovered numerous new structural-type ionic conductors as shown below.
Dion−Jacobson phases have attracted much attention due to their wide variety of properties; however, there were no reports on oxide-ion conduction in Dion−Jacobson phases. We report oxide-ion conduction in the Dion−Jacobson phase for the first time [1]. This high conductivity is attributable to the large anisotropic thermal motions of oxygen atoms, the existence of carriers (oxygen vacancies), and the formation of oxide-ion conducting layers in the crystal structure.
High oxide-ion and proton conductors with hexagonal perovskite related structures are rare. Here, we also report high oxide-ion conduction in $Ba_7Nb_{3.9}Mo_{1.1}O_{20.05}$ [2] and $Ba_7Ta_{3.7}Mo_{1.3}O_{20.15}$ [3], and high proton conduction in $Ba_5Er_2Al_2ZrO_{13}$ [4] and Ba_2ScAlO_5 [5].
Interstitial oxide-ion conduction is rare in Bi-containing materials. Herein, we report high oxide-ion conductivity through interstitial oxygen sites in Sillén oxychlorides, $LaBi_{2-x}Te_xO_{4+x/2}Cl$ [6]. Oxide-ion conductivity of $LaBi_{1.9}Te_{0.1}O_{4.05}Cl$ is 20 mS cm^{-1} at 702 °C, and higher than best oxide-ion conductors as $Bi_2V_{0.9}Cu_{0.1}O_{5.35}$ below 201 °C.

References

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2. Yashima, M; Tsujiguchi, T.; Sakuda, Y.; Yasui, Y.; Zhou, Y.; Fujii, K.; Torii, S.; Kamiayama, T.; Skinner, S. J. High oxide-ion conductivity through the interstitial oxygen site in $Ba_7Nb_4MoO_{20}$-based hexagonal perovskite related oxides. ***Nat. Commun.*** **2021**, *12*, 556.
3. Murakami, T.; Shibata, T.; Yasui, Y.; Fujii, K.; Hester, J. R.; Yashima, M. High Oxide-Ion Conductivity in a Hexagonal Perovskite-Related Oxide $Ba_7Ta_{3.7}Mo_{1.3}O_{20.15}$ with Cation Site Preference and Interstitial Oxide Ions. ***Small.*** **2022**, *18*, 2106785.
4. Murakami, T.; Hester, J. R.; Yashima, M. High Proton Conductivity in $Ba_5Er_2Al_2ZrO_{13}$, a Hexagonal Perovskite-Related Oxide with Intrinsically Oxygen-Deficient Layers. ***J. Am. Chem. Soc.*** **2020**, *142*, 11653.
5. Murakami, T.; Avdeev, M.; Morikawa, R.; Hester, J. R.; Yashima, M. ***Adv. Funct. Mater.*** **2023**, *33*, 202206777.
6. Yaguchi, H.; Morikawa, D.; Saito, T.; Tsuda, N.; Yashima, M. High Oxide-ion Conductivity through the Interstitial Oxygen Site in Sillén Oxychlorides. ***Adv. Funct. Mater.*** **2023**, *33*, in press.

Biography

Masatomo Yashima is Professor of the Department of Chemistry, School of Science, Tokyo Institute of Technology (Tokyo Tech). He received his Ph.D. in 1991 from Tokyo Tech. He has been a principle investigator at Tokyo Tech since April 1997. He has published more than 300 original research papers (cited more than 17313 times, h-index = 66 (Google Scholar) March 15, 2023). His group has been studying the ceramic materials based on the crystal structure analysis. He has successfully performed the crystal structures analyses of ionic conductors, ferroelectric materials, photocatalysts, optical materials, and structural materials. He has also experimentally visualized ion-diffusion pathways of ceramic ion conductors using high-temperature neutron diffraction and maximum-entropy methods. In recent years, he has focused on the structural design of ceramic ion conductors. His group has been discovering novel, new-structural-type oxide-ion conductors and proton conductors exhibiting high conductivities, high chemical and electrical stability.
He received more than 74 awards including the Chemical Society of Japan (CSJ) Award for Creative Work (2018), Best Teacher Award -Award for Excellence, Tokyo Tech (2014), The American Ceramic Society, Richard and Patricia Spriggs Phase Equilibria Award (2009), the Ceramic Society of Japan (CerSJ) Awards for academic achievements in ceramic science and technology (2009), the Award of the Crystallographic Society of Japan (2008), Technology Award from Catalyst Manufacturers Association, Japan (2008), The Japan Institute of Metals and Materials Meritorious Award (2008).

Title: Stereolithographic Additive Manufacturing of Dielectric Microlattices in Photonic Crystals for Terahertz Wave Control

Dr. Soshu Kirihara
Professor
Osaka University
Japan

Abstract

Three-dimensional (3D) microphotonic crystals with a diamond structure composed of titania microlattices were fabricated using ultraviolet laser lithography, and the bandgap properties in the terahertz (THz) electromagnetic-wave frequency region were investigated. An acrylic resin paste with titania fine particle dispersions was used as the raw material for additive manufacturing. By scanning a spread paste surface with an ultraviolet laser beam, two-dimensional solid patterns were dewaxed and sintered. Subsequently, 3D structures with a relative density of 97% were created via layer lamination and joining. A titania diamond lattice with a lattice constant density of 240 μm was obtained. The properties of the electromagnetic wave were measured using a THz time-domain spectrometer. In the transmission spectra for the Γ-X <100> direction, a forbidden band was observed from 0.26 THz to 0.44 THz. The frequency range of the bandgap agreed well with calculated results obtained using the plane–wave expansion method. Additionally, results of a simulation via transmission-line modeling indicated that a localized mode can be obtained by introducing a plane defect between twinned diamond lattice structures.

Biography

Soshu Kirihara is a Professor of Joining and Welding Research Institute (JWRI), Osaka University, Japan. In his main investigation “Materials Tectonics”, geometric structures were successfully fabricated to modulate energy and materials flows effectively. Original stereolithography systems were developed, and new start-up company “SK-Fine” was established through academic-industrial collaboration.

Title: Superspace Approach to the Incommensurate Crystal Structure of Higher Manganese Silicide-based Thermoelectric Materials

Yuzuru Miyazaki*, Nagendra Singh Chauhan, and Kei Hayashi
Department of Appllied Physics
Graduate School of Engineering
Tohoku University
Japan

Abstract

Higher Manganese Silicide (HMS) consists of two tetragonal structural units (subsystems) of [Mn] and [Si] with an irrational c-axis length ratio $\gamma = c_{Mn}/c_{Si}$, forming an incommensurate Nowotny chimney-ladder (NCL) structure. The [Mn] subsystem has less positional modulation and 3d electrons of Mn are responsible for the electronic conduction of this compound. In contrast, significant positional modulation of Si in the [Si] subsystem effectively blocks the propagation of phonons and hence to reduce lattice thermal conductivity. A good thermoelectric (TE) material must have a high Seebeck coefficient and electrical conductivity as well as a low thermal conductivity and HMS is thus regarded as a potential TE material to be used at a mid-temperature range. Using γ, the structure formula of HMSs is represented as $MnSi_{\gamma}$ ($\gamma \sim 1.73$). To comprehend the electronic structure of such a complicated composite crystal and its solid solutions, we adopted the concept of valence electron counts, VEC. Based on the VEC concept, we have successfully prepared V-, Cr-, Fe- and Co-substituted HMS solid solutions $(Mn_{1-x}M_x)Si_{\gamma}$ (M = V, Cr, Fe and Co). Rietveld refinement was performed for the X-ray diffraction (XRD) data using the superspace group of $I4_1/amd(00\gamma)00ss$. A VEC value was determined by the valence electron numbers Z of Mn, V, Cr, Fe, Co and Si and refined γ values as VEC = $Z_{Mn}(1\text{-}x) + Z_M\, x + Z_{Si}\,\gamma$. Due to the irrational nature, the VEC value of the parent compound (13.93) is slightly less than 14, responsible to realise good p-type performance. By appropriately controlling the VEC values, the highest dimensionless figure-of-merit $zT = 0.6$ at 800 K has been achieved for the V-substituted samples.

Biography

Dr. Yuzuru Miyazaki, is currently a Full Professor in the Department of Applied Physics, Graduate School of Engineering, Tohoku University, Japan. He is also a Member of the Thermoelectrics Society of Japan, International Thermoelectric Society, and Japan Society of Applied Physics. Currently his researches focus on thermoelectrics, novel superconductors and cathode materials of Ca-ion secondary batteries, based on the knowledge of crystal structures.

Title: A New Method to Co-crystallize Organics with Chaperone Compounds

Kenji Yoza*, Tobias Stuerzer, Martin Adam, Wolfgang Frey, Felix Krupp, Fabian Rami, and Clemens Richert
Application Scientist
Bruker Japan
Japan

Abstract

Nowadays, performance of single crystal diffractometer is much better or stunning compared to that even just five or ten years ago. Its X-ray generator can produce intense X-ray with lower power consumption. And the detector can detect single X-ray with wide 2D area detector. Therefore, we can determine molecule structure of organics with much tinier sample than before. But still, there are many organic compounds which cannot be crystallized well. Then here is the new crystallization method developed by the University of Stuttgart[1], a new alternative to other methods, such as the crystal-sponge method. The new method is a co-crystallization with chaperon compound. It has several merits/features:
It is very simple and easy to do.
It is fast to be done.
It can provide high quality data even for absolute structure determination.
In the talk, the details will be shown including several results with various samples.
[1] Angew. Chem. Int. Ed. 2020, 59, 15875–15879.

Biography

Kenji Yoza, an application scientist, working for Bruker Japan received the doctoral degree from Tohoku university. After one year post-doc career in Kyushu university, he joined Bruker as application scientist for the single crystal diffraction business. He has conducted thousands of data collections and has been consulted from the customers on problems to solve molecular structure with single crystal diffraction instrument everyday. And he visits customer labs often to help them to use their single crystal diffractometers more effectively.

Title: Crystal Structure and Magnetocrystalline Anisotropy in Hexaferrites, Examined by Electron Microscopy and Diffraction Techniques

Dr. Toru Asaka*, Mai Komabuchi, Daisuke Urushihara, and Koichiro Fukuda
Associate Professor
Nagoya Institute of Technology
Japan

Abstract

The hexaferrite family has long been used as common magnet materials, and has been studied for a long time from the viewpoint of basics and applications. Since magnetic-field-induced ferroelectricity was found in a kind of hexaferrite, the hexaferrites have attracted attention as multiferroics. We have also studied the structural properties of various multiferroic hexaferrites, including Y-type ferrite, in which magnetic field-induced ferroelectricity was first discovered. Here, we investigated the correlation between the crystal structure and magnetism in X-type ferrite, $Sr_2Co_xFe_{30-x}O_{46}$ using magnetic measurements and transmission electron microscopy (TEM), including electron diffraction (ED), high-resolution scanning TEM (STEM) and Lorentz transmission electron microscopy (LTEM). We prepared single crystals including various contents of cobalt ions using a flux method. It was found that the magnetic anisotropy of this system greatly changed depending on the cobalt content. In particular, the $x = 2$ compound exhibits a very characteristic magnetic anisotropy. In $Sr_2Co_2Fe_{28}O_{46}$, when the temperature changed, the magnetization magnitude along the [210] and [1-10] directions changed dramatically at around 340 K, while the magnetization magnitude along the [001] direction remained almost unchanged, suggesting a spin-reorientation transition. The magnetic field dependence of the magnetization along [210] exhibited a characteristic step-like behavior below 150 K, whereas the magnetization along [1-10] did not exhibit this behavior, suggesting an anomalous magnetic anisotropy in the (001) plane. Characterization of the domain structure reveals that $Sr_2Co_2Fe_{28}O_{46}$ exhibits a strong axial-magnetocrystalline anisotropy at low temperatures with axes along directions tilted ~60° from the [001] direction to the [1-10] direction. Such anisotropy results in a unique magnetocrystalline anisotropy, that is, multiaxial anisotropy caused by the crystal symmetry.

Biography

Toru Asaka, Associate Professor of Materials Science, Nagoya Institute of Technology, grew up in Japan and received his Doctor degree from Waseda University in 2001. After working as a postdoctoral fellow at the National Institute for Materials Science and the Japan Fine Ceramics Center, he has been working at Nagoya Institute of Technology since 2010. Until now, he has consistently focused on structural physics of inorganic materials.

Title: Unusual Dielectric Response of Sizable-Glass Formers with Polar Rotors

Marzena Rams-Baron*, Alfred Błażytko, and Marian Paluch
Associate professor
University of Silesia in Katowice
Poland

Abstract

The dynamics of molecular reorientation play an important role in many classes of materials, determining their physical and mechanical properties and underlying applications and thus influencing materials science and development. The consideration of large and anisotropic systems with significant moments of inertia leads to questions regarding their rotational dynamics, most of which have never been investigated. To address these fundamental issues, we proposed a new class of sizable glass-forming materials with peculiar relaxation properties revealed in dielectric relaxation studies. The concept of sizable glass-forming molecules (molar masses of approx. 600 g/mol, number of atoms > 80) concerns material being a collection of rigid or semi-rigid planar frameworks creating molecular cores functionalized with flexible chains and linked to small polar units. Our approach, based on systematic dielectric studies of sizable molecules differently labeled with a dipole, allows us to tackle the previously unknown aspects related to the impact of large size (significant moment of inertia) and anisotropy on the reorientation of sizable molecules probed by BDS, and allow us to explain to what extent the properties of a probe (dipole) govern the overall picture of their reorientation dynamics.
This research was funded by National Science Centre, Poland (grant No. 2021/41/B/ST5/00992).

Biography

Marzena Rams-Baron is an associate professor at the Institute of Physics, Faculty of Science and Technology, University of Silesia in Katowice. She is a specialist in the dielectric research of glass-forming systems aimed at deepening the knowledge of structure-dynamics relationships. She obtained her Ph.D. in physics in 2013 for interdisciplinary research on new photosensitizing agents for photodynamic therapy. In 2015, she began post-doctoral research as part of a project concerning amorphous pharmaceuticals in the group of Prof. Marian Paluch, focusing on molecular mechanisms of amorphous drug stabilization and the role of tautomerization. Currently, she continues her research in experimental dielectric research as principal investigator (PI) in a project funded by the National Science Center devoted to the dynamics of sizable molecular rotors.

Title: High Pressure Synthesis and Structural Phase Transition of the Strontium Tungstate $Sr_3W_2O_9$

Dr. Daisuke Urushihara* and Toru Asaka and Koichiro Fukuda
Assistant Professor
Nagoya Institute of Technology
Japan

Abstract

The strontium tungstate compound $Sr_3W_2O_9$ was prepared using a high-pressure synthesis technique. The crystal structure was determined by transmission electron microscopy and single-crystal X-ray diffraction. The crystal structure was found to be a hettotype structure of the high-pressure phase of $Ba_3W_2O_9$, which has corner-sharing octahedra with trigonal symmetry. $Sr_3W_2O_9$ has a monoclinic unit cell of $C2/c$, and one characteristic of the structure is the breaking of the threefold rotation symmetry existing in the high-pressure phase of $Ba_3W_2O_9$. The substitution of Sr at the Ba site results in a significant shortening of the interlayer distances of the [AO_3] layers (A = Ba, Sr) and distorts the crystal structure.
In the investigation within a broad range of temperatures, we observed successive structural phase transitions from the high-temperature ($R\bar{3}m$) to the middle-temperature ($R\bar{3}c$), and then to the low-temperature ($C2/c$) phases. The order parameter between the high- and middle-temperature phases can be regarded as the tilt angle of WO_6 octahedra. In the middle-temperature phase, the tilt angle of WO_6 octahedra decreases and approaches that of the high-temperature phase with increasing temperature. In the low-temperature phase, an additional monoclinic distortion, which breaks the threefold rotation symmetry that is observed in the high- and middle-temperature phases, appears. The successive structural phase transitions in $Sr_3W_2O_9$ are attributed to the tilting of WO_6 octahedra and subsequent octahedral distortion related to the layered structure.

Biography

Daisuke Urushihara, Assistant Professor of Material Science, Nagoya Institute of Technology, grew up in Japan and received his Doctor degree from Nagoya Institute of Technology in 2018. His work focuses specifically on crystal structure analysis of inorganic oxide materials using X-ray and electron diffraction.

Title: Liquid Phase Crystal Growth of Metal Oxide Nanostructures and Their Gas/Molecular Sensing -SnO_2, TiO_2, ZnO-

Dr. Yoshitake Masuda
Senior Research Scientist
National Institute of Advanced Industrial Science and Technology
Japan

Abstract

Metal oxide nanomaterials have been attracted much attention for functional devices. In this study, sophisticated shapes of SnO_2, TiO_2 or ZnO nanocrystals were developed in aqueous solutions for a molecular sensor, a gas sensor, a hydrophilic coating, an anti-reflective coating, etc. Nucleation and crystal growth were controlled to synthesize characteristic nanostructures.

SnO_2 nanosheets were crystallized on transparent conductive substrates in aqueous solutions [1]. They were modified with dye-labeled monoclonal antibody. Monoclonal antibody reacts with human alpha-fetoprotein in blood serum of hepatocellular cancer patient. Photoluminescence and photocurrent were obtained from the nanosheets under excitation light. Photoelectric conversion was an essence in the sensing system. SnO_2 nanosheets with dye-labeled prostate specific antigen will be used for electrodes of prostate cancer sensors.

A sensor has been developed for detecting 1-nonanal gas present in the breath of lung cancer patients by combining SnO_2 nanosheets with SnO_2 nanoparticles and noble metal catalysts [2]. A significant change in the electrical resistance of this sensor was observed with increasing 1-nonanal gas concentration; the resistance decreased by a factor of 1.12 within the range of 1 to 10 ppm at 300 °C. High sensitivity is attributed to the accelerated oxidation of 1-nonanal molecules caused by the (101) crystal faces of the SnO_2 nanosheets and should provide a simple and effective approach to the early detection of lung cancer.

[1] Y. Masuda, T. Ohji, K. Kato, *ACS Appl. Mater. Interfaces*, **4**, 1666 (2012)
[2] Y. Masuda, T. Itoh, W.S. Shin, K. Kato, *Scientific Reports*, **5**, 10122 (2015)

Biography

Dr. Yoshitake Masuda is a Research Group Leader at the National Institute of Advanced Industrial Science and Technology (AIST). He graduated from Tsukuba University in 1994, and received his Master of Engineering degree from Tsukuba University in 1996. He was an engineer at NGK Spark Plug Co., Ltd., from 1996 to 1998. Dr. Masuda was an Assistant Professor at Nagoya University from 2000 to 2006. He received his Doctor of Engineering degree from Nagoya University in 2004. His Ph.D. thesis was on the Patterning of TiO_2 Thin Films and Particles using Self-assembled Monolayers.

Title: Structural Changes in Porous Lithium Disilicate and Lithium Metasilicate Systems during Formation of Voids and Self-healing Processes Examined by Molecular Dynamics Simulations

Dr. Junko Habasaki
Assistant Professor
Tokyo Institute of Technology
Japan

Abstract

Porous materials have become increasingly important in nanotechnology. Molecular dynamics (MD) simulations of nano-porous lithium disilicate ($Li_2Si_2O_5$) systems were performed in previous works [1,2] and roles of caged ion dynamics in porous materials in the enhancement of dynamics and non-Gaussian characters of motions were argued. In a low density region (<1.6 g cm^{-3}), self-organization of larger (but still in ~nm in sizes) voids is found in the *NVE* (constant number of particles, volume and energy) condition. In this talk, I will present structural changes during this process and following self-healing process observed in *NPT* (constant number of particles, pressure and temperature) conditions. In lithium disilicate, some holes remain in the systems after the healing, while almost complete repairs are found in the case of porous lithium metasilicate (Li_2SiO_3), which contains larger number of Li ions. These processes are important to understand the mechanism of the structural formation as well as to control structures of porous materials [3].
[1] Junko Habasaki, *J. Chem. Phys.,* 145, 204503 (2016)
[2] Junko Habasaki, K.L. Ngai, *J. Non-Cryst. Solids,* 498, 364-371 (2018).
[3] Junko Habasaki, *Molecular Dynamics of Nanostructures and Nanoionics: Simulations in Complex Systems, Pan Stanford Publishing* Pte Ltd, in press.

Biography

Dr. Junko Habasaki graduated from Tokyo University of Education and completed her doctoral course in Tokyo Metropolitan University (Doctor of Science). She is currently an Assistant Professor of Tokyo Institute of Technology, Japan. She was invited as a Professor of Physics of Université de Lille 1, France (2007-2008). Her current research interest is concerned with structures and dynamics in nano-structured materials examined by molecular dynamics simulations. Tokyo Tech Best Engineering Teacher Award was given in 2019. She was awarded as the Outstanding Reviewer of three international journals such as Physica A. She has done many invited and keynote talks in international conferences. She is one of the coauthors of the book entitled "*Dynamics of Glassy, Crystalline and Liquid Ionic Conductors*". (Springer International, 2017). Two best book awards were given for this book.

AnalytiX 03:

Environmental & Pharmaceutical Analysis

Chair

Dr. Erik R. Christensen, Distinguished Professor Emeritus, University of Wisconsin-Milwaukee, USA

Co-chair

Dr. Magdalena Maj-Zurawska, Professor, University of Warsaw, Poland

Time: 14:00-17:40, May 17, 2023 (Wednesday)

Place: Kamo, 5F, Hyatt Regency Osaka

Title: Qualitative Screening for Fungicide Dithiocarbamates Using QuEChERS Methodology

Dr. H. Zipper*, C. Seyfried, E. Scherbaum, and M. Anastassiades
Research Manager
Chemical and Veterinary Investigations Office
CVUA Stuttgart
Germany

Abstract

Despite of the fact that the first representatives of dithiocarbamate fungicides (DTCs) were introduced more than 50 years ago (thiram in 1942, zineb and nabam in 1943, maneb in 1955, mancozeb in 1962), DTCs are still among the most extensively used organic fungicides in modern agriculture. For routine pesticide residue laboratories, being in charge with controlling compliance of food with maximum residue levels, analysis of DTCs remains challenging since the physicochemical properties of various representatives belonging to this compound class lead to analytical difficulties. The polymeric DTCs (ethylene-*bis*-DTCs fungicides (e.g. mancozeb) and propylene-*bis*-DTCs fungicides (propineb)) are macromolecular metal-coordinated complexes of variable size and are thus virtually impossible to analyze directly and are practically insoluble in aqueous and organic solutions. Thiram is soluble e.g. in toluene, but easily degrades during analysis. For these reasons, routinely applied multi-residue methods which involve an extraction/partitioning step of individual DTCs into organic solvents are not applicable. Various single residue methods are described in literature for the analysis of DTCs (e.g. by derivatization with dimethyl sulfate), but most routine pesticide laboratories apply a methodology that is based on the chemical cleavage of DTCs by a mixture of tin(II)-chloride and hydrochloric acid and the partitioning of the released carbon disulfide (CS2) into an organic solvent. Then, the quantitative analysis of CS2 is either achieved by spectrophotometry or gas chromatography with different detector options (e.g. GC-ECD). From the practical point of view, the disadvantage of this method is that a laborious analysis has to be conducted without having any information if the analytes of interest are present in the sample or not. A qualitative screening approach for DTCs by a routinely applied multi-residue method would help to overcome this drawback by allowing the selection of positive samples. Consequently, workload and costs could significantly be reduced for the quantitative DTC-analysis. In this study, characteristic degradation products of (a) ethylene-*bis*-DTCs (e.g. mancozeb, maneb, zineb), (b) propylene-*bis*-DTCs (propineb) and (c) N,N-dimethyl-DTCs (e.g. thiram, ziram) were identified and it was tested if these substances could be used as screening indicators for DTCs in QuEChERS-extracts analyzed by routine GC- and/or LC-MS techniques. The screening detection limits were determined according to Document No. SANTE 11945/2015 for high-water content commodities to ensure the reliable and sensitive identification of these indicator substances at a specific level of concentration. QuEChERS-extracts of numerous samples of plant origin were screened. Positive samples were re-analyzed by the chemical cleavage approach involving the release of CS2 for confirmatory and quantitative purposes. The results of this study are discussed during the presentation.

Biography

Dr. Hubert Zipper is a scientific expert at the Pesticide Residue Laboratory of CVUA Stuttgart (Germany). He got his Ph.D. thesis in Chemistry at the University of Stuttgart. Currently, he is working on databases with the aim to provide analysts with a convenient and efficient access to information needed for proper decision-making in pesticide residue analysis. His research focuses on developing of screening methods for dithiocarbamate pesticide residues in fruits and vegetables.

Title: Enhanced Catalytic Performance of $CuFeS_2$ Chalcogenides for Activation of Persulfate towards Decolorization and Disinfection of Pollutant in Water

Yang-Wei Lin[1,*], Ting-Yu Lai[1], Yu-Shu Pan[1], Xuan-Wei Fang[1], Hsing-Yi Chen[1], Chen-Hao Yeh[2,*], and Tsunghsueh Wu[3]

[1] Department of Chemistry, National Changhua University of Education, 1 Jin-De road, Changhua City, 50007, Taiwan

[2] Department of Materials Science and Engineering, Feng Chia University, 100 Wenhwa road, Taichung City, 40724, Taiwan

[3] Department of Chemistry, University of Wisconsin-Platteville, 1 University Plaza, Platteville, Wisconsin, 53818-3099, USA

Abstract

This study focuses on the synthesis and properties of $CuFeS_2$ chalcogenides, which were prepared using a heat precipitation method. The effect of synthetic temperature on the properties and catalytic activity of $CuFeS_2$ was also investigated. The study found that $CuFeS_2$ prepared at 250°C ($CuFeS_2$–250) had higher crystallinity, a higher concentration of Fe^{2+} on its surface, and a higher catalytic activity in the decolorization of rhodamine B (RhB) using a Fenton-like oxidation process with $Na_2S_2O_8$ (99.0% RhB decolorization efficiency within 7 min). The iron sites of $CuFeS_2$ were found to be the catalytic active sites through density-functional theory calculations. The study also determined that $\bullet SO_4^-$ and •OH radicals were the reactive species responsible for the decolorization of RhB. In addition, the study demonstrated that $CuFeS_2$–250 had the ability to decolorize different dyestuffs (methylene blue, methyl orange, and acridine orange) in environmental water samples (river and seawater). Furthermore, $CuFeS_2$–250/ $Na_2S_2O_8$ possessed excellent antibacterial activity (>90.4% eradication rate within 120 min) against pathogen (*Escherichia coli*, *Staphylococcus aureus*, and methicillin-susceptible *S. aureus*). In conclusion, this study highlights the enhanced catalytic activity of $CuFeS_2$–250 and its potential for industrial applications related to the decomposition of organics from wastewater.

Biography

Yang-Wei Lin, Professor of Chemistry, National Changhua University of Education, grew up in Taiwan and received his doctor of philosophy's degree from National Taiwan University in 2006. The interest of the research group (https://reurl.cc/b757kl) includes (1) synthesis and characterization of nanomaterials, (2) environmental analysis using nanosensor, (3) development of nanoscience curriculum and instructional materials. The focus is on the preparation of functional nanomaterials and the fabrication of (micro) nanoparticle substrates for high sensitivity assays and catalytic applications.

Title: Sources of Organic Pollutants and Trace Elements in the Environment

Dr. Erik R. Christensen
Distinguished Professor Emeritus
University of Wisconsin-Milwaukee
USA

Abstract

Source apportionment of organic pollutants can be carried out by chemical mass balance (CMB) modeling if sources, but not contributions, are known. Both sources and contributions may be determined by factor analysis with nonnegative constraints (FNNC) or positive matrix factorization (PMF). PMF was used to analyze dechlorination of polychlorinated biphenyl (PCB) contaminated sediments from Sheboygan River, Wisconsin, and debromination of polybrominated diphenyl ethers (PBDEs) in Arkansas water bodies. Combining a Bayesian CMB model with PMF yields probability distributions of source contributions. We review here results for polycyclic aromatic hydrocarbons (PAHs) in sediments from Lake Calumet, Illinois (FNNC) and Illinois River (CMB-PMF). Source apportionment of poly- and per-fluorinated compounds (PFASs) from the Great Lakes of North America was carried out by PMF for two sediment cores from Lake Ontario. PMF results for trace elements in moss and soil in Norway are also discussed.

Results from Sheboygan River indicate the original Aroclor 1248, 1254 mixture from Tecumseh Co., and anaerobic dechlorination profiles. Results for PBDEs in an Arkansas wastewater retention pond near Albemarle Co. reflect factors (1) deca-BDE, (2) octa/deca-BDE, (3) penta/deca-BDE with debromination, (4) penta/deca-BDE, and (5) deca with debromination. Sediment dating demonstrate that factor 2 was dominant from 1952 to 1989 consistent with timing of the receipt of wastewater effluent. Major PAH sources in Lake Calumet and the Illinois River are coke oven, traffic, coal and wood combustion. Of the four factors for the PFAS analysis, factor 3 with fluorobutane sulfonic acid (PFBS) has the largest contribution (47.8%). Significant scores for perfluorohexane sulfonic acid (PFHxS) and PFBS, along with flat or decreasing perfluorooctane sulfonic acid (PFOS) contributions since 2003, indicate that the replacement of PFOS with these compounds is beginning to take effect in the environment. Results for the trace element study of soil and moss from Norway show that major PMF factors reflect air pollution with Pb, Mo, Cd, Sb, As, and geogenic soil represented by Ce, La, Y, Eu, Co. The rare earth element Y:La:Ce ratio in soil is consistent with literature data for grazing lands.

Biography

Erik R. Christensen is a UWM distinguished professor emeritus of environmental engineering. He has edited a IAWQ (now IWA) book on contaminated aquatic sediments and co-authored the book “Physical and Chemical Processes in the Aquatic Environment,” with An Li (Wiley, 2014). He recently published a review of persistent and mobile polar organic water pollutants including perfluorinated compounds, pesticides, and pharmaceuticals. He has been an associate editor for the Journal of Great Lakes Research and the ASCE Journal of Environmental Engineering, and he is a 2005 Fellow of the American Society of Civil Engineers.

Title: Controversies, Consensus and Collaboration in the Use of -I-131 Therapy in the Differentiated Thyroid Cancer

Dr. Ciprian Draganescu
Head of Nuclear Medicine Department
University Hospital of Martinique
France

Abstract

In 2015, the American Thyroid Association (ATA) published its new guidelines for thyroid cancer.
However, these guidelines have not been validated by either the North American Society (SNMMI) or the European Society of Nuclear Medicine (EANM).
The reason for the discord was the diagnostic and therapeutic use of iodine-131.
Practically, a patient with the same file, in 2015, if he was in France, could receive a weak dose of 30 mCi I131, a standard dose of 100 mCi if he was in Germany, and in America he was only supervised during consultations.
Two years earlier, I had done an internship at the University of Michigan (UM), at the nuclear endocrinology department of Prof. Anca M. Avram, my mentor.
On the other hand, Martinique has a tradition of Franco-American presidential meetings: Valery Giscard d'Estaing - Gerald Ford (1974) followed in 1991 by the François Mitterrand-George H.W. Bush summit.
In December 1940, President FD Roosevelt made a stopover in Martinique to visit Fort St Louis, a military fortification dating from the 17th century.
And last but not least, the ERANOS meetings, where Mircea Eliade could discuss, among others with C.G. Jung and Gershom Scholem, represented for me an important example of informal meetings between personalities from neighboring fields.
The first person to whom I spoke about my idea to organize a consensus meeting on thyroid cancer was my colleague and friend, Dr Patrick Bourguet.
The proposed format for the conference: 4 half-days of work (morning and afternoon), under the guidance of a facilitator, during a weekend chosen by the four associations: European Association of Nuclear Medicine (EANM) European Thyroid Association (ETA) American Thyroid Association, (ATA), and the Society of Nuclear Medicine and Molecular Imaging (SNMMI) for teams of 3-4 experts, plus the president of each society.
In 2017, I made lobby for the conference at the World Thyroid Congress in Boston where I met the ATA President Charles H. Emerson (University of Massachusetts Medical School) and the Elected President Elizabeth N. Pearce, and the four societies accepted my invitation for January 2018, in Trois-Ilets
Arrived in Martinique, the guests realized that despite the fact that they had approximately the same information, they drew some sometimes divergent conclusions. To avoid to repeat this situation, concerned with the fundamentals of research in their field, they elaborated, at the 1st Martinique conference, nine very general principles, the Martinique Principles, later published in Thyroid (Controversy, consensus and collaboration in the use of 131I therapy in differentiated thyroid cancer : a joint statement of the ATA, ETA, EANM and SNMMI).
It should be noted that it was for the first time in the history of medicine, through the exceptional quality of the participants, .when such high-level, trans-disciplinary, trans-societal and transatlantic meeting took place.
Already validated by the four most influential scientific societies in the field, the Martinique Principles are now known and applied all over the planet.
A working group (Martinique Working Group) was created spontaneously by the participants of the first meeting. They needed 18 months to publish this first article.
Practically the same group met in 2019 in the same place and they needed almost a year to publish another very important article, always with the facilitator Laszlo Hegedus, an editorial in the EANM Journal.
Although the 2020 conference was interrupted by Covid, the MWG continue to publish yearly joint statements, in spite of the pandemic, and the next meeting is scheduled in March this year in Martinique.

Title: Voltammetric and Spectrophotometric Studies on DNA Interacting with Daunoand Doxorubicin and Their Amidino Derivatives

M. Maj-Zurawska*, A. Palinska-Saadi, I. Marinović, J. Oszczapowicz, M. Lukawska, I. Oszczapowicz, E. Zwierkowska, and S. Achmatowicz
Professor
University of Warsaw
Poland

Abstract

Daunorubicin (DAU) and doxorubicin (DOX) are anthracyclines used for the treatment of wide range of human neoplasms, e.g. breast cancer, soft tissue sarcomas, aggressive lymphomas etc. One of the mechanisms of their activity is a direct interaction with DNA. Unfortunately, in spite of their therapeutic usefulness, DAU and DOX reveal high toxicity. For this reason, it is necessary to search for new compounds which are less toxic and more active in chemotherapy than daunorubicin and doxorubicin. We have used derivatives of daunorubicin and doxorubicin, in which the –NH2 group in the daunosamine moiety was replaced by the formamidine system (–N=CH–NR1R 2) containing the rest of the cyclic amines: morpholine (DAU-Fmor, DOX-Fmor) or hexamethyleneimine (DAU-Fhex, DOX-Fhex). Our goal was to investigate interactions of daunorubicin (DAU) and of doxorubicin (DOX) as well as their formamidine derivatives with various kinds of oligonucleotides monitoring changes in the UV-Vis spectra, and changes in guanine (G) and adenine (A) oxidation signals. We have studied the influence of DAU and DOX on the DNA conformational changes by monitoring DNA circular dichroism. We have tested the influnce of different daunosamine moiety structures on the DAU-DNA and the DOX-DNA interactions.

Biography

Prof. Magdalena Maj-Zurawska, Ph.D., Dr.Sc., has a position of professor at University of Warsaw, Poland. She received her Dr.Sc. from University of Warsaw in 1998. She is a member of numerous Scientific Societies, such as Polish Chemical Society, International Society of Electrochemistry, International Society for the Development of Research on Magnesium, Gesellschaft für Mg-Forschung e.V. (Germany), among others. As a visiting professor, she has given a set of lectures in the field of analytical chemistry at several universities abroad (University of Florence, Italy; Abo Akademi University, Finland; Demirel Suleyman University, Turkey; Universidad de Alcala de Henares, Alcala de Henares, Spain; University of Rijeka, Croatia; University of Milan, Italy).
Acknowledgements: The work is partly supported by European Union in the framework of European Social Fund, and National Science Centre (NCN), Republic of Poland, grant No N N204 154540.

Title: Understanding Microbial Contaminants Occurrences in Domestic Water Supply Systems Using Non-Invasive Spectroscopic Techniques

Dr. Herlina Abdul Rahim* and Syahidah Nurani Zulkifli
Professor
Faculty of Electrical Engineering
Universiti Teknologi Malaysia
Malaysia

Abstract

Microbial contaminants' endurance in the domestic water pipeline systems is complicated due to exceptionally diverse microhabitats influencing their colonization. However, little attention has been given to water quality once it enters the consumption phase, without regard to the type of microbes present in natural pipeline settings. Therefore, using Raman spectroscopy, this study outlines the scientific understanding of microbial epidemiology influenced by seasonal fluctuations, stagnation periods, and flow dynamics in domestic water supply systems. Throughout the six-month observation, over 20% of residential tap water samples contain two bacteria species, *Legionella* and *Salmonella*, having a significant spread during the peak of rainy seasons and post-stagnation period. Raman spectra significantly produce intense peaks of distinct bands and species-specific bands related to molecular compositions between wavelengths of 420 cm^{-1} to 1800 cm^{-1}. These environmental discoveries prove that consistency in water quality monitoring at domestic pipeline systems, especially at point-of-use, is necessary. Obtaining first-hand knowledge related to point-of-use water quality should be modular and accessible to house owners and water utilities to sustain a safer water supply.

Biography

Herlina Abdul Rahim received a B.Eng in Electrical Engineering (Control and Instrumentation) and M.Sc in Electrical Engineering from Universiti Teknologi Malaysia in 1998 and 2000, respectively. She received her Ph.D. in Electrical Engineering from Universiti Teknologi MARA, in 2009. At present she is a Professor at School of Electrical Engineering, Faculty of Engineering, Universiti Teknologi Malaysia. She is currently a Deputy Director (Corporate and Project Management) at Research Management Centre in UTM. Her current research interests are sensor technology and artificial intelligent system. She actively involved in R&D and to date, she has filed 72 IPR including patent filings and copyrights. She had won many medals for her inventions and innovations at international and local research exhibition. She had also published more than 250 research articles in international journals, proceedings, book chapters and research monographs. She is a senior member of the IEEE, a Professional Engineer of Board of Engineers Malaysia (BEM), a corporate member of the Institute of Engineers Malaysia (IEM) and Chartered Engineer, the Institute of Engineering and Technology.

Title: A Novel Bioassay with Improved Sensitivity, Dynamic Range and Serum Tolerance for the Quantification of the ADCC Activity of Therapeutic Antibodies

Dr. Michael G. Tovey
Managing Director
Svar Life Science
France

Abstract

Expression of the co-stimulatory molecules CD80, CD86, or CD80 and CD86 on target cells that carry a specific antigen recognized by one of the monoclonal antibodies Herceptin®, Erbitux®, Rituxan®, or Remicade®, was found to markedly enhance ADCC activity determined using engineered effector cells expressing the firefly luciferase reporter-gene regulated by the principal transcription factors involved in FcγRIIIA receptor signaling. In contrast, background levels of reporter gene activity were observed using the same effector cells and control target cells in which the gene encoding the specific target antigen recognized by the therapeutic antibody had been invalidated by genome editing. The use of target cells expressing a co-stimulatory molecule(s) and a specific antigen and control target cells in which the gene encoding the specific antigen has been invalidated together with effector cells carrying a reporter-gene regulated by the principal transcription factors involved in FcγRIIIA receptor signaling allows the ADCC activity of therapeutic antibodies to be quantified more rapidly and with increased sensitivity and specificity compared to the use of wild type target cells and effector cells carrying a reporter gene regulated by NFAT alone. In addition, a high degree of assay precision is obtained by using target cells and effector cells prepared in thaw-and–use format resulting in intra-batch and inter-batch coefficients of variation of less than 10 % for most assay parameters.

Title: Sustainability (CSR): Energy Efficiency in Building Sector and Its Environmental Impact

Dr. Shashi Ram
Assistant Professor
National Institute of Technology Warangal
India

Abstract

For any country, energy is an important parameter for its economy. One of the major consumers of energy is building sector. Buildings consume energy during its construction phase (i.e. energy associated with the acquisition, processing, manufacturing, and transportation of the building materials) and in operating stage (i.e. to maintain healthy and comfortable living environment within a building). In addition, this energy demand for providing building services is rising with the continuous increment in the population. Thus, intensifying the already existing pressure on natural resources.

In response to growing global environmental and economic concerns, adoption of CSR approach towards energy efficiency in buildings is the need. In order to achieve energy efficiency, it is required to develop decisive methodologies to conserve energy, water, material, indoor and outdoor environment quality (Chwieduk, 2003). The current topic investigates and analyses the various techniques and alternative solutions available for the enhancement of energy efficiency in buildings.

Biography

Dr. Shashi Ram, currently affiliated as an Assistant Professor in the Department of Civil Engineering, National Institute of Technology Warangal, India. She has completed Ph.D. in Construction Technology and Management from Visvesvaraya National Institute of Technology (Nagpur, India) in 2019. She has completed M. Tech. degree in Construction Technology and Management from Visvesvaraya National Institute of Technology, Nagpur, India, in 2013. Her area of research is Sustainable development, building materials, energy efficiency in buildings and corporate social responsibility.

AnalytiX 04:

Mass Spectrometry, Raman & NMR & IR Spectroscopy

Chair

Dr. Michel Mermoux, Research Director, LEPMI-CNRS, France

Co-chair

Dr. Ciprian Mihai Cirtiu, Head of Trace Metals Division, Institut National de Sante Publique du Quebec, Canada

Time: 09:00-12:40, May 18, 2023 (Thursday)

Place: Tatsuta, 5F, Hyatt Regency Osaka

Title: Possible Ring Exchange and Chiral Spin Fluctuations in Quasiperiodic Planar Antiferromagnets: Raman Observations

Shoji Yamamoto
Professor
Department of Physic
Hokkaido University
Japan
e-mail: yamamoto@phys.sci.hokudai.ac.jp

We study Raman response of Heisenberg antiferromagnets on the $\mathbf{C}_{5v}$ Penrose and $\mathbf{C}_{8v}$ Ammann-Beenker lattices within and beyond the Loudon-Fleury second-order perturbation scheme intending to explore optical features peculiar to quasiperiodic magnets. Within the Loudon-Fleury mechanism, we find one and only Raman-active mode of E_2 symmetry without any dependence on linear incident and scattered polarizations. Beyond the Loudon-Fleury mechanism, two more symmetry species A_1 and A_2 are activated via dynamic ring exchange and chiral spin fluctuations, respectively, which can be extracted by the use of circular as well as linear polarizations. We employ Green's functions on one hand and configuration-interaction wavefunctions on the other hand to calculate the multimagnon contributions to inelastic light scatterings. Demonstrating the great advantage of the configuration-interaction scheme, we reveal that a major portion of the Shastry-Shraiman fourth-order Raman intensity is mediated by multimagnon fluctuations.

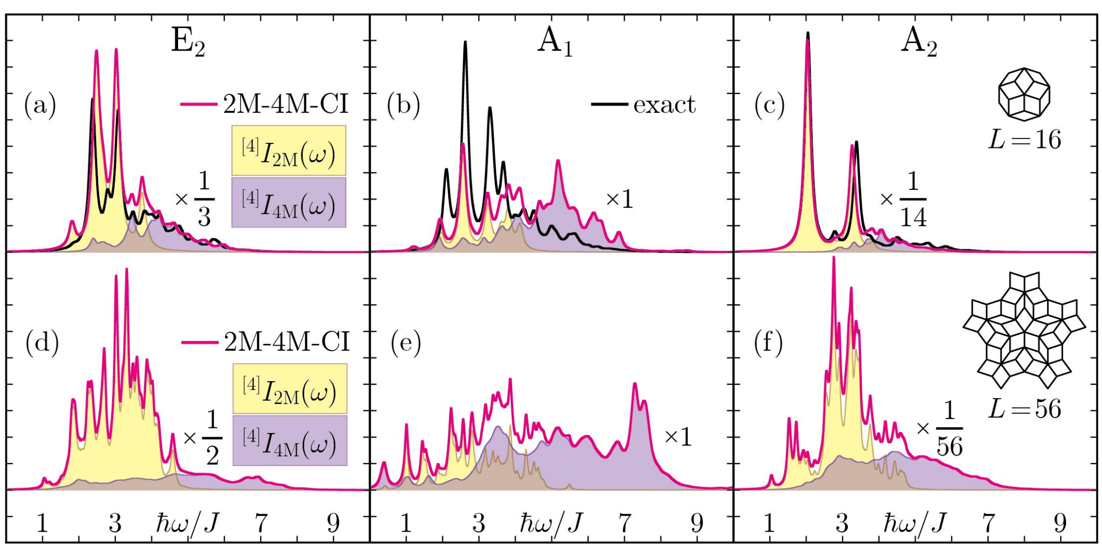

Fig.1: Two-magnon (2M)-four-magnon (4M)-configuration-interaction (CI) calculations of the Shastry-Shraiman fourth-order Raman scattering intensities $^{[4]}I(\omega) \equiv \sum_{l=1}^{\infty} {}^{[4]}I_{2l\mathrm{M}}(\omega)$ for the L=16 [(a) to (c)] and L=56 [(d) to (f)] two-dimensional Penrose lattice of C5v point symmetry, the above three of which are compared with the exact solutions, where J (>0) is the antiferromagnetic Heisenberg pair exchange parameter, while $^{[4]}I_{2l\mathrm{M}}(\omega)$ denotes the spectral weight mediated by 2l magnons. The CI calculations of $^{[4]}I_{2\mathrm{M}}(\omega)$ and $^{[4]}I_{4\mathrm{M}}(\omega)$ are individually specified and differently colored.

Title: High Temperature Oxidation of Zircaloy-4 Under Conditions Simulating a Loss of Cooling Accident in Nuclear Plants Spent Fuel Pools Examined with Raman Imaging and ^{18}O Tracer techniques

Michel Mermoux[1], Christian Duriez[2]
[1]Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, Grenoble INP*, LEPMI, 38000 Grenoble, France
* Institute of Engineering Univ. Grenoble Alpes
[2]IRSN/PSN-RES/SEREX/LE2M, Cadarache, 13115 Saint-Paul-lez-Durance

Abstract

Since the Fukushima accident, an increased attention is continuously paid to the vulnerability of the Spent Fuel Pools (SFPs). In SFPs, for different reasons, degradation of the fuel rods induced by oxidation in air-steam mixtures after dewatering is a major safety concern: (i) the cladding material is the only barrier left against fission product dissemination, (ii) the heat released by the oxidation reactions can overcome the residual decay heat of the fuel and may become the main driving force to the accident escalation, (iii) hydrogen production is a strong concern because of the presence of steam, (iv) presence of air in the atmosphere is known to be an aggravating factor because of the “catalytic” role of nitrogen on the oxidation mechanism.
In this study, high temperature oxidation tests in oxygen, air and air - steam atmospheres were performed with Zircaloy-4 cladding tubes and plates specimens. The tests described in this study were restricted to the 700 – 950°C range. Raman imaging was used to examine the specimens after the oxidation tests, either directly at the oxide surface, or on metallographic preparations for cross-section examinations.
We first used new opportunities given by Raman imaging to analyze, at least qualitatively, the structural and mechanical phenomena involved in this particular corrosion phenomena. The different methods used to extract this information that is present in the Raman data will be described and discussed.
Moreover, isotopic substitution was also considered. Raman imaging gave clear evidence for different characteristic distributions of ^{18}O in the scales. Some of them have been correlated with the development of cracks and porosity in the oxide which allows the corroding medium to penetrate locally in the scales. Thus, we also emphasize the potential of this method to investigate the ^{18}O distribution in such complex corrosion scales.

Biography

Dr Michel Mermoux is a Research Director at CNRS. He obtained a Ph.D. degree in 1988 at the Institut National Polytechnique de Grenoble, working on the synthesis, characterization and electrochemical properties of graphite oxide. Currently his researches focus on the use of Raman spectroscopy and Raman Imaging for the analysis of various materials.

Title: Detecting Falsified Oral Contraceptives with Visual Assessment and Diffuse Reflectance Spectroscopy: A Need to Supplement Traditional Pharmacopeia Techniques

Dr. David Jenkins*, Dr. Cherif Diallo, and Michael Payne
Scientist II
Product Quality and Compliance, FHI 360
USA

Abstract

Complete characterization of suspect pharmaceutical products is necessary to understand their potential public health implications. Situations can occur where traditional pharmacopeial techniques may not always fully characterize a sample. Substandard and falsified pharmaceuticals may present a major health risk, particularly for low- and middle-income countries where standard enforcement is weak. Staff from the United States Agency for International Development (USAID) reported finding in a retail market in a Sub-Saharan African country an oral contraceptive (OC) product (0.15 mg levonorgestrel and 0.03 mg ethinyl estradiol) labeled on the outer packaging with a logo (and associated brand name) visually matching one historically used by USAID but purportedly was manufactured by an unauthorized source. The product was found to align with pharmacopeia standards for assay and dissolution for levonorgestrel and ethinyl estradiol tablets. However, further visual examination of tablet characteristics and diffuse reflectance spectroscopy (350 – 2500 nm) assessments supported that the tablets were not the same type of tablets when compared to authentic control samples, thus confirming that the suspect sample was a falsified product. As shown in this work, comprehensive characterization of suspect pharmaceuticals from the field can often be required (depending on the nature of the sample) to understand the public health risks to the end user within the local market. Simple visual assessment and spectroscopic techniques to screen a sample can further help to supplement traditional pharmacopeia approaches.
Primary Reference: Jenkins, D.; Diallo, C.; Payne, M.; "Detecting falsified oral contraceptives by visual assessment and diffuse reflectance spectroscopy (350–2500 nm): the need for supplementing traditional pharmacopeia techniques and the public health implications" *Heliyon*, **2022**, 8, e10837. https://doi.org/10.1016/j.heliyon.2022.e10837

Biography

Dr. Jenkins completed his Ph.D. in Fiber and Polymer Science at North Carolina State University in 2001. After post-doctoral positions at the Georgia Institute of Technology and North Carolina State University, he joined the Product Quality and Compliance Department of FHI 360 in 2004. While at FHI 360, Dr. Jenkins provides analytical and research leadership for pharmaceuticals and medical devices. Most of his efforts are focused on the development and implementation of analytical techniques that either provide alternate types of characterizations for product assessments (when combined with more traditional techniques) or improve the efficiency (reagent usage, equipment cost, and/or testing time) of existing techniques.

Title: Microdose Pharmacogenetic Study and MIST Evaluation of 14C-Tolubutamide in Healthy Subjects by Utility of Mass Spectrometry

Dr. Zenzaburo Tozuka
Professor
Osaka University
Japan

Abstract

We estabulished the analytical methodology of microdose clinical study by quantitative determination of fexofenadine in human plasma using liquid chromatography/electrospray ionization tandem mass spectrometry (*J Chromatogr B* 858:118–128 (2007)) and Quantitative determination of nicardipine and prediction of metabolites in human plasma (*Drug Metab Pharmacokinet.* 4 (4) 389–403 (2009)). FDA published MIST Guidance in January 2010. We established MIST evaluation by Comprehensive Quantitative and Qualitative Liquid Chromatography‐Radioisotope‐Mass Spectrometry Analysis for Safety Testing of Tolbutamide Metabolites without Standard Sample (*J. Pharm. Sci.,* 100, 4024–4036 2011). In addition of MIST, the problems of clinical study of new drugs are drug interaction and phatmacogenetic differences that we studied in microdose clinical trials 1) Microdose Drug Interaction Study of 14C-Acetaminophen with Probenecid by Accelerator Mass Spectrometry (*Clin Pharmacol Ther.* 88, 824-830 (2010)), 2) Microdose Pharmacogenetic Study of 14C-Tolbutamide in Healthy Subjects with Accelerator Mass Spectrometry to Examine the Effects of CYP2C9∗3 on its Pharmacokinetics and Metabolism (*Eur.J.Pharm.Sci.,* 40,4(2013)). A microdose of 14C-tolbutamide (100 µg) was administered orally to healthy volunteers with the CYP2C9(∗)1/(∗)1 or CYP2C9(∗)1/(∗)3 diplotype. Area under the plasma concentration-time curve (AUC) for the 14C-radioactivity, determined by AMS, or that for the parent drug, determined by liquid chromatography/mass spectrometry, was about 1.6 times or 1.7 times greater in the CYP2C9(∗)1/(∗)3 than in the CYP2C9(∗)1/(∗)1 group, which was comparable to the previous reports at therapeutic dose and $T_{1/2}$ values in subjects with CYP2C9*1/*3 were higher than that with CYP2C9*1/*1 that clearance of tolbutamide was decreased in subjects with CYP2C9*3. In the plasma and urine, tolbutamide, carboxytolbutamide, and 4-hydroxytolbutamide were detected and practically no other metabolites could be found in both diplotype groups. The fraction of metabolites in plasma radioactivity was slightly lower in the CYP2C9 (∗)1/(∗)3 group. Microdose study can be used for the prediction of the effects of genetic polymorphisms of enzymes on the pharmacokinetics and metabolic profiles of drugs with minimal care of their pharmacological/toxicological effects. The ratio of AUC of each metabolite to the total AUC was lower than 5% and this ratio shows no significant difference at microdose and therapeutic dose, suggesting that we can evaluate the AUC ratio required on the “Safety testing of drug metabolites”.

Biography

Dr. Zenzaburo Tozuka, Doctor of Philosophy (Ph.D.), now is a Professor of Compound Library Screening Center and Laboratory of Molecular and Cellular Physiology, Graduate School of Pharmaceutical Science, Osaka University. He got M.Sc. and Ph.D. in Organic Chemistry at Osaka University. He contributed synthesis of Cefsone and determine of metabolites of Cefsone, Tacrolims, Micafungine and Istoducs at Fujisawa Pharmaceutical Co. Ltd., Microdose study and Quantitative analysis of Nucleic acid drugs by mass spectrometry as a Director of Laboratory at CRO. Currently his researches focus on the epigenetic transcription and discover and development of new drugs by mass spectrometry.

Title: Design of NMR Supersequences: Ten 2D Spectra in a Single Measurement

Dr. Ēriks Kupče
Principal Scientist
Bruker BioSpin
UK

Abstract

Structure elucidation and characterization of small molecules by NMR largely follows well-established protocols that rely on a core set of 2D correlation experiments such as COSY, TOCSY, NOESY, ROESY, HSQC, HMBC, ADEQUATE or INADEQUATE. We show that up to 10 such experiments can be combined into a single entity called a supersequence. This leads to a dramatic reduction of data collection time and significant improvements in sensitivity of NMR measurements. Such supersequences can be tailored for specific applications, for instance, the analysis and characterization of molecular structure of complex organic molecules. When combined with computer assisted structure elucidation (CASE) software such as CASPER, structures of oligosaccharides can be established from a single measurement with a high degree of confidence. Likewise, 2D NMR-based metabolomics with sensitivity improved versions of HSQC/TOCSY NOAH supersequences allow efficient measurement of multiple 2D NMR spectra (HSQCsi and/or HSQCsi−TOCSY and TOCSY) of metabolomics samples in a single experiment for the accurate and comprehensive identification and quantitation of metabolites. Involving multiple receiver technology opens new avenues for multiplexing NMR experiments thus reducing the cost of NMR analysis, increasing sensitivity and the information content of NMR measurements.

Biography

Ēriks Kupče, Principal Scientist at Bruker BioSpin, grew up in Latvia and received his Bachelor's degree from the Technical University of Latvia in 1978. He did his post-doctoral research at the Cambridge University with Prof. Ray Freeman, 1991, Oxford University with Prof. Iain Campbell 1993 and was visiting scientist with Prof. G. Wagner at the Harvard Medical School, 1995. He has received various awards, with the most representative being the 2006 Günther Laukien Prize in NMR and 2008 Grand Medal of Latvian Academy of Sciences. He is a member of Latvian Academy of Sciences, 1991, Varian Fellow, 2006, ISMAR Fellow, 2010 and Agilent Research Fellow, 2011. Since 2013 he is a principal scientist at Bruker BioSpin.

Title: IR Imaging/Spectroscopy on Biological Samples

Dr. Gianluca Grenci
Research Assistant Professor, Biomedical Engineering Department
Senior Research Fellow, Mechanobiology Institute (MBI)
National University of Singapore, Singapore

Abstract

Infrared (IR) spectro-microscopy (FTIR) is a label-free chemical imaging technique that has wide biomedical applications as a diagnostic and research tool. Being capable of producing high resolution chemical maps with little to none preparation of the sample, its application to studying living systems is still limited by the strong absorbance of water in the mid-IR band (i.e. 2.5 to 10 µm). Even as a thin of a layer as 10 µm thick, water can completely hide the chemical information from the biological sample. Microfluidic technology can provide a solution to overcome this limitation, with benefits in terms of measurement accuracy and integration of FTIR with other technics (e.g. flow cytometry).

Standard materials used in microfluidic such as silicon, glass, plastics and PDMS show lack of transparency to IR or visible light or absorption profiles similar to those of organic samples, thus limiting the availability of ready-to-use set-ups for the application of FTIR to live cells analysis. Here we will discuss our approach based on well-established lithographic procedures for the fabrication of FTIR-compatible microfluidic devices, which maintain transparency to both visible and IR light and have been proven suitable for live-cells IR imaging. When coupled with an high brilliance source of IR photons, such as a Synchrotron light source, we demonstrated sub-cellular mapping capabilities of our method. In the second half of this contribution we will discuss more recent advances of our work, aimed at circumventing the need for IR sources and detectors in hyperspectral wide-field IR microscopy by employing quantum optical phenomena. Our method is based on the concept of the nonlinear interference of correlated photons, also known as *induced coherence*. Two photons are generated in a nonlinear crystal via spontaneous parametric down-conversion (SPDC) with one photon (signal) in the visible range, and the correlated photon (idler) in the IR range. The crystal is put into an interferometer and the interference pattern of the detected visible photons carries information about the IR photons, which are the ones interacting with the sample. Information about the sample properties in the IR range is inferred from the measurements of visible range photons using standard visible light components. The benefits of our system comprise of: highly reduced cost of the whole set-up, high spectral resolution (comparable with standard FTIR), small foot-print and the promise for high quality wide-field optical microscopy embedded in the same apparatus.

Biography

Dr Gianluca Grenci is a Research Assistant Professor at Biomedical Engineering Department and the Director of the micro-fabrication core facility at the Mechanobiology Institute(MBI) at the National University of Singapore. He got his M.Sc. in materials engineering and his PhD in metrology (science and technology of measurements) at the Polytechnic School of Turin (Italy). Currently his researches focus on the design and fabrication of micro-optical systems and microfluidic devices for cells micro-spectroscopy and high resolution imaging in chemically and geometrically defined micro-niches.

Title: Progress in the Analysis of Metal Nanoparticles to Assess Human Exposure

Dr. Ciprian Mihai Cirtiu
Head of Trace Metals Division
Institut National de Sante Publique du Quebec
Canada

Abstract

Metal and metal-oxide nanoparticles (NPs) are increasingly produced and already incorporated in various daily-used products: food, cosmetics, care products, drugs, textiles, paints and electronics. The large use of NPs raises concerns about human safety. Actually, their outstanding physicochemical properties could be at the origin of their toxicity. The information available on toxicity and accumulation in living organisms still raises controversy, and results are often difficult to compare because of unreliable data. In order to minimize their negative effects and continue using NPs, more research is needed especially in assessing the fate of NPs as well as their biological effects. Studies on internal exposure need to quantify uptake, transport, metabolism, fate and NPs excretion, thus there is an urgent need to detect and quantify NPs in biological fluids and tissues. Despite the wide range of techniques and methods for detection, quantification and characterization of NPs in their raw state, formulations or various environments, only a few methodologies are adapted and suitable for the analysis of NPs in biological samples.
Single-Particle-ICP-MS (SP-ICP-MS) technique is a relatively new and promising mass spectrometry-based technique used for the characterization of metal and metal-oxide nanoparticles in biological fluids. The research in my group is directed towards the development of SP-ICP-MS-based methodologies in order to advance knowledge of human exposure and toxicology.
The present speech aims presenting current and emerging technologies for the characterization of NPs in biological samples with emphasis on SP-ICP-MS technique. Examples of different NPs (Au, Ag, TiO_2) analyzed in biological media using SP-ICP-MS will be discussed.

Biography

CIPRIAN MIHAI CIRTIU has completed his Ph.D. in Chemistry at Université de Sherbrooke (2007). He continued to specialize in materials chemistry as postdoc from 2007 to 2011 at UQAM and McGill University respectively. He joined the Centre de toxicologie du Quebec (Institut National de sante publique du Québec) in 2011 where he acts as head of Trace Metals Division. From February 2015 he also holds a position of Adjunct Professor at Université Laval. The scientific contribution can be summarized as follow: 30 articles in peer reviewed journals, 2 patents, 1 book chapter, 43 oral communications and 29 posters. He is serving as editorial board member and reviewer for several scientific journals.

Title: Determination of the $^{144}Ce/^{238}U$ Ratio in Spent Nuclear Fuel Samples by Double Spike Isotope Dilution Mass Spectrometry

Anthony Nonell[a], Aurélien Beaumais[b], Céline Caussignac[a], Sébastien Mialle[a], Guillaume Stadelmann[c], Myriam Janin[d], Hélène Isnard[a], Michel Aubert[a], Thomas Vercouter[e] and Frédéric Chartier[f]
[a]Université Paris-Saclay, CEA, Service de Physico-Chimie, F-91191 Gif Sur Yvette, France
[b]Université Paris-Saclay, CEA, List, LNE-LNHB, 91120 Palaiseau, France
[c]IAEA laboratories, Friedenstrasse, 1, A-2444 Seibersdorf, Austria
[d]Direction des Services Départementaux de l'Education nationale de Moselle, France
[e]Université Paris-Saclay, CEA, Service d'Etudes des Matériaux Irradiés, F-91191, Gif Sur Yvette, France
[f]Université Paris-Saclay, CEA, Département de Recherche sur les Matériaux et la Physico-chimie pour les énergies bas carbone, F-91191 Gif Sur Yvette, France

Abstract

Precise knowledge of the energy released by radioactive decay of nuclides (decay heat) after the shut down of a nuclear reactor is of major importance for spent fuel management and nuclear safety. Among those radionuclides, the ^{144}Ce isotope is a fission product that significantly contributes to the decay heat for cooling time less than 10 years. The accurate quantification of this low abundance isotope in nuclear fuels is therefore required (1) to bring new constrains on neutronic calculation codes that predict the evolution of the spent nuclear fuel composition with time and (2) to improve the short-term management of irradiated fuels.
An innovative method combining liquid chromatography with double spike isotope dilution and state of the art mass spectrometric techniques (MC-ICP-MS, TIMS) has been developed for this purpose.
This new method was applied for the first time on two Mixed Oxide (MOx) spent nuclear fuel samples. It enabled the determination of $^{144}Ce/^{238}U$ atomic ratios of less than a hundred of ppm with expanded measurement uncertainty at around 1 % at the 95 % confidence level. This corresponds to a reduction of at least three times of the measurement uncertainty compared to classical gamma-ray approaches.
In the case of UOX samples or irradiated fuels cooled for longer periods, the ^{144}Ce content is even lower, i.e. $^{144}Ce/^{238}U$ in the range of a few ppm. Consequently, specific developments were carried out based on either extraction techniques or HPLC and will also be discussed.

Biography

Anthony NONELL obtained his Ph.D. in Isotope Geochemistry from the Paul Sabatier University (Toulouse III, France) in 2005. Since 2006, he has been a researcher in the Nuclear Energy Division of the French Atomic and Alternative Energies Commission (CEA). Within the Laboratory of Nuclear, Isotopic and Elementary Analytical development (LANIE), he is conducting research on state of the art analytical developments for isotopic and elementary measurements on radioactive samples by mass spectrometric techniques such as MC-ICP-MS and TIMS. He has published about 50 publications in high-ranked journals and books chapters in this field.

AnalytiX 05:

Novel Bioanalysis Method & Technology

Chair

Dr. Ming-Tsang Wu, Distinguished Professor and Director, Research Center for Precision Environmental Medicine, Kaohsiung Medical University, Taiwan

Co-chair

Dr. Mai Thanh Duc, Associate Professor, University Paris Saclay, France

Time: 09:00-12:40, May 18, 2023 (Thursday)

Place: Yoshino, 5F, Hyatt Regency Osaka

Title: Analysis of Non-Volatile Compounds in Exhaled Breath: Clinical Applications of Exhaled Breath Condensate Analysis

Dr. Makoto Sawano
Professor of Acute Medicine and Surgery
Saitama Medical University
Japan

Abstract

Human exhaled breath consists of three phases: the gaseous, liquid, and solid phases. Breath researchers have mainly focused on the discovery of volatile organic compounds in the gaseous phase as biomarkers for various diseases using gas chromatography coupled with mass spectrometres (MS). Meanwhile, the recent development of simple devices for non-invasive collection of exhaled breath condensate (EBC) and state-of-the-art analytical techniques such as high-performance liquid chromatography (LC) combined with MS or reverse transcription-polymerase chain reaction (RT-PCR) has provided the researchers with opportunity to explore no-volatile compounds (carbohydrates, proteins, nucleic acids, etc.) in liquid phase of breath as potential biomarkers. In the first part of the speech, an overview of breath analysis via EBC is provided with focus on the nature of EBC and various analytical techniques for investigating non-volatile compounds as biomarkers. In the second part, the author's recent studies, 'RT-PCR diagnosis of COVID-19 from EBC: a clinical study' and 'Non-invasive blood glucose monitoring from glucose in EBC' are presented as examples of EBC analyses and their clinical application. In the former study, a novel diagnostic method using RT-PCR targeting SARS-COV-2 viral RNA in EBC specimens was developed and its clinical validity was evaluated. In the latter study, the authors quantified minute carbohydrates in EBC using LC/MS/MS and the potential for application in non-invasive blood glucose monitoring was evaluated.

Biography

Makoto Sawano M.D., Ph.D., was born in Tokyo and grew up in Europe. He is a university teacher, a surgeon and a breath researcher. He graduated from the University of Tokyo Medical School in 1986 and earned Ph.D. degree in 1998. He is the Professor of Acute Medicine and Surgery in Saitama Medical University, Associate Professor of Surgery in the University of Tokyo, and Professor of Health and Life Science in Chubu University, Japan. He is the Chairman and of Advanced Centre for Emergency Medicine, and Critical Care, Saitama Medical Centre Hospital. Currently, he serves as a councillor of the Japanese Association for Acute Medicine, a board member of the Japanese Society for Medical Application of Stable Isotope and Biogas (JSMASIB) and chaired the 6th JSMASIB annual scientific meeting in 2014. He also serves as an editorial board member of the Journal of Breath Research, the Acute Medicine and Surgery and several other international academic journals. He also serves as a member of the Election Committee in the International Association for Breath Research.

Title: Combination of Analytical Method and Epidemiological Design to Unravel the Exposure Source of Arsenic in Residents Next to One Heavy-Industrial Area

Dr. Ming-Tsang Wu
Distinguished Professor and Director
Research Center for Precision Environmental Medicine, Kaohsiung Medical University
Attending physician
Department of Family Medicine, Kaohsiung Medical University Hospital, Kaohsiung Medical University
Kaohsiung, Taiwan

Abstract

The people living near a coastal heavy-industrial area of southwestern Taiwan have expressed concern over risk of arsenic (As). To investigate the potential source of As exposure in the local people, we assembled a cross-disciplinary research team to apply the quick and smart analytical method and epidemiological design for solving the concern. First, we analyzed urinary total As (TAs) levels in 328 adult subjects from the Nutrition and Health Survey in Taiwan in 2005-2008 (NAHSIT 2005-8). We found the top three highest median urinary TAs levels in residents from the Penghu islands (150.90 µg/L, n = 21) and the upper northern region (78.04 µg/L, n = 56) and the southern region (75.21 µg/L, n = 33) of Taiwan. Then, urinary TAs levels in 1,801 and 1,695 voluntary adult residents of the above-mentioned six villages in 2016 and 2018 respectively were compared with those from the top three highest TAs levels of NAHSIT 2005-8. Median urinary As levels were 84.60 µg/L in 2016 and 73.40 µg/L in 2018, similar to those in the southern region of Taiwan, but far below those in the Penghu islands ($p < 0.05$). Finally, in 2020, we interviewed 116 healthy adult residents from the same six villages and analyzed one-spot urine samples of total inorganic-related As (TiAs), a summation of As^{3+}, As^{5+}, monomethylarsonic acid, and dimethylarsinic acid. Subjects consuming seafood two days before urine sampling (n = 15) were significantly higher TiAs levels than those not (n = 101, p = 0.028). These results suggest that seafood consumption is probably the main source of urinary TAs and TiAs in people residing close to that coastal heavy-industrial area. We provide our scientific findings to help expedite the risk communication between local government and stake holders.

Biography

Dr. Ming-Tsang Wu has completed his MD from Chung Shan Medical University in Taiwan and PhD from Harvard School of Public Health in the USA. He is a distinguished professor in the PhD Program in Environmental and Occupational Medicine and the Director in Research Center for Precision Environmental Medicine, Kaohsiung Medicine University, Taiwan. His major research interest is on the interactive effects of environmental and occupational exposures, genetic factors, and biomarkers on the health outcomes.

Title: Polyphenols from Knotweed and Their Bioactivities

Dr. Lea Pogačnik*, Rui FM Silva, Neja Frkal, Dušan Žigon, Nataša Poklar Ulrih, and Tina Kosjek
Professor
University of Ljubljana, Biotechnical Faculty
Slovenia

Abstract

Knotweed species, namely Japanese knotweed (*Fallopia japonica*), Sakhalin knotweed (*Fallopia sachalinensis*), and their hybrid, Bohemian knotweed (*Fallopia × bohemica*), are among the most invasive plants in the world. Therefore, they pose a major environmental problem by reducing biodiversity in the local ecosystem. Recently, however, these plants have been shown to be a very rich source of bioactive molecules, especially polyphenols. The aim of our study was to identify phenolic compounds in ethanol extracts of root peels and young shoots and to investigate their biological activity, namely antioxidant, antidiabetic, antimicrobial and neuroprotective. Phenolic compounds were separated by reverse-phase liquid chromatography followed by electrospray ionization in a negative mode. High-resolution and tandem mass spectrometry were used for their identification and quantification. Initially, mass spectrometric libraries were used as tools for the identification of phenolic compounds, followed by confirmation with reference standards. A total of 10 compounds were identified, namely catechin, epicatechin, polydatin, resveratrol, emodin, piceatanol, epigallocatechin gallate, quercetin, chlorogenic acid, and ferulic acid, and 5 others were suggested, namely emodin-8-o-β-D-glucoside, procyanidin B1, procyanidin C1, taxifolin, and epicatechin gallate. The root peels were found to be a better source of phenolic compounds than the young shoots, which also resulted in a higher antioxidant capacity, determined by the DPPH assay. The anti-α-amylase activity of all tested extracts also showed a concentration-dependent pattern. In addition, all tested extracts showed antimicrobial activity against *Escherichia coli*, *Listeria monocytogenes*, and *Candida albicans* and were able to significantly prevent oxidative stress-induced apoptotic and necrotic-like neuronal cell death. In conclusion, our results show that it is possible to use all three invasive knotweed species as a source of powerful bioactive molecules to prevent or even treat various oxidative stress-induced diseases.

Biography

Lea Pogačnik, professor of chemistry, Food Analytical Chemistry and biochemistry at the Biotechnical Faculty of the University of Ljubljana, earned her bachelor's degree from the University of Ljubljana in 1995 and her Ph.D. in 2001. She has supervised more than 60 graduate students and published more than 30 research papers. She has presented more than 80 papers at scientific meetings around the world. She is a scientific editor of Sensors & Transducers and a guest editor of a special issue of the journal Antioxidants (Dietary Polyphenols and Neuroprotection).

Title: Lecturers' Perceptions about Challenges and Ways of Dealing with the New Era in Higher Education During Covid-19 Pandemic

Dr. Nitza Davidovich* and Rivka Wadmany
Professor
Ariel university
Israel

Abstract

The Covid-19 outbreak created challenges for higher education as well as opportunities for transitioning to models of teaching and learning adapted to the vision and culture of institutions of higher education in the new era.
The transition to online learning in an emergency situation involves breaking down barriers and poses challenges for faculty members, as well as for students that call for immediate response. In the present study we examined 223 lecturers' opinions who teach at various academic institutions on the advantages and disadvantages of online teaching and learning from various aspects, from a systemic, multi-institutional perspective. The study employed the quantitative and qualitative methods. The findings of the study indicate the preference for online learning that was not high at the beginning of the crisis. The lecturers and the students mentioned the lack of social and emotional interactions (SEL) between students and lecturers and among students as one of the main disadvantages of online learning. The findings of the study highlight the lecturer's role in the digital age, in teaching practice and the role of professional administrator in charge of teaching and learning at academic institutions, with an emphasis on the pedagogical aspects of that role. While this study seeks to shed light on teaching practice during a health crisis, it also focuses on the potential implications for teaching and learning processes after the current crisis. Specifically the findings of the study call for in-depth discussion among higher education policymakers and academic institutions on the new and effective purpose of the campus in the post-covid period and the challenges and ways of coping with the new reality.

Biography

Davidovitch, N. & Wadmany, R. (2021). 2020 – The Lecturer at a Crossroads of Teaching and Learning in Academia in Israel. *Journal of Education and e-Learning Research*. 8(3), 281-289. Asian Online Journal Publishing Group. USA
Davidovitch, N. & Wadmany, R. (2021). E-learning in times of crisis – An incidental or facilitative event? In Z. Sinuany-Stern (Ed.), *Handbook of operations research and management science in higher education* (pp 453-479). Springer. DOI: 10.1007/978-3-030-74051-1_15

Title: Lab-in-Droplet for Biomarker Analysis: From Instrumental Conception towards Diagnostic Applications

Théo Liénard--Mayor, Camille Bricteux, Nguyet Thuy Tran, Arnaud Bruneel, Myriam Taverna, and Thanh Duc Mai*
Assciate Professor
Institut Galien Paris Saclay
Faculty of Pharmacy
University Paris Saclay
France

Abstract

Our work focuses on the development of a novel analytical platform, named Lab-in-Droplet, which integrates i) magnetic bead-based sample treatment in droplets [1, 2] and ii) miniature capillary electrophoresis (CE), in order to unprecedentedly offer both efficient sample treatment and resolute analytes separation within µL droplets. We aim to couple sample treatment and analyte separation modules without any problem of working volume mismatch, thus solving the instrumental and methodological bottlenecks currently encountered in analytical module integration. To demonstrate the applicability and significance of Lab-in-Droplet, the platform has been applied for mapping the glycan patterns of human serum, serving for diagnosis of Congenital Disorders of Glycosylation (CDGs). The magnetic-bead based sample handling module will serve for N-deglycosylation, on-beads fluorescent labeling of glycans prior to mapping of glycans with CE. In a larger application scope, the Lab-in-Droplet platform will provide a novel tool for both biomarkers discovery and pathogenesis unraveling.

[1] https://doi.org/10.1016/j.aca.2022.340150
[2] https://doi.org/10.1016/j.talanta.2022.123625

Biography

Name: Thanh Duc MAI
Birthday:27 October 1983.
Nationality: French
Professional Title: Assc. Professor.
E-mail：thanh-duc.mai@universite-paris-saclay.fr

Research field Development of electrokinetic and microfluidic instrumentation and methodology for diagnosis purposes

Funds： PI of different projects granted by National Research Agency (ANR - France), French National Centre for Scientific Research (CNRS), University Paris Saclay (France), Swiss BlueTech Bridge (Switzerland, for StartUp foundation). Consultant and key member of different national projects funded by Vietnam government.

Publications：75 publications; H-index 25; https://www.researchgate.net/profile/Thanh-Mai-3 .

Patents: 4

Title: Three-Dimensional Imaging of $NADH/NAD^+$ Ratio in Bacterial Colonies

Dr. Yoshihide Tokunou*, Hiromasa Tongu, Dr. Masanori Toyofuku, Dr. Nobuhiko Nomura
Assistant Professor
University of Tsukuba
Japan

Abstract

Over 80 % of bacterial cells thriving on Earth form aggregates such as biofilms. Bacterial metabolism, gene expression, and physiologic property spatially alter in such aggregations due to chemical gradient, acquiring tolerance to antimicrobial challenges and resilience to changing environmental conditions. Confocal fluorescence microscopy imaging is a fundamental tool to observe spatial changes in bacterial metabolism and gene expression. However, it has been a challenge to capture the whole picture when the aggregate is formed at several tens of micrometers because of light decay in the aggregate. In this study, we developed an approach to observe a thick bacterial aggregate, bacterial colony, with over one hundred micrometers of thickness using confocal fluorescence microscopy and reflection microscopy. In the presentation, we will show the distribution of $NADH/NAD^+$ ratio in the colony and discuss the strategy to drive metabolisms in the bacterial colonies with limited nutrients and oxygen.

Biography

Dr. Yoshihide Tokunou received a Ph.D. of Engineering at the Department of Applied Chemistry, the University of Tokyo in 2019. Following a year of a postdoctoral fellowship at the Japan Society for the Promotion of Science, he joined to University of Tsukuba as an Assistant professor in the Faculty of Life and Environmental Science in 2020. He also works as a visiting scientist at National Institute for Materials Science in Japan. He has done work in analytical chemistry developing novel techniques to investigate the electron transfer process between bacteria and electrodes, and the fundamental electrochemistry of the microbial electron transfer process. His current interest is directed to the observation and control of bacterial aggregation.

Title: Soft Mechanochemistry Based on Interfacial Anisotropy

Dr. Daisuke Ishikawa
Lecturer
Tokyo Medical and Dental University
Japan

Abstract

Of the various external stimuli that can change molecular structure, such as light, heat, and pH, the most familiar to us are mechanical forces such as pushing and twisting. However, for molecules to be mechanically manipulated, they must be arranged in anisotropic space, not isotropic bulk space such as solution or gel, where forces are dissipated. Therefore, the air-water interface was focused on as an anisotropic two-dimensional space. The air-water interface, which has both a centimeter-scale X-Y axis direction and a single molecule-scale Z axis direction, is a suitable field for assembling and manipulating nano-sized objects on a macroscopic scale. In other words, an anisotropic two-dimensional interface is a unique space that can connect the macro- and nano-scale.

Amphiphilic compounds with axial chirality called molecular pliers, were synthesized to quantitatively evaluate changes in molecular structure induced by mechanical manipulation at the air-water interface. Applying an external force to the molecular pliers causes the two naphthyl groups to rotate around an intramolecular rotation axis, which is easily measured as an ellipticity change in the circular dichroism (CD) spectrum. By mechanically compressing a monolayer prepared at the air-water interface with molecular pliers, the mechanical energy imparted was calculated from a plot of surface pressure vs. molecular are. Furthermore, by measuring the CD spectrum of the transferred membrane during compression and performing molecular dynamics calculations on the area of a single molecule in the molecular assembly, the energy required for a 10º angular change around the rotation axis of the molecular pliers was found to be about 1 kcal mol^{-1}. The energy required to change the intramolecular conformation of a single molecular plier was experimentally found to be ~1.6 k_BT $molecule^{-1}$, which is extremely small energy equivalent to the thermal fluctuation of a molecule (~1 k_BT $molecule^{-1}$).

By utilizing this extremely small mechanical energy, microcrystals were also found to form and collapse reversibly in air-water interfacial monolayers composed of hydrophobic molecular pliers and lipid membranes.

Biography

Daisuke Ishikawa, Lecturer, Tokyo Medical and Dental University, grew up in Japan, graduated from Tokyo University of Science in 2008 and received his doctral degree from Tokyo Institute of Technology in 2013. His recent research interests include mechanical deformation of DNA nanostructures at two-dimensional interfaces and mechanical metamaterials developed using DNA origami, one of the DNA nanotechnologies.

Title: Towards the Detection of Biomarkers at the Single Molecule Limit

Dr. John J. Kasianowicz
Physical Scientist
National Institute of Standards and Technology
USA

Abstract

The ability to accurately measure blood glucose electronically nearly 40 years ago completely revolutionized the management of Type 1 and Type 2 *diabetes mellitus.* With that in mind, one of our major research goals has been to develop the basic science and technology that would enable the electronic detection, characterization, identification, and quantitation of biological molecules at the single molecule limit. To that end, we developed a nanopore-based method that is now being used by two companies to sequence DNA. More recently, we showed that the technique can also discriminate, at high accuracy, between differently-sized polymers. We will discuss an additional breakthrough technology we are developing that could lead to the identification of proteins at low copy number. If successful, this cutting-edge nanoscale technology might prove useful for understanding how individuals respond to therapeutic agents and provide a rational measurement to quantitate disease and wellness states.

AnalytiX 06:

X-ray Spectroscopy and Gamma Spectroscopy

Chair

Dr. Wataru Yashiro, Professor, Tohoku University, Japan

Time: 09:00-12:40, May 18, 2023 (Thursday)

Place: Kamo, 5F, Hyatt Regency Osaka

Title: Determination of Distributions and Structures of Cupric-Chloro Complexes in Hydrochloric Acid Solutions by UV-Vis and X-Ray Absorption Spectroscopy and *ab initio* Calculation

Dr. Masahito Uchikoshi* and Takatoshi Matsumoto
Associate Professor
Tohoku University
Japan

Abstract

Conditions of metal species in aqueous phase are important for hydrometallurgical separation process, such as solvent extraction and ion-exchange. However, thermodynamic parameters of metal complexes are scattered and often existing species were missed and vice versa. Hence, a certain method determining a distribution of metal complexes must be established. Cupric chloro complexes were chosen as a model case, because copper is one of the most widely used base metals and chlorine is a typical ligand and representative of halides. Distribution of cupric chloro complexes in hydrochloric acid solutions was investigated by factor analysis of UV-Vis absorption spectra followed by fitting analysis of thermodynamic model. Division of a matrix of absorption spectra of a series of solutions by a distribution from left side yields a matrix of spectra of individual species. Thus, UV-Vis and/or X-ray absorption spectra of individual species were obtained. Consequently, comparison in complex geometry between the observed and the values calculated using an *ab initio* technique was possible. The distribution of cupric chloro complexes was validated using the comparison in complex geometry. As results, four cupric species were found and their coordination numbers of Cl^- were 0, 1, 2, and 4. The corresponding cumulative formation constants were $\beta_1 = 0.38$, $\beta_2 = -1.24$, $\beta_4 = -5.78$, and Setchénow coefficient for a neutral species of $[CuCl_2(H_2O)_4]^0$ was 0.077. In addition, the structures of cupric chloro complexes were experimentally determined and presented. Anion-exchange reaction of cupric chloro complexes will be qualitatively interpreted using the distribution determined in this work.

Biography

Dr. Masahito Uchikoshi is an Associate Professor of Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Japan. He received his Ph.D. (2006) from Tohoku University. In 2013, he worked as a Visiting Scholar at University of Miskolc, Hungary. He was awarded by The Minerals, Metals & Materials Society twice (2003 EPD Science Award and 2014 EPD Technology Award). His research interests include ultrahigh purification of metals, semiconducting silicides, and thermodynamics related to hydrometallurgy.

Title: Recent Advance and Future Potential in Grating-based X-ray Interferometry

Dr. Wataru Yashiro
Associate Professor
Tohoku University
Japan

Abstract

Grating-based X-ray interferometers have attracted much attention since the mid-2000s because they allow for highly sensitive X-ray phase-contrast imaging. It has three advantages: (i) it can use continuous-spectrum X-rays, i.e., a white synchrotron source is available, which makes it possible to realize high-speed X-ray tomography even with a temporal resolution of a few ms [1]; (ii) it works with spherical-wave X-rays, which enable us to construct X-ray projection or imaging microscopes with high magnifications [2]; (iii) it has multi-modality, providing three independent images, i.e., transmission, differential-phase, and visibility-contrast images [3], the third of which is formed by ultra-small-angle X-ray scattering (USAXS) from unresolvable microstructures and enables structure analysis at each pixel of an X-ray image detector. I will introduce the recent advances of the application of the grating-based X-ray interferometers and their future potentials for materials research.
This research was partly supported by JST CREST (Grant Number: JPMJCR1765), and AMED-SENTAN (17hm0102054).

[1] W. Yashiro *et al.*, *Appl. Phys. Express* **10** (2017) 052501; W. Yashiro *et al., Jpn. J. Appl. Phys.* **56** (2017) 112503; W. Yashiro *et al.*, *Appl. Phys. Express* **11** (2018) 122501.
[2] Y. Takeda *et al.*, *Appl. Phys. Express* **1** (2008) 117002; W. Yashiro *et al.*, *Phys. Rev. Lett.* **103** (2009) 180801; W. Yashiro *et al.*, *Phys. Rev. A* **82** (2010) 043822; H. Kuwabara *et al.*, *Appl. Phys. Express* **4** (2011) 062502.
[3] W. Yashiro *et al.*, *Opt. Express* **18** (2010) 16890-16901; W. Yashiro *et al.*, *Phys. Rev. B* **84** (2011) 094106; W. Yashiro *et al.*, *Opt. Express* **23** (2015) 9233-9251.

Biography

Dr. Wataru Yashiro is an Associate Professor of IMRAM, Tohoku University from 2012. He received Ph.D. degree in 2000 from the University of Tokyo, Japan. He was a Research Associate of Japan Society for JSPS, AIST, NIMS, and GSFS, the University of Tokyo, Japan. In 2005, he became an Assistant Professor of GSFS, the University of Tokyo, and moved to Tohoku University in 2012.

Title: Theoretical Study of the Properties of X-ray Diffraction Moire Fringes

Dr. Jun-ichi Yoshimura
Former Researcher
Photon Factory, High Energy Accelerator Research Organization (KEK)
Japan

Abstract

In the study of X-ray diffraction moiré images, satisfactory theory of moiré images which helps the exact and detailed understanding of observed moiré-fringed images had not been given so far, although many superb results had been reported in the experimental study of moiré images. In answer to this situation a full theory of moiré-fringed diffraction images has been worked out on the basis of plane-wave dynamical diffraction theory. By this theory it has become possible to show the exact theoretical simulation of moiré images produced from a bi-crystal specimen (i.e., a two-crystal system), in X-ray topography. The bend of moiré fringes influenced by Pendellösung intensity oscillation due to a curvature strain in the specimen can be analyzed in detail, and in connection with that analysis it has been shown that the interference phase in the wave field develops extensively beyond the conventional [$-\pi$, $+\pi$] range. Furthermore, the character of crystal moiré fringes was theoretically ascertained to be essentially a two-dimensional pattern produced by the phase difference between the inner facing surfaces (in the case of bi-crystal moiré), and based on this idea the well known A.R. Lang's (Lang (1968), *Nature* 220, 652-657) observation on appearance and disappearance of moiré dislocations was successfully explained. Moiré images (Si 220 reflection) simulated by this theory are confronted with experimental images, to demonstrate the correctness of the theory.

Biography

Jun-ichi Yoshimura, grew up in Japan and received the Doctoral degree from the Univ. of Tokyo in 1975. Worked as research assistant in the Univ. of Tokyo in 1973-75, lecturer or associate professor in Yamanashi Univ. in 1975-2003, and researcher in the Photon factory, High Energy Accelerator Research Organization (KEK) in 2007-2015.

Title: From X-ray Diffraction to MOs: XMO Analysis of Diformohydrazide

Dr. Kiyoaki Tanaka
Senior Researcher, Nagoya Industrial Science Research Institute,
Professor Emeritus, Nagoya Institute of Technology.
Japan

Abstract

Two-center scattering factors necessary in LCAO-MO models were formulated by R. Stewart in 1969. However, many efforts to get molecular orbitals (MO) from the electron density (ED) observed by X-ray diffraction failed because of the divergence in least-squares refinements. It comes from the orthonormal relationship between MO's and the use of many similar GTF's to express an atomic orbital (AO). These problems were solved and molecular orbitals (MO) of diformohydrazide (DFH) were determined with X-ray molecular orbital analysis (XMO) established by the author in 2018. 2997 X-ray structure factors were measured at 100 K by a four-circle diffractometer avoiding multiple diffraction (MD), the effect of which is comparable to the two-center scattring factors. Well-tempered basis functions were employd to prevent sharp cusps on nuclei. Six core MO's were frozen to reduce the number of variables and 788 MO coefficients of 23 occupied MO's based on 142 symmetry orbitals were determined by XMO, in which 694 were significant. R_w reduced from 0.0278 of the spherical refinement to 0.0109 resulting in a plain residual density. XMO succeeded to get MO from X-ray diffraction experiment.

XMO enables to exhibit the shapes of EDs of AOs, atoms and chemical moieties based on ED's, which are Fourier transformed from the X-ray structure factors calculated in the XMO analysis. Further, the relative phases of *p* orbitals as well as the directions of them are identified from the various kinds of EDs of AOs, and the bond-phase-diagram (BPD) is obtained for each MO. It explains well the ED of each MO. For example, O *p* and C *p* in MO17 lie along the C=O bond and C *p* is enforced by pumping C *s* electrons to the bond, while the pumping effect of O *s* deforms O *p* in a reverse way and the other O *p* lobe extends toward the N-H…O H-bond. Mixing of *s* orbitals in the MO may reduce the energy and gives a delicate shape to the ED. XMO enables also to exhibit the interaction between distant AOs.

Detailed examination of the XMO-MOs reveals how excellently the LCAO-MO models represent the detailed features of EDs of DFH. Quantum chemistry and X-ray diffraction now shake hands and it will give both fields a fruitful future.

Biography

Dr Kiyoaki Tanaka, completed his doctorate in chemistry with the accurate measurement of electron density with X-ray diffraction at Tokyo University in 1975. After his study on 3d-electron densities in Tokyo Institute of Technology as an assistant professor, he joined Nagoya Institute of Technology as an associate professor in 1990 and as a professor from 1993, where he directed his research on AO's (XAO analysis) including rare-earth complexes, and developed experiments avoiding MD, he joined Nagoya Industrial Science Research Institute in 2010 as a senior researcher, where he developed XMO. Currently he focuses on advance of the XMO and avoidance of MD for two-dimensional detectors to disseminate the XMO analysis.

Title: Operando X-ray Nanospectroscopy Observation of devices Using 2D Channel Layers

Dr. Hirokazu Fukidome
Associate Professor
Research Institute of Electrical Communication
Tohoku University
Japan

Abstract

2D electron systems are promising for next-generation high-speed devices. However, due to it ultrathinness, the electronic properties of the 2D electron systems are dramatically influenced by surrounding environments, resulting in degradation of devices performances [1]. We have developed operando, i.e. under bias application, x-ray spectromicroscopies using x-ray photoelectron emission and absorption processes, which elucidate modulated electronic states due to surface and interfaces, at a nanoscale. In this talk, I will present operando spectromicroscopy study on transistors using the 2D electron systems, such as graphene and AlGaN/GaN interfaces, as channels. These results demonstrated the importance of the modulation of electronic states on the operation device mechanisms and device performances, with academia-industry collaboration.

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Biography

Dr. Hirokazu Fukidome received his B.Sc. degree from Osaka University, Japan, in 1995 and his M.Sc. and Ph.D. degrees from Osaka University, Japan, in 1997 and 2000, respectively. From 2000 to 2001, he was a Postdoctoral Fellow at AT&T Bell Laboratories, USA. From 2001-2002, he was a Postdoctoral Fellow at RIKEN, Japan. From 2002-2007, he was an Assistant Professor at Toyota Technological Institute, Japan. From 2008-2011, he was an Assistant Professor at Tohoku University, Japan. Since 2012, he has been an Associate Professor at Tohoku University, Japan. His research interests are in Surface Science, crystal growth, MEMS, and high-speed devices.

Title: The Group of Professors Portraits from the Collection of Collegium Maius Painted by Jan Trycjusz. The Significance of Technological Research and X-ray Examinations in the Attribution of These Portraits

Dr. Anna Jasińska
Curator
Museum of Jagiellonian University
Poland

Abstract

The 28 likenesses of professors in the collections of the Museum of the Jagiellonian University constitute a fairly numerous and homogeneous group of modern-era portraits in Poland (from XVI to XVIII century). All of them are portraits of professors whose activity was a great importance to Cracow's Alma Mater. Due to their symbolic content and the stylistic features which most of them shares, they form a separate group in the Polish portrait painting. The studies of the portraits were carried out by an art historian, a historian, by conservators, physicists and chemists – researchers from the Jagiellonian University and the Academy of Fine Arts in Krakow. The have revealed that the majority of portraits was commissioned by the University authorities and painted by members of Cracow painters guild during the life time of models.
In the course of the works this set was divided into nine groups. This classification appeared to be very helpful in our research. One of the most important and interesting discoveries happened in the group sixth. It was the discovery of a signature on the portrait of Wojciech Dąbrowski, painted by the well- known Polish artist, active in Cracow, Jan Trycjusz (?- 1692). After this discovery the others portraits from this same group were becoming similar to this one – to Dąbrowski's portrait.
Chemical, physical and technological tests were conducted and they provided information which considered together with archival information and knowledge of the art historian allowed to attribute these portraits to one painter – to Jan Trycjusz. To present the process of achieving this attribution underlining the significance of technological tests in it – will be the subject of this presentation.

Biography

Dr. Anna Jasińska, Art Historian, Curator in the Museum of Jagiellonian University is dealing with the collection of painting. She focuses in her work on the interdisciplinary research of the museum paintings and, among them, the professors' portraits. She is the author of many articles and some books e.g. *Foreign Painting in the Collections of the Collegium Maius, Portraits of professors of the Cracow Academy in the collections of Collegium Maius, Portraits of professors of Jagiellonian University to be active from 1800 till 1945 in the Collection of Collegium Maius.*

Title: Grounds' of the 19th and 20th Century Paintings as a Tool of Authentication of the Works of Art

Dr. Miroslaw Wachowiak
Assistant Professor
Nicolaus Copernicus University Torun
Poland

Abstract

Investigation of the 19th century materials was till this moment highly concentrated on the paint-layer yet the ground layer can bring significant information enabling better dating and attributing the painting. In the 19th century painting the ready - made producer commercial primings became poplar instead of self-made artists' grounds. They could have been purchased as individual already stretched paintings of form the roll of the primed fabric cut later for the exact painting by artist in his studio. For this reason and considering numerous new materials continuously implemented to the grounds like zinc white barites, lithopone and titanium white in 20th century, as well as other fillers, in some cases it is possible to indicate paintings executed on supports bought in one set. In order to non-invasively identify the non-organic compounds of the paint layer portable XRF spectrometer was used for measurements undertaken from the top on tacking margins and from the backside through the canvas research conducted on significant number of paintings. The research allowed proposition of preliminary chronogical database of different kinds of priming used in following decades of the 19th century. In order to deepen the results and prove another instrumental technique was used when sampling was possible - microscopic observation in the ViS and UV light, SEM-EDX including mapping of elemental composition as well as FTIR-ATR. The method proves to be sufficient for better authentication of the 19th and 20th century works of art.

Biography

Miroslaw Wachowiak, Ph.D. of Conservation Science is Associate Professor in the Department of Conservation of Modern and Contemporary Art, Deputy Dean of the NCU Fine Arts Faculty, Toruń, Poland. In his research he focuses on conservation and technological recognition of the 19th and 20th century works of art. One of his achievements is chronological database of dates of pigments implementation by central European artist in the 19th century and characterization of their grounds. At present he focuses on recognition of contemporary works of art, often cooperating with living artist, among others in 2017-18 - with David Lynch.

Title: Development of Spatio-Temporal Orientation of Children with Down Syndrome through Educational Platforms After Roumanian Pandemic Lockdown

Popescu Ofelia* and Leonte Nicoleta
University Polytechnic of Bucharest
Romania

Abstract

The restrictions due to COVID-19 have left their mark on the education of children with disabilities. Conducting physical therapy classes online was a necessity and at the same time a challenge for both teachers and parents. The purpose of this paper was to investigate the spatio-temporal orientation, followed by the design and implementation of stimulation programs for its education, by applying multisensory intervention programs, conducted online. The study included 27 students with DS and associated conditions. The groups were established according to the kinetic diagnosis, motor and psychomotor disorders of each child. The statistical analysis was quantitative, with a significance level of 95%. The dependent test was used to highlight the significance of the rate of progress achieved by the children. The results obtained for the psychomotor component - spatial orientation registered an increase of 1.81 units, between the initial and the final test. The value of the "Student" test calculated "t" between the two tests is 6.20 so 6.20> 2.056 (Tab. Fischer), as a result the differences are significant ($p < 0.05$). Regarding the psychomotor component - temporal orientation, the results registered an increase of 1.37 units, between the initial and the final test. The value of the "Student" test calculated "t" between the two tests is 7.68 so 7.68> 2.056 (Tab. Fischer), as a result the differences are significant between the averages of the two tests ($p < 0.05$). Following the experiment, the results obtained by the subjects, at the final test, were superior to the initial ones, with differences between statistically significant arithmetic averages, for all components of the investigated psychomotor ability: spatial orientation, temporal orientation.

Biography

Lecturer, Ph.D. candidate, Ofelia Popescu
The “Polytechnic” University of Bucharest
Graduate University of Physical Education and Sport-Kinetoterapy– Bucharest.
The work experience in the domain is 22 years of them are in Kinetoterapy and Sport, 22 of them physical therapy in the field of children with disabilities, and the other 10 are in higher education activity.
Competence areas: physical education and sport – theory and methodology, didactics of physical education and sport, kinetoterapy, physical therapy of children with disabilities.

Assistant Professor Nicoleta Leonte, Ph.D.
The “Polytechnic” University of Bucharest
Graduate University of Physical Education and Sport – Bucharest. The work experience in the domain is 25 years, 10 of them are in performance sport domain and the other 15 are in higher education activity.
Competence areas: Human Motricity, physical education and sport – theory and methodology, didactics of physical education and sport, the theory of sport training, basketball, fitness.

AnalytiX 07:

Bioanalysis in Human Diseases & Infectious Diseases

Chair

Dr. Avraham Dayan, Professor, Tel Aviv University, Israel

Co-chair

Dr. Makoto Kano, Former Professor of Physics, Tokyo University of Science, Japan

Time: 14:00-17:40, May 18, 2023 (Thursday)

Place: Tatsuta, 5F, Hyatt Regency Osaka

Title: Walk-Through Screening System for COVID-19

Dr. Ji Yong Lee*, and Sang Il Kim
H Plus Yangji Hospital
South Korea

Abstract

The ongoing COVID-19 pandemic has dramatically increased the number of individuals to be tested. We have developed a walk-through screening system to cope with this situation. The Safe Assessment and Fast Evaluation Technical booth of the H Plus Yangji Hospital(SAFETY), is a negative pressure booth that is inspired by the biosafety cabinet class 3. SAFETY has an area of 1.0 m2 and a height of 2.0 m3, and is made of a stainless steel frame with polycarbonate walls and a mobile negative pressure device including a HEPA filter. We implemented a Walk-through (WT) screening center using 4 SAFETYs. To reduce the risk of cross-infection, we developed an automatic ventilation and disinfection system for each SAFETY, established a reservation system, and allowed patients to fill out electronic questionnaires through mobile phones. We use a safe environmental disinfectants certified by the US and Korean governments. From March 10, 2020, when we started operating the WT clinic, we have been monitoring crossinfection through epidemiological investigations and real-time polymerase chain reaction testing of environmental samples. Currently, the WT clinic is screening more than 200 patients within 8 hours, but to date, there has not been a single case of cross-infection of COVID-19. The WT system not only increases patient access to examination clinics, but also increases access to medical institutions, keeps medical staff and patients safe, while reducing the consumption of personal protective equipment and staff fatigue. In the COVID-19 pandemic, a walk-through system using SAFETY can test patients faster, safely, and efficiently.

Biography

Dr. Lee received Medical Degree from the Eulji University. He completed internship and residency training in Internal Medicine at Kangbuk Samsung Hospital, Sungkyunkwan University and fellowship training in Division of infectious disease, Department of Internal medicine at Samsung Medical Center, Sungkyunkwan University. Now he is the Director of the Division of infectious disease, Department of Internal medicine, and the manager of infectious control team of H PlusYangji Hospital since 2016.

Title: Cancer Targeted Treatment by RGD-Modified Dihydrolypoamide Dehydrogenase

Dr. Avraham Dayan*, Raphael Lamed, and Gideon Fleminger
Professor
Tel Aviv University
Israel

Abstract

The Reactive Oxygen Species (ROS)-dependent phototoxic effect of UV-excited titanium dioxide (TiO_2), has been demonstrated in several cancer models of Photodynamic therapy. However, serious damage to the surrounding healthy tissue limits the applicability of this approach, hence targeted delivery of TiO_2 towards cancer cell would make the treatments more selective. Cancer cells often overexpress integrin receptors (e.g. $\alpha v \beta 3$) on their surface, which interact with proteins of the extra cellular matrix through RGD (Arg-Gly-Asp) recognition sites. Studies in our lab has shown that Dihydrolipoamide dehydrogenase (DLDH) has strong TiO_2- binding capabilities. Bio-engineering of DLDH with RGD moieties (DLDHRGD), generated a hybrid-conjugate nanobiocomplex (TiO_2-Protein-RGD) capabilities with high affinity to the integrin expressing cancer cells. We have demonstrated that the nanobiocomplex possesses tumor targeted and UV-excitable cytotoxicity in cutaneous melanoma cells (B16F10) while normal kidney cells (HEK293) remain unharmed. No cytotoxic effect was observed in absence of UV. The activity of mitochondrial dehydrogenases (such as DLDH), is often associated with elevated levels of ROS production, leading to pro-apoptotic activity. Our studies showed that DLDH possesses ROS production activity as well as DNA binding properties. We examined the cytotoxic effects of DLDHRGD and its potential use as an anti-cancer drug with melanoma (B16F10) glioblastoma (005), breast (4T1), cervical (Hela) and ovarian (Ovcar3) cancers cell lines. Normal kidney (HEK293) and cortex (NF5310) were unharmed. DLDHRGD incorporation into the cancer cells and apoptosis induction were analyzed by confocal and FACS assays. In-vivo assay showed positive safety profile using IV, SC and IP (BALB/C or C57Bl/6 mouse strains). Treatments with DLDHRGD in subcutaneous melanoma mice model resulted in significant tumor inhibition. Currently the efficacy of DLDHRGD on Glioblastoma (murine 005 model in BALB/C) including BBB penetration are under active research

Biography

Avraham Dayan is a Postdoctoral Research from the The Shmunis School of Biomedicine and Cancer Research, George S. Wise Faculty of Life Sciences, Tel Aviv University, Israel. He obtained his Ph.D. degree from the Faculty of Life Science, School of Molecular Microbiology and Biotechnology, Tel Aviv University, Israel. Has M.Sc from Faculty of Engineering, Center for Nanomaterials and Nanotechnology, Tel Aviv University, Israel as well as B.Sc. from Faculty of Life Sciences, Department of Biotechnology, Bar-Ilan University, Israel.
He has received various awards, with the most representative being the 2016 Young Israeli Controlled Release award and 2018 Cancer Biology Research Center (CBRC) prize.
Dayan has 11 manuscripts publications in international journals, 2 review articles, 2 book chapters and has applied for 2 Patents. He delivered 16 invited talks and 13 scientific presentations at the international conferences. He is also serving as a member of editorial board on 2 international journals. Dayan leads a number of multidisciplinary research projects and serves as a director in a number of start-up companies.

Title: Gut Microbial, Inflammatory and Metabolic Signatures in Older People with Physical Frailty and Sarcopenia: Results from the BIOSPHERE Study

Dr. Anna Picca
Associate Professor
LUM University, Casamassima, Italy
Fondazione Policlinico Universitario "A.Gemelli", Italy

Abstract

Multisystem derangements are associated with physical frailty and sarcopenia (PF&S). Alterations in circulating amino acids and chronic low-grade inflammation have been found in older adults with PF&S. Gut microbiota balances inflammatory responses in several conditions. Therefore, altered gut-muscle crosstalk has been hypothesized also in PF&S. We analyzed gut microbial taxa, systemic inflammation, and metabolic characteristics of older adults with and without PF&S through multi-marker analytical approach. Sequential and Orthogonalized Covariance Selection (SO-CovSel), a multi-platform regression method developed to handle highly correlated variables, was applied to explore the classification performance of potential biomarkers for PF&S. Thirty-five community dwellers aged 70+ (18 with PF&S and 17 nonPF&S controls) were enrolled. The SO-CovSel model with the best prediction ability using the smallest number of variables was built using seven mediators. The model correctly classified 91.7% participants with PF&S and 87.5% nonPF&S controls. Higher serum concentrations of aspartic acid, lower circulating levels of concentrations of threonine and macrophage inflammatory protein 1α, increased abundance of Oscillospira and Ruminococcus microbial taxa, and decreased abundance of Barnesiellaceae and Christensenellaceae were found in participants with PF&S compared with nonPF&S controls. Whether these biomediators are involved in PF&S pathophysiology warrants further investigation.

Biography

Anna Picca earned her M.Sc. in Biology and a Ph.D. in Biochemistry, Molecular Biology and Bioinformatics at the University of Bari, Italy. She was a Postdoctoral Research Fellow at the Buck Institute of Aging in Novato, California, and at the Institute on Aging at the University of Florida, USA. Currently, she is a Postdoctoral Research Associate at the Center for Aging and Geriatric Research of the Catholic University of the Sacred Heart in Rome, Italy, and a visiting scientist at the University of Florida. Her research activity is focused on mitochondrial involvement in aging and identification of biomarkers for age-related conditions. She has authored several scientific papers in international peer-reviewed journals and abstracts. She is also an editorial board member of Frontiers in Medicine, Experimental Gerontology, and International Journal of Molecular Sciences as well as peer-reviewer for several scientific journals

Title: Effects of L-Arginine Plus Vitamin C Supplementation on Physical Performance, Endothelial Function and L-Arginine Metabolism in Adults with Long COVID

Matteo Tosato
Fondazione Policlinico Universitario A. Gemelli IRCCS
Università Cattolica del Sacro Cuore
Italy

Abstract

Altered L-arginine metabolism has been described in patients with COVID-19 and has been associated with reduced physical performance, immune and endothelial dysfunction. Supplementation of L-arginine may improve endothelial and muscle function by stimulating nitric oxide synthesis. A single-blind randomized, placebo-controlled trial was conducted in adults aged between 20 and 60 years with persistent fatigue attending a post-acute COVID-19 outpatient clinic. Participants were randomized 1:1 to receive twice-daily orally either a combination of 1.66 g L-arginine plus 500 mg liposomal vitamin C or a placebo for 28 days. Changes in distance walked on the 6 min walk test, handgrip strength, flow-mediated dilation, and fatigue persistence were assessed.
Moreover, we determined the serum concentrations of L-arginine, citrulline, ornithine, monomethyl-L-arginine (MMA), and symmetric and asymmetric dimethylarginine (SDMA, ADMA) in adults with long COVID at baseline and after 28-days of L-arginine plus vitamin C or placebo supplementation, through a validated liquid chromatography with tandem mass spectrometry method. L-arginine plus vitamin C supplementation improved walking performance, muscle strength, endothelial function, and fatigue in adults with long COVID. Lower markers of NO bioavailability were found in participants with long COVID. After 28 days of L-arginine plus vitamin C supplemen- tation, serum L-arginine concentrations and L-arginine/ADMA increased significantly compared with placebo. This supplement may therefore be proposed to increase NO bioavailability, restore physical performance and relieve persistent symptoms in people with long COVID.

Biography

Matteo Tosato is Assistant Professor at Catholic University of Rome, Leader of Day-Hospital Post Covid at Department of Geriatrics, Neurosciences and Orthopedics, Fondazione Policlinico Universitario Agostino Gemelli. He received a PhD in Geriatric and Rehabilitation Sciences in 2013 at Catholic University of Rome. His research activity is focused on sarcopenia, frailty and aging. He has authored over one hundred scientific papers in international peer-reviewed journals, in addition to numerous abstracts and several book chapters. He also serves as an editorial board member for Nutrients, as well as a peer-reviewer for numerous scientific journals.

Title: The Necessity of Environmental Scientific Literacy for Dealing with Corona Pandemic

Dr. Makoto Kano
Former Professor of Physics
Tokyo University of Science
Japan

Abstract

The Corona crisis would have been an endemic disease in local region of Africa, if the original sustainable, recycling-oriented society had continued. However, it is the result of capitalism's endless pursuit of profit, which has brought about globalization and spread throughout the world in the blink of an eye.

For understanding the future vision and the basic principles for establishing the eco-innovation policies to the people and the politicians, the environmental scientific literacy has been required under the clear view of the symbiosis with creatures on the earth. The strategies are proposed to promote environmental scientific literacy based on environmental physics in dealing with Corona Pandemic, Climate Change and so on. The knowledge on environmental literacy and its implementation in various parts of the globe can enable our society to ultimately get an environmentally hazard-free world with sustainable development. So, we can realize the sustainable society in which human and many forms of life can coexist.

Only knowledge on environmental literacy and its implementation in various parts of the globe can enable our community of the world to ultimately get an environmentally hazard-free world with sustainable development.

In this talk, our drawbacks of recent track record are illustrated (1-4), and the strategies are proposed to promote environmental scientific literacy for the SDGs and Corona Pandemic.

Then, we will find a way to realize the sustainable society in which human and many forms of life can coexist, in spite of the recent situations of hegemonism, protectionism and populism in the world (5-10) .

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Biography

Makoto KANO, Former Professor of Physics, Tokyo University of Science, Yamaguchi, Department Head and Dean of Students, grew up in Japan and received his Dr.'s degree from the University. He has received various awards, and was nominated for the chairman from many International Conferences, with the most representative being the IUMRS-ICA97 International conference excellent thesis prize, Excellent contribution award of the MRS-Japan at the MRS-J 30th anniversary, Chairman of the organizing committee of the Eco-Design Products & Service symposium 2018-2022, and 2022 Fellow of the Environmental Physics region of the Physical Society of Japan.

Title: Strptococcus Pneumoniae and Its Family Planning with Five Carbon Sugar Alcohol Xylitol

Dr. Sunil Palchaudhuri
Professor
Wayne State University
USA

Title: Real-Time Endoscopic Raman Spectroscopy for Improving Early Lung Cancer Detection

Haishan Zeng
Professor
BC Cancer Research Institute, University of British Columbia
Canada

Abstract

Lung cancer is the leading cause of cancer-related deaths, with a five year survival rate of less than 20%. If lung cancer can be diagnosed earlier, the survival rate can be improved significantly (>70% for patients with stage 0 or 1A disease). Currently the most sensitive method for localizing lung cancers in central airways is autofluorescence bronchoscopy (AFB) in combination with white light bronchoscopy (WLB). The diagnostic accuracy of WLB+AFB for high grade dysplasia (HGD) and carcinoma *in situ* is variable depending on physician's experience. When WLB+AFB are operated at high diagnostic sensitivity, the associated diagnostic specificity is low. Raman spectroscopy probes molecular vibrations and gives highly specific, fingerprint-like spectral features and has high accuracy for tissue pathology classification. In this study we present the use of a real-time endoscopy Raman spectroscopy system to improve the diagnostic specificity. A spectrum is acquired within 1 second and clinical data are obtained from 280 tissue sites (72 HGDs/malignant lesions, 208 benign lesions/normal sites) in 80 patients. Using multivariate analyses and waveband selection methods on the Raman spectra, we demonstrated that HGD and malignant lung lesions can be detected with high sensitivity (90%) and good specificity (65%). This is a significant improvement compared to WLB+AFB, which has a specificity of 18% -32% when the sensitivity is set at 90%. Point Raman measurement on lesions identified by white light and autofluorescence imaging could become a new clinical tool for real-time detection of lung cancer.

Biography

Haishan Zeng is a distinguished scientist with the BC Cancer Research Institute and a professor at the University of British Columbia. Dr. Zeng's research focuses on biophotonics and its medical applications. His group has pioneered the multiphoton-absorption based laser therapy and is at leading position in endoscopy imaging and Raman spectroscopy for noninvasive early cancer detection. He has published more than 180 refereed journal papers and holds 29 granted patents. Several medical devices derived from these patents including fluorescence endoscopy (ONCO-LIFE™) and rapid Raman spectroscopy (Aura™) have passed regulatory approvals and are in clinical uses around the world. The Aura™ device was awarded the Prism Award in 2013 by the International Society for Optics and Photonics.

Title: Using Blood-Derived Immune Cells in Inform on Human Disease

Prof. John Miles
Principal Research Fellow
Australian Institute of Tropical Health and Medicine
James Cook University
Australia

Abstract

The human immune system is a hugely complex network of cell types relentlessly communicating on host health through direct recognition and secreted compounds. We have recently found that listening to this immune cell “chatter” through phenotyping or molecular typing can inform pathology in rapid time using high-dimensional analysis and machine learning. We are currently developing highly sensitive and specific immune signatures for diagnostics, prognostics and identifying individuals at high risk of disease. In this talk I will describe the work we have achieved thus far across a number of infectious and chronic diseases.

Biography

Professor John Miles is Principal Research Fellow of Molecular Immunology at the Australian Institute of Tropical Health and Medicine, James Cook University, Australia. He is co-director for the Centre for Tropical Bioinformatics and Molecular Biology and theme leader for the Centre for Molecular Therapeutics at James Cook University. Professor Miles is an expert in human immune system monitoring and modulation.

AnalytiX 08:

Terahertz Spectroscopy and Laser Spectroscopy

Chair

Dr. Jay Theodore Cremer, Chief Scientist, Adelphi Technology, Inc., USA

Time: 14:00-16:10, May 18, 2023 (Thursday)

Place: Yoshino, 5F, Hyatt Regency Osaka

Title: Precision Measurement of Molecular Vibrational Transition Frequencies

Dr. Masatoshi Kajita
National Institute of Information and Communications Technology (retire at March 2023)
Japan

Abstract

Precision measurement of transition frequencies have been performed with different atomic (neutral or ion) transition frequencies, and uncertainty of the order 10^{-18} has been attained with several transitions. However, no molecular transition frequencies have been measured with an uncertainty below 10^{-15}. Precision measurements of molecular transition frequencies are useful to observe the phenomena, which cannot be observed only with atomic transition frequencies (variation in proton-electron mass ratio, symmetry violation between optical isomers of chiral molecules etc.). In this talk, we discuss the possibility to measure the molecular transition frequencies with the uncertainties of 10^{-18}. The frequency shift induced by the electric field (Stark shift), electric field gradient (electric quadrupole shift), magnetic field (Zeeman shift), and the relativistic effects (quadratic Doppler shift) are the components to discuss the attainable measurement uncertainty.

The molecular vibrational transitions without the change of any quantum numbers of angular momentums (molecular rotation, electron spin etc.), are particularly advantageous for the precision measurement, because the Stark, electric quadrupole, and Zeeman energy shifts at upper and lower states are almost equal. The pure vibrational transition frequencies with the lowest rotational states of $^{15}N_2^+$ and $^{16}O_2^+$ molecular ions in a linear trap and $^{40}Ca^{19}F$ molecules in an optical lattice are expected to be measured with the uncertainty of 10^{-18}.

Biography

Masatoshi Kajita, National Institute of Information and Communications Technology (NICT), grew up in Japan and received his Ph. D degree from the University of Tokyo in 1986. After working at Institute of Molecular Science as a post Dr., he joined Communications Research Laboratory (CRL: now NICT). He has been engaged mainly with precision measurement of atomic transition frequencies. Since 2006, he has considered the possibility of precision measurement of transition frequencies of cold molecules. He was guest professor of Province university (France) at 2009.

Title: Superconducting Wollaston Prism for Spin Echo Scattering Angle Measurement

Dr. Jay Theodore (Ted) Cremer, Jr.
Chief Scientist
Adelphi Technology, Inc.
USA

Abstract

Neutron beams are powerful materials science probe, providing unique information about structure of matter. Presented is a cold neutron instrument, a neutron spin echo device using Wollaston prisms, developed by Roger Pynn Group at Low Energy Neutron Source (LENS) at Indiana University in collaboration with Adelphi Technology.
This novel Superconducting Wollaston Prism (HiTc-Wollaston Prism instrument) for Spin Echo Scattering Angle Measurement (SESAME) with cold neutrons, uses high temperature superconducting (HiTc) coils and Meissner screens, achieving high magnetic fields and dimensional precision, required for accurate structural measurements, over length scales from nanometers to 20 microns, using matched Wollaston prism pairs, which precisely cancel neutron spin precession, needed for spin echo angle encoding, via neutron polarization.
Also presented are recent theory and experiments performed with a HiTc RF flipper combined with a HiTc Wollaston prism pair, which allows simultaneous measurement of both the spatial and the time dependence of density fluctuations, within a wide range of hierarchical and disordered meso-scale materials.
Finally presented, is our recent progress on a design of an inexpensive compact device, based on high-temperature superconducting technology (I-WASP), which is designed to achieve similar goals to the non-superconductor-based Wide-Angle Spin Echo (WASP) at Institut Laue-Langevin (ILL), enabling study motions of biological functional groups, diffusive dynamics, dynamics of molecular magnets, and dynamics of molecules confined in one or two dimensions.
Keywords:
Neutron Spin Echo Scattering Angle Measurement (SESAME), Neutron Wollaston Prism, Neutron Reflectometry, Diffractometry, Phase Contrast Radiography, Wide Angle Spin Echo, HiTc RF Flipper, HiTC Wollaston prisms, combined HiTc RF flipper and Wollaston prism pair

Biography

Dr. Cremer (B.S. MIT, 1976, Ph.D. Electrical Engineering, U. of Maryland, 1984), chief scientist of Adelphi Technology, has a diverse experimental and theoretical background in applied physics, which includes x-ray/neutron sources, detectors, optics, bioelectric phenomena (artificial skin S.B thesis at MIT), and postdoctoral traineeship in biophysics on cellular electrofusion and electrically mediated gene transfer at University of California at San Francisco, 1984-1986. Dr. Cremer has published 44 peer-reviewed publications, 4 books on neutron and x-ray optics with Academic Press (Elsevier), and 5 issued US patents.

Title: Electronic Structures of Ti_2O_3 Films Revealed by Soft x-Ray Angle-Resolved Photoemission Spectroscopy

Dr. Kohei Yoshimatsu
Associate Professor
IMRAM, Tohoku University
Japan

Abstract

Corundum-type Ti_2O_3 exhibited metal-insulator transition (MIT) at approximately 450 K over a wide temperature range of ~150 K. The characteristic MIT was interpreted as a result of overlapping Ti 3*d* bands due to lattice deformation [1]. In contrast, an on-site Coulomb repulsion was crucial to reproduce the insulating electronic structures of Ti_2O_3, thereby the importance of electron correlation [2]. Detailed information about the electronic structures was indispensable to elucidate the mechanism of the MIT in Ti_2O_3. Angle-resolved photoemission spectroscopy (ARPES) is a powerful experimental technique directly investigating electronic structures in momentum (k) space. ARPES experiments require a well-defined surface, which hinders ARPES study on Ti_2O_3 without any cleavable planes. Recently, we developed a thin-film growth technique to stabilize low-valence titanate films under reductive and non-equilibrium conditions [3]. Using epitaxial Ti_2O_3 films with a clean and flat surface, we achieved soft x-ray ARPES measurements. Clear band dispersions along both k_z and $k_{//}$ directions were observed, indicating that we first revealed k-resolved electronic structures of Ti_2O_3. Band-structure calculations based on GGA + U approximation were also conducted to compare the experimental and calculated band dispersions. We found that the electron correlation in the calculation was essential to reproduce the experimental band dispersions along $k_{//}$ directions [4].

[1] L. L. Van Zandt *et al*., J. Appl. Phys. **39**, 594 (1968).
[2] L. Mattheiss *et al*., J. Phys.: Condens. Matter **8**, 5987 (1996).
[3] K. Yoshimatsu *et al*., APL Materials **6**, 101101 (2018) and Scientific Reports **10**, 22109 (2020).
[4] N. Hasegawa, K. Yoshimatsu et al., Phys. Rev. B (2022).

Biography

Kohei Yoshimatsu is an Associate Professor at Tohoku University, Japan. He received his B.S., M.S., and D.Sc. degrees from the University of Tokyo in 2007, 2009, and 2012, respectively. After his Ph. D. student, he became a JSPS post-doc at the University of Tokyo for a year. Then, he was an assistant professor at the Tokyo Institute of Technology between 2013-2018. Since 2018, he has been working in the present position. He has focused on oxide-thin-film growth using pulsed-laser deposition and investigation of electronic structures by using photoemission spectroscopy.

Title: Means to Understand the Laser Damage

Dr. Herve Piombini
Senior Engineer
CEA Le Ripault
France

Abstract

For 50 years, a great international community has been working around the laser damage of material and films for high power lasers. Many works in the field of the modelling, of the measurement and the understanding of the phenomena have been realized. I am modestly going to summarize my works made in this field at the CEA during the 30 last years about thin layers and material used for ALVIS and LMJ projects. I will introduce the problem and the metrology of the laser damage with the statistic aspect up to the O'Connel's model which will be developed. We will make a link among several parameters of damage and the sample properties (absorption, electric field, gap, temperature...) and we will see that it is difficult to obtain scale laws among several apparatus. Then, we will glance about the different defects on or in the materials and the thin layers with different optical means which have been developed and enhanced. I will present and the advantage of the spectroscopy resolved in time to see the changes of materials when they are under laser flux. I will introduce a few examples of experiment leads about the (D) KDP to understand the laser conditioning, which allows the improvement of the damage threshold. Also, I will introduce the new results about the mechanical properties of sol-gel layers obtained by ultrasound laser and SAW technique.

Biography

Dr. Herve Piombini studied at Institut d'Optique Graduate School in 1985. He has been working at CEA since 1987 where he is currently is a Senior Expert in optical metrology. In 1989, he started its studies about thin layers. He has designed many benches to characterize the thin layers and materials (laser damage, mirage effect, scattering (TIS and BRDF), stress, guided wave, laser conditioning, LIBS and Luminescence…). At the CEA Le Ripault, he worked about the industrialization of LMJ reflector, the (D) KDP and the sol-gel layer. Now, his research subject is about the mechanic of thin layers. He has written over 70 scientific papers and several patents.

Title: Optical Harmonics Spectroscopy of Semiconductors and Dielectrics

Prof. Dr. Victor Pavlov
Ioffe Institute
Russian Academy of Sciences
Russia

Abstract

Nonlinear spectroscopy based on optical second and third harmonics generation (SHG and THG) enables a possibility for giving new information as compared with linear optical phenomena. This is due to the fundamental difference between selection rules for single-photon and multi-photon processes [1]. The SHG and THG methods are successfully used for studies of nonlinear optical interactions on excitonic states in bulk semiconductors [2].
New nonlinear magneto-optical phenomena in different types of semiconductors and magnetic dielectrics will be discussed. Various aspects of nonlinear optical spectroscopy will be analysed such as polarization, temperature and field dependencies. Contributions to SHG and THG of crystallographic and magnetic nature will be considered and identified. The possibility of visualization of antiferromagnetic domains by nonlinear optical techniques will be demonstrated.
Supports from the Russian Foundation for Basic Research (project 19-52-12063-NNIO_a), the Presidium of Russian Academy of Sciences Program № 5 and the Deutsche Forschungsgemeinschaft (grant ICRC TRR160, project C8) are appreciated.
[1] M. Fiebig, V. V. Pavlov, and R. V. Pisarev, Second-harmonic generation as a tool for studying electronic and magnetic structures of crystals: review, J. Opt. Soc. Am. B **22**, 96 (2005).
[2] D. R. Yakovlev, V. V. Pavlov, A. V. Rodina, R. V. Pisarev, J. Mund, W. Warkentin, and M. Bayer, Exciton spectroscopy of semiconductors by the method of optical harmonics generation (review), Physics of the Solid State **60**, 1471 (2018).

Biography

Prof. Dr. Victor Pavlov is head of laboratory on Optical Phenomena in Ferroelectric and Magnetic Crystals at the division of Physics of Dielectric and Semiconductors at Ioffe Institute of the Russian Academy of Sciences. He has got his PhD in 1993 and habilitated doctor’s degree in 2008 at the Ioffe Institute. The main scientific activity is devoted to linear and nonlinear optical studies of magnetically ordered bulk crystals, nanostructures and heterostructures. Different types of experimental techniques are used in optical studies, such as linear optical absorption and ellipsometry, magneto-optical Faraday and Kerr effects, optical harmonics generation. Studied materials are ferro- and antiferromagnetic dielectrics, ferro- and diamagnetic semiconductors, magnetic nanoparticles, thin layered heterostructures. He got in 2006 the certificate of honors from the Russian Academy of Sciences, he become in 2011 a laureate of the Bessel Research Award from the Alexander Humboldt Foundation, Germany.

AnalytiX 09:

Chemometrics and Chromatography

Chair

Dr. Federico Marini, Professor, University of Rome "La Sapienza", Italy

Co-chair

Dr. Riccardo Calvani, Research Associate, Catholic University of the Sacred Heart in Rome, Italy

Time: 14:00-18:05, May 18, 2023 (Thursday)

Place: Kamo, 5F, Hyatt Regency Osaka

Title: An Automated Support Vector Elastic Net for Calibration and Classification for Chemotyping Complex Materials

Dr. Peter B. Harrington
Professor
Ohio University
USA

Abstract

Natural medicines are gaining in popularity because of their lower costs and perceived reduced risk of side-effects. One important example for the USA is Cannabis for which a growing number of states are legalizing its medical and recreational use. However, because natural medicines are complex mixtures characterization and authentication are much more difficult. One important classification is marijuana from hemp for which hemp products must contain less than 0.3% tetrahydrocannabinol (THC). Two examples are applying the automatic support vector elastic net (aSVEN) to identify hemp from marijuana samples using direct infusion low-resolution mass spectra (i.e., 1 amu). A second application determines the concentration of cannabidiol in help oil directly by reflectance near infrared spectroscopy.

Biography

After graduating with a BS degree in Chemistry from Randolph-Macon College-Ashland, Peter worked for Nabisco as a flavor chemist where he became interested in analytical chemistry, chemometrics, and the forensic analyses of foods. After working for 2 years, he pursued doctoral research in analytical chemistry and machine learning under Tom Isenhour at the University of North Carolina-Chapel Hill. Afterward, he held a research assistant professor appointment at the Colorado School of Mines where he developed algorithms and software for the detection of pathogenic bacteria by pyrolysis-mass spectrometry. In 1989, he began his career at Ohio University. His research involves the areas of chemometric, forensic, metabolomic, and proteomic analysis. Professor Harrington founded the Center of Intelligent Chemical Instrumentation in 1992 to foster automated chemical instruments and assumed the role of Director in 2002. In 2015, he was recognized as a Fellow of the American Academy of Forensic Sciences. In 2016, he earned the Ohio University College of Arts and Sciences Award for Excellence in Research and in 2019 he earned the Eastern Analytical Symposium Award for his Outstanding Contributions to Chemometrics and was recognized as an OHIO Presidential Research Scholar. He is interested in self-optimizing chemometric algorithms and has devised many chemometric methods. He seeks new collaborations with many groups and government agencies on combining state-of-the-art methods in machine learning and artificial intelligence to problem-solving using analytical chemistry.

Title: Rethinking SIMCA for One and Multiple Blocks

Dr. Federico Marini
Professor
Sapienza University of Rome
Italy

Abstract

Modeling classification techniques have several advantages over discriminant ones, especially when dealing with asymmetric problems, where there is only one category of interest. Indeed, in class modeling, attention is focused on a single category at the time, whose class space is built only on the basis of the data collected on samples from that particular group. Classification is then carried out as an outlier detection problem: if a sample is found to be an outlier with respect to the class model (usually, according to a distance to the model criterion), is predicted as not belonging to the category under exam. In SIMCA, the distance to the model is calculated by combining residuals with a distance in the scores space, which is usually Mahalanobis-like. In the present communication, the possibility of defining the scores distribution non-parametrically by means of a gaussian mixture model (potential functions) is presented. Such approach allows a more-tailored definition of the class space even in the case of severe deviations of the distribution of the class scores from normality. Due to this property, this approach can easily be extended to the multi-block case in a framework which could be defined of mid-level data fusion.

Biography

Dr. Federico Marini received his M.Sc. (2000) and Ph.D. (2004) from Sapienza University of Rome. He is currently Associate Professor of Chemometrics at Sapienza University of Rome. In 2006, he was awarded the Young Researcher Prize from Italian Chemical Society and in 2012 he won the Chemometrics and Intelligent Laboratory Systems Award "for his achievements in chemometrics". He has been visiting researcher in various Universities (Copenhagen, Stellenbosch, Silesia, Lille). His research activity is focused on all aspects of chemometrics, ranging from the application of existing methods to real world problems in different fields to the design and development of novel algorithms. He is author of more than 150 papers in international journals, and recently he edited and coauthored the book Chemometrics in food chemistry (Elsevier). He is member of the Editorial boards of Chemolab, Analytica Chimica Acta, J. of Chemometrics, J. of NIR Spectroscopy, J. of Spectral Imaging and he serves as Associate Editor for Chemometrics in Wiley's Encyclopedia of Analytical Chemistry. He is the past coordinator of the Chemometric group of the Italian Chemical Society and the coordinator of the Chemometric study group of EUCheMS.

Title: Variable Sorting for Normalization

J-M. Roger[1], G. Rabatel[1], F. Marini[2], B. Walczack[3]
[1] ITAP, INRAE Montpellier Centre, BP 5095 34196 Montpellier cedex 5, France.
[2] Department of Chemistry, Univeristy of Rome "La Sapienza", P.le Aldo Moro 5, I-00185 Rome, Italy
[3] Silesian University, 9 Szkolna Street, 40-006 Katowice, Poland

Abstract

Standard Normal Variate (SNV) is often used to correct for multiplicative and additive effects. It consists in subtracting to every spectrum its mean value and to divide it by its standard deviation. However, the compound of interest also has an effect on the spectrum. Consequently, because SNV processes all the variations indistinctly, it jeopardizes the interpretation of the resulting spectrum shapes and of the model coefficients. A solution is to weight the variables before the calculation of the mean and of the standard deviation used in the SNV normalization. In this study, we propose an original method to calculate these weights. The procedure has been tested on synthetic data and on a set of real spectra. The main output of this method is to give some insight to the data, providing a clear view on additive and multiplicative components present in the spectra. The spectra processed by standard and VSN have been used in Partial Least Squares (PLS) models. The main result of VSN is that the resulting model often gives better predictions, always gives more interpretable loadings and is more robust. The examples given in the presentation are related to Near Infrared Spectroscopy, but the VSN method is also very adapted to processing of other analytical data, as chromatograms.

Biography

Dr. Jean-Michel Roger, now is a senior researcher in Chemometrics, mainly applied to Near Infrared Spectroscopy. Member of the French Group of Chemometrics, International Board of Chemometrics for Analytical Chemistry, Member of the International Council for Near Infrared Spectroscopy, it has been awarded by the Tomas Hirschfeld Award in 2016. Currently his researches focus on the robustness of NIR calibrations.

Title: Automation of (Big) Data Processing in Analytical Chemistry Using Bayesian Statistics: Why, When and How

Dr. Gabriel Vivo-Truyols
CEO and Founder,
Tecnometrix
Spain

Abstract

Data analysis methods applied to chemical data (either chromatographic or spectroscopic), are a routine part of most modern analytical workflows. With the emergence of n-th order instruments, the large data sets pose a new challenge for the data analysis. Basically, we are witnessing a boom of the amount of data to be processed, up to the point we can talk about Big Data in Analytical chemistry. Analyzing these enormous and complex quantities of data becomes a tremendous challenge, especially because of the need of automation.

Automation is always a challenging task. In most of cases, the scientist has to "rely" on the algorithm taking (automated) decisions on both qualitative (e.g. peak identification) or quantitative (e.g. calibration) processes. However, Bayesian statistics offers an actual paradigm shift on the automation process. Contrary to classical methods mentioned above, it is not the algorithm but the scientist the one who takes the decisions, and the role of the algorithm is to calculate the probabilities of the variables of interest. This way of thinking has been applied to a broad range of situations. One example concerns toxicological screening, in which the probabilities of a list of compounds being present in the sample, analysed with LC-MS. Using a Bayesian approach, it is easy to build up evidence about the presence/absence of a compound by taking into account adduct formation, isotope ratios, retention times and mass values, resulting in more accurate values of probability. Another example is a Bayesian version of MCR-ALS, in which the classical multivariate curve resolution is applied probabilistically, so the question of parsimony of the model (i.e. how many compounds are present) is solved using Bayesian model averaging. Another application to be discussed concerns peak assignment, which is tackled from a combinatorial optimization perspective. All in all, the use of Bayesian statistics to deal with massive data treatment constitutes a shift in the way we think about data analysis.

Biography

Gabriel Vivó-Truyols (1975) studied analytical chemistry at the University of Balearic Islands (Spain) and graduated in 1998. In 2004 he obtained his PhD with honours from University of Valencia (Spain) on chemometrics methods for optimization and data treatment of HPLC. His PhD was awarded with the D.L. Massart award in chemometrics. In 2004 he joined the team of Peter Schoenmakers (University of Amsterdam) as a post-doc for 3 years. In 2007 he joined the analytical chemistry team at BP in Sunbury (London area) as chemometric specialist. In 2009 he re-joined the analytical-chemistry group of Peter Schoenmakers at University of Amsterdam as assistant professor. He left in 2017, establishing his own consultancy (based in Spain) in data analysis for chromatography and spectroscopy. With 20+ years of teaching experience at 4 different universities in this subject, Gabriel is currently scientific consultant for major multinationals in the area of data analysis, including USP, BP, Castrol, BASF, Merck and Agilent technologies, among others, as well as a collaborator with the university of Pardubice (Lipidomics, M. Holcapek group). Gabriel Vivó-Truyols has co-authored more than 60 papers, most of them at the interface of chemometrics & chromatography.

Title: Biomarkers for Aging-Related Conditions: The Role of Chemometrics

Riccardo Calvani
Research Associate
Fondazione Policlinico Universitario A. Gemelli IRCCS Università Cattolica del Sacro Cuore Rome - Italy

Abstract

Aging is an inevitable phenomenon characterized by a general and progressive decline in physiological functions associated to alterations in organ and tissues that leads to increased vulnerability to stressors and higher risk of developing diseases. While aging per se cannot be considered a disease, age-related health issues may be contrasted to preserve the functional independence and improve the quality of life of older adults. In this context, the identification of reliable biomarkers of aging and age-related conditions is of utmost importance. Recently, the biological mechanisms underlying aging, the so-called “hallmarks of ageing”, have been unveiled. Perturbations in these nine processes are associated to increased susceptibility to chronic diseases, functional loss and death. It follows that biomarkers discovery in aging should imply a comprehensive multivariable approach able to incorporate as many factors as possible. Chemometrics strategies are especially suited for handling multi-block data sets populated by variables that are strongly interdependent and represent a valuable option for identifying and validation biomarkers for aging. Here, the preliminary results of the application of chemometric modeling techniques in some prototypical aging-related conditions (including physical frailty and sarcopenia and neurodegenerative diseases) will be presented and discussed.

Biography

Riccardo Calvani received a M.Sc. in Medical, Cellular and Molecular Biotechnology at the "Sapienza University" of Rome (Italy) in 2005 and a Ph.D. in Physiopathology of Nutrition and Metabolism at the "Università Cattolica del Sacro Cuore" of Rome (Italy) in 2009. He works as a research associate at the Center for Aging and Geriatric Research of the "Università Cattolica del Sacro Cuore" of Rome. His research activity is focused on the identification of biomarkers for various age-related conditions, including musculoskeletal aging, sarcopenia, frailty and cancer. He has authored over one hundred scientific papers in international peerreviewed journals, in addition to numerous abstracts and several book chapters. He also serves as an editorial board member for Experimental Gerontology and Frontiers in Medicine, as well as a peer-reviewer for numerous scientific journals.

Title: Data Analytics, Driving the Digital Revolution

Johan Hultman
Manager OEM & Embedded Solutions
Sartorius Digital Solutions
Sweden

Abstract

Most companies today have a strategy for driving the digital revolution forward, with initiatives as IIot 4.0, Quality by Design and Industry 4.0 and intend to spend a lot of time and money to increase business value and distinguish them from the competition. Very few of them have managed to provide the significance and the unique value on their own and they are trying to find partners that can help to reach the ambitions goals that they have.
Sartorius/Umetrics have provided solutions for AI/ML, and easy to use Advanced Data Analytics software for more than 30 years with a proven track record within many industries, pharma, biotech, chemical, food & beverage, semicon and automotive. The easy-to-use solutions provide high value usage for both end users but also as embedded items in OEM& Partner solutions. Providing Data Analytics solutions that can enable Product and Process Understanding & Optimization, Real-Time monitoring and Advanced Control as the foundation for example Predictive Maintenance.
Examples from spectroscopy, mass spectrometry chromatography and process analytical technology will be used. Understanding your data is the Key to Success.

Biography

Johan Hultman joined Sartorius Digital Solutions (former Umetrics) in 1999, and has held several important positions within the organization utilizing AI/ML for Advanced Data Analytics, generating value adding and cost savings within operations, R&D and commercial manufacturing both internally and with external partners and customers.

Title: Evaluation of Different Analytical Tools for Studying the Performance of Extraction and Membrane Processes During Biosurfactant Refinery

X. Vecino[1], A. Martínez-Arcos[1], M. Reig[2], J.L. Cortina[2,3], J.M. Cruz[1], and A.B. Moldes[1]*
1 Chemical Engineering Department, School of Industrial Engineering – CINTECX, University of Vigo, Campus As Lagoas-Marcosende, 36310 Vigo, Spain
2 Chemical Engineering Department, Escola d'Enginyeria de Barcelona Est – Barcelona Research Center for Multiscale Science and Engineering, Universitat Politècnica de Catalunya, Campus Diagonal-Besòs, 08930 Barcelona, Spain
3 CETaqua, Carretera d'Esplugues, 75, 08940 Cornellà de Llobregat, Spain

Abstract

Biosurfactants are bioactive compounds used in different industrial sectors as they provide more biodegradable and biocompatible products. Wastes from the agri-food industries are used as source for obtaining cost-competitive biosurfactants. However, their refining is often a bottleneck in the production costs of these metabolites. For that, several extraction and membranes processes are carried out for their recovery, separation and/or purification, based on our R&D projects (ref. PID2019-103873RJ-I00; TED2021-129650B-I00). In this work, the performance of the previous processes was evaluated using different analytical techniques such as tensiometer (Krüss K20 EasyDyne), FTIR (Niocolet 6700 system), mass spectrometry (Bruker FTMS APEXIII) and/or electrophoresis gel (Tricine-SDS-PAGE) to detect the presence of biosurfactants. Firstly, the surfactant capacity was determined with surface tension measurements, obtaining values about 50 mN/m. The FTIR spectrum detected the presence of protein-related weak bands at 1700-1500 cm-1 region; moreover, proteins were observed in the gel of electrophoresis. Additionally, the ESI-MS spectrum showed the presence of lipopeptide biosurfactants composed by masses about 879 Da and 966 Da and other less intensive signals corresponding with masses between 1200-1400 Da. Therefore, it was concluded that the techniques employed are optimal analytical tools for biosurfactant refinery coming from agri-food wastes.

Biography

Xanel Vecino is a Ramón y Cajal postdoc researcher in the Chemical Engineering department of the University of Vigo (Spain). Her long-term goal of research is the development of cost-effective and sustainable revalorization of secondary raw materials to produce value-added products (e.g., biosurfactants and bioadsorbents) by following the concept of circular economy and industrial symbiosis. Indeed, she is a PI of a JIN-type I+D+i project, from the call «Proyectos Retos Investigación 2019», based on the recovery of biosurfactants from corn steep waters by membrane technology, in the University of Vigo (Spain) in collaboration with the Universitat Politècnica de Catalunya (UPC, Spain).

Title: Development and Validation of HPLC-DAD-MS/MS Analytical Methods for the Chemical Characterization of Hop and Related Products

Sandra Mariño-Cortegoso[1], Frank Silvano Lagos[2,3], Patricia Vázquez Loureiro[1], Ilario Ferrocin[4], Ana Rodriguez-Bernaldo de Quirós[1], Raquel Sendón[1], Cicero Deschamps[2] and Letricia Barbosa-Pereira[1]*

[1]Department of Analytical Chemistry, Nutrition and Food Science, Faculty of Pharmacy, University of Santiago de Compostela, Santiago de Compostela, Spain
[2]Department of Agronomy, Federal University of Parana, Curitiba, Brazil
[3]Department of Agronomy, Federal Institute of Education Science and Technology of Paraná, Palmas, PR, Brazil.
[4]Department of Agricultural, Forest, and Food Science, University of Turin, Grugliasco, Italy
*Associate Researcher Ramón y Cajal
University of Santiago de Compostela
Spain

Abstract

Hop (Humulus lupulus L.) is commonly used in beer production to add bitterness due to the hop resins present in the female inflorescences of the plant (hops), which contain two groups of bitter acids, humulones (α-acids) and lupulones (β-acids). In addition, the hops also contain polyphenolic compounds being the most abundant the flavonoid xanthohumol (XN) and isoxanthohumol (IXN) and related prenylflavonoids such as 6-prenylnaringenin (6-PN) and 8-prenylnaringenin (8-PN). These bioactive compounds have a positive effect on human health due to their antioxidant, anticancer, antimicrobial, and anti-inflammatory properties. In addition to its common consumption through the diet over foods in which hops are used for manufacture as beer or food supplements, the interest in using hops as a novel nutraceutical is increasing because of their health benefits.

In this oral communication, the authors propose analytical methodologies based on high-resolution liquid chromatography coupled to a diode array detector and mass spectrometry detector (HPLC-DAD-MS/MS) to evaluate the biomolecules of interest present in different cultivars of hop and related products such as beer and food supplements. The methodologies were validated in terms of linearity, limits of detection and quantification, repeatability, and recovery.

The results showed that the chromatographic method proposed was suitable to determine simultaneously four prenylflavonoids and hop bitter acids in different samples analyzed. Thus, this methodology will allow the qualitative and quantitative determination of these functional compounds in hops for authentication purposes and ensure the quality of the related products.

Biography

Graduated in Pharmaceutical Sciences (University of Porto, Portugal) and a Ph.D. in Analytical Chemistry, Nutrition, and Food Science from the University of Santiago de Compostela (USC, Spain), Letricia Barbosa-Pereira is currently an Associate Researcher at the Faculty of Pharmacy of USC. Her research has been supported by several competitive grants from different European and national agencies: Marie Curie grant (EU), MIUR (IT), JdC, JIN, and RyC (ES). She participated in 24 national (ES and IT) and 4 European research projects, author and co-author of more than 50 scientific publications; 3 patents; presented more than 60 works at international scientific conferences and is a guest editor of the open-access journal Foods (2 SI).

Title: Systematic Chiral Method Development Approach for Early Phase Product Development

Dr. Nilesh K. Joshi*, Balaji D, Athimoolam A, Laura Blue, Peter Zhou, and Jason Tedrow
Assistant General Manager
Syngene Amgen Research and Development Centre (SARC)
Syngene International Ltd.
India

Abstract

Most therapeutic drugs contain one or more chiral centers and are used either as discrete enantiomerically pure molecules or as racemic mixtures. Regulatory agencies recommend individual assessment of the activity of each enantiomer for racemic drugs and promote the development of new chiral drugs as single enantiomers, hence it's very essential to have chiral method to detect and quantitate stereoisomers.
Mostly the method development for chromatographic chiral separations has usually proceeded by trial and error
In the present article, the systematic approach towards chiral method development discussed in detail. The systematic pathway for screening of chiral stationary phases, mobile phase components and their compositions, use of chiral mobile phase additives and sample derivatization has been demonstrated and explained. Furthermore, the selection of separation techniques like HPLC and GC has been discussed. The chiral method development expedition by GC has been explained. The entire systemic path way has been supported by a case study example. The methods developed by this systematic approach was qualified and being used for the routine quality control check.
The major advantage of this systematic approach found to be availability of development data and history for product development report as per regulatory requirements under QbD approach and reduction in method development time.

Biography

Dr. Nilesh K. Joshi, currently working as Assistant General Manager (Lead Scientist), is leading the Attribute Sciences team at Syngene Amgen Research Center (SARC), Syngene International Ltd., Bangalore, India. He is experienced in Analytical Research & development across Drug substance and Drug products including Process development, generic formulations, technology transfer, bioanalytical and quality control laboratory.

AnalytiX 10:

Materials in Analytical Chemistry

Chair

Dr. Christian J. Engelsen, Senior Scientist, SINTEF Building and Infrastructure, Norway

Co-chair

Dr. Mariusz Pietrzak, Associate Professor, Faculty of Chemistry, Warsaw University of Technology, Poland

Time: 09:00-12:15, May 19, 2023 (Friday)
Place: Tatsuta, 5F, Hyatt Regency Osaka

Title: Spectroscopic Ellipsometry: Thin Film Solutions from Deep Ultra-Violet to Terahertz

Jianing Sun* and James N. Hilfiker
J. A. Woollam Company
311 South 7th Street, Lincoln, NE, 68508
USA

Abstract

Spectroscopic ellipsometry (SE) is an optical technique precisely characterizing thin films from sub-nanometer to tens of microns thick. The technique has grown rapidly in recent years, covering an ever-increasing range of the electromagnetic spectrum, from deep ultra-violet to terahertz frequencies. In this presentation, we will review the principles of spectroscopic ellipsometry and introduce a variety of information that can be extracted from SE in different spectral ranges.

Spectroscopic ellipsometry is very sensitive to process-induced changes of thin films. It is commonly used in semiconductor industry to monitor film thickness, uniformity and determine bandgap energy, composition or surface roughness. Photolithography relies on SE for determining refractive index of photoresists designed for different ultra-violet wavelengths and accurate thickness monitoring during deposition or etching process. The absorption profile of photovoltaic materials in the visible spectrum is crucial for calculating optical efficiency, while anisotropy behavior in liquid crystals or organic light emitting diode materials is important for display architect design. Free electron absorption leads to increased extinction coefficient in the infrared, which can easily be identified using SE. Infrared ellipsometry also offers dispersive absorption information to characterize organic bonding and microstructure in addition to the film thickness. Far-infrared and terahertz ellipsometry has been proven useful in the research of electronic systems such as 2d electron gases or superconductors as well as very thick films such as paint coatings or 3d printed microstructures.

Key Words: Spectroscopic ellipsometry, thin films, Optical properties, UV-Vis, Infrared, Terahertz.

Biography

Dr. Jianing Sun is an Applications Engineer at J. A. Woollam Company. The company specializes in spectroscopic ellipsometry and thin film solutions. Dr. Sun got her bachelor and master's degrees in Chemical Engineering at Tsinghua University and her Ph.D. in Material Science and Engineering at the University of Michigan.

Title: New Method to Directly Measure the CO_2-Binding to Cementitious Materials

Dr. Christian J. Engelsen*, Bjørn Ludvigsen, Arne Gunnar Bruun, and Monica S. Nodland
Senior Scientist
SINTEF Building and Infrastructure
Norway

Abstract

Carbonation of concrete normally occurs when air or water-borne CO_2 dissolves in the concrete pore water and react with Ca^{2+} to form stable $CaCO_3$. Upon carbonation, the pH of the concrete pore water is decreased to around 9. Carbonation mainly involves decalcification of the Ca-bearing hydrate phases when different polymorphs of $CaCO_3$ are formed. In addition, the Mg-bearing hydrate phases (OH-hydrotalcite and CO_3-hydrotalcite) will also carbonate by forming $MgCO_3$ and $Al(OH)_3$. Carbonation starts at the surface of the concrete and evolves inwards as a result of the diffusion of air and moisture. The carbonation depth is normally determined with an aqueous pH-indicator of phenolphthalein or thymolphthalein which become colorless at a pH below 10. The indicator is usually sprayed on the surface of a newly split concrete sampled (e.g. core drilled sample) and the carbonation depth (colorless area) is measured. However, the indicator cannot give an exact amount of the carbonation degree within the carbonated zone. Model calculations of the CO_2-binding to cementitious material containing cement has been conducted (e.g. 330 kg of CO_2 per kg of Portland cement), which can be applied to concrete materials with known cement contents.
A new method has been developed for cement-based materials to measure the CO_2-binding more precisely. This method has been applied for crushed materials as well as for block products. It contains chambers that are determining the consumption of CO_2 by the exposed materials. The temperature, moisture and CO_2 concentration are controlled throughout the exposure. The new method contributes to a more precise calculation of the global warming potential in life cycle analysis for cement-based products, since CO_2-binding caused by carbonation is currently not included.

Biography

Dr. Christian J. Engelsen holds a Senior Scientist position at SINTEF and has a Ph.D. degree in chemistry from University of Oslo. His research field of interest is processing and treatment and recycling of C&D waste into cementitious systems. Technical and environmental performance of the recycled products. He is a specialist in metal binding mechanisms to cementitious systems and materials effect on environment. Engelsen has published more than 100 scientific papers in journals, book chapters, conference proceedings and technical reports. He has managed or has been key scientific personnel in more than 150 contract research projects.

Title: Numerical Analysis and Investigation of Surfaces with Protrusions

Mitsuru Nishikawa* and Toshiharu Yamamoto
Asahi Kasei Corporation
Production Technology Center
Japan

Abstract

Protrusions on surfaces are utilized for a variety of technological applications, particularly cooling functioning. Heat sinks are one of well-known examples, and a vital component to maintain operating temperature of electric devices and computational resources. Not only that, cooling channels are equipped with protrusions to promote heat release. Seemingly, their structures are so similar, but the fundamental of cooling phenomena differ in them. In other words, even for our shallow imagination of their simple geometric structure, nature of protrusions is a gimmick to make industrial instruments to be artfully-designed organism. As is often the case with seemingly simple structures, they hold rich and profound physical mechanism as I mentioned, which stirs their research field up in the pursuit of sustainable ecosystems. Without being afraid of misunderstanding, protrusions are exactly a structure which is protruded.

In the conference, as previous researches relating to protrusions are surveyed, we will present our state-of-the-art numerical analysis of protrusions. Our investigation opened the door to a new frontier of research field of protrusions. We hope that this result attracts researchers who are irrelevant to as well as concerned with protrusions.

Biography

M.N. is a production technology engineer in Asahi Kasei Corporation.

Title: Electrochemical Analysis of Correlation Between Doping Level and Electrical Properties of Conducting Polymers

Dr. Ichiro Imae
Associate Professor
Hiroshima University
Japan

Abstract

Using potential-step chronocoulometry (PSC), the doping levels of conducting polymers were controlled by the applied voltage and precisely quantified. In concert with the electrochemical oxidation of the polymers, the doping levels gradually increased and finally reached around 20–30%, suggesting that one positive charge is formed on every three to five monomer units. The maximum value of the doping levels was affected by the electron-donating natures of the polymers. The plot of log(doping level) vs. electrode potential fits a straight line in the low doping region, and saturated. The saturated values were changed depending on the chemical structures of the conducting polymers. The charge mobility (μ) was also successfully related to the doping level because the relationship between the electrical conductivity (σ) and the charge density (n) associated with the doping level is established by the formula $\sigma = ne\mu$. This PSC technique was also applied to the investigation of the correlation between the thermoelectric properties of the conducting polymers and their doping levels. Such correlation had not precisely investigated because the history of researches on the application of conducting polymers to thermoelectric materials is too short. We found for the first time that in the logarithmic plot of the Seebeck coefficient and the doping level, a good linear relationship was obtained in a wide doping range from 1 to 20%, and the slope values were changed depending on the chemical structures of the conducting polymers.

Biography

Dr. Ichiro Imae received the Bachelor, Master and Doctor degrees (Engineering) from Osaka University (Osaka, Japan) in 1992, 1994, and 1997, respectively. During his doctor course, he worked as a Research Fellow of Japan Society for the Promotion of Science (JSPS) from 1994 to 1997. In 1997, he joined with Japan Advanced Institute of Science and Technology (JAIST) (Ishikawa, Japan) as an Assistant Professor. Since 2006, he is an Associate Professor of Hiroshima University, Hiroshima, Japan. Also, he worked as an Adjunct Lecturer of Muroran Institute of Technology and a Visiting Professor of Huazhong University of Science and Technology in 2018. He is mainly interested in the development of novel photo- and electroactive materials based on organic materials and organic-inorganic hybrid materials and their application to electrochromic and electroluminescent displays, organic field-effect transistors, organic solar cells, and organic thermoelectrics. The details are described in his own website: https://home.hiroshima-u.ac.jp/imae/. If any student wants to study in his group, she should also check this website.

Title: Application on Multifunctional Nanoparticles in Modern Immunoassays

Mariusz Pietrzak[1,2], Polina Ivanova[1,2], Marcin Drozd[1,2], Katarzyna Tokarska[2], Kamil Żukowski[2], Jan Górniaszek[1], Paweł Stańczak[1], Kamil Michrowski[1]
Associate Professor ([1]Faculty of Chemistry) and Head of Department of Medical Diagnostics ([2]Centre for Advanced Materials and technologies)
Warsaw University of Technology
Poland

Abstract

Nanozymes belong to the group of such nanomaterials which exhibit enzyme-like activity. Due to several advantages, they are gaining more and more attention, especially in the field of bioanalytical chemistry, medicine, and therapies. In recent years, one can observe their application as substitutes for natural enzymes in the construction of biotests and biosensors. They can be used in the role of labels that are responsible for signal generation (optical and electrochemical) in immunoassays after conjugation with antibodies. In the framework of this presentation, some examples of the synthesis, modification, conjugation with antibodies, and application of multimetallic nanoparticles (e.g., Fe_3O_4@Pt@Au and Fe_3O_4@Ru@Au) which combine high catalytic activity (peroxidase-like) with magnetic properties will be given. Their use as labels and agents allowing the preconcentration of analytes will be discussed, and analytical parameters (among others, the limit of detection, sensitivity, selectivity) of assays developed with their use and based on typical multiwell plates, thin polyester films in both stationary and automated systems will be compared for a model antigen - CRP.
This work was supported by the BIOTECHMED-2 project granted by the Warsaw University of Technology under the program Excellence Initiative: Research University (ID-UB).

Biography

Mariusz Pietrzak is an Associate Professor at the Faculty of Chemistry, Warsaw University of Technology. He is the head of the Department of Medical Diagnostics of the Centre of Advanced Materials and Technologies, CEZAMAT. He graduated in 2003 in polymer technology after completing a research project under the supervision of prof. Zbigniew Florjanczyk. He obtained a Ph.D. in analytical chemistry in 2008 under the supervision of prof. Elżbieta Malinowska. For almost two years, he worked at the University of Michigan (Ann Arbor) as a research fellow in a group supervised by prof. Mark Meyerhoff. Since 2009 he has supervised more than 60 diploma theses. He played a role of an auxiliary supervisor in two completed PhD projects. Currently a supervisor of 2 Ph.D. students. A laureate of the FNP Start program and a beneficiary of the CSZ scholarship for young scientists. He was repeatedly awarded the award of the Rector of the Warsaw University of Technology for scientific and didactic achievements.

Title: Colorimetric Papers for the Selective Detection of Novichok Agents

Dr. Alexandre Carella*, Lucile Termeau, and Sébastien Penlou
Head of the Decontamination and Supercritical Processes Laboratory
Science and Technology Institute for Circular Economy of Low Carbon Energy
French Alternative Energies & Atomic Energy Commission
Marcoule, France

Abstract

Novichok is a recently identified class of neurotoxic organophosphorus compounds that have subsequently been banned by the Organization for Prohibition of Chemical Weapons (OPCW) as chemical warfare agents (CWAs). Selective, rap-id detection of Novichok remains a challenge. Several colorimetric paper-based detection devices have recently been developed for the rapid and selective detection of sarin, VX and sulfur mustard. I will present a similar colorimetric device designed specifically for the detection of Novichok, based on hydrazone derivatives impregnated on a glass fiber substrate. Results show that these compounds rapidly and selectively reveal the presence of Novichok agents to the naked eye.
The low cost, ease of use, portability, and high selectivity to Novichok of this device complete the detection range of colorimetric paper-based sensors for chemical warfare agents.
In this communication, we will describe the design and preparation of the sensors and reports their colorimetric and spectroscopic properties along with the results of tests performed with a variety of live CWAs.

Biography

Alexandre CARELLA, PhD, HDR is head of the Decontamination and Supercritical Processes Laboratory since 2021. He received his Ph.D. in chemistry from Toulouse University in 2004. Since then, his research interests include surface functionalization and nanomaterials-based electronic devices, organic thermoelectric materials and chemical sensors. Alexandre Carella obtained his Habilitation in 2017 and directed or co-directed 8 PhD. He is author or co-author of 35 patents and 45 publications.

Title: Narrow-Gap Rheometry - A Tool to Characterize Mechanical Properties of Biological Samples

Haider Dakhil[1], Santanu K. Basu[1], Suhyang Lee[2], K. M. Imran Bashir[2]* and Andreas Wierschem[1,2]
Professor
[1]Friedrich-Alexander-Universität (FAU), Germany
[2]LSTME Busan, Republic of Korea

Abstract

Rheometers are versatile tools for the mechanical characterization of complex viscous liquids and soft solids. They offer the ability to study viscoelastic material properties over a large parameter range. To further enhance their applicability, we have reduced imprecisions in their alignment by about two orders of magnitude allowing to carry out measurements at gap widths of about 10 µm. Working at these narrow gaps has several advantages:

- Minimum amount of sample
- Increasing the measurement window for viscosity and normal-stress differences from maximum shear rates of about 10^3 s^{-1} to about 10^5 s^{-1}.
- Studying average viscoelastic cell properties
- Studying adhesion and load limits of particles or cells in a low viscous environment

We will present how we improved the device and show examples of its applicability to the characterization of biological samples such as cells and DNA solutions.

Biography

Dr. Andreas Wierschem is a professor for High Pressure Thermofluiddynamics and Rheology at Friedrich-Alexander-Universität in Erlangen, Germany, and a member of the scientific steering committee at the research institute LSTME in Busan, Republic of Korea. He got his M.Sc. in physics at Münster University, Germany, Ph.D. at Humboldt University, Berlin, and habilitated at Bayreuth University, Germany. Currently, his researches focus on narrow-gap rheometry and its applications, pressure-induced phase transitions, cyclones, film flows, and flow-induced particle motion.

AnalytiX 11:

Sensors and Microarrays

Chair

Dr. Weiwei Dang, Associate Professor, Baylor College of Medicine, USA

Co-Chair

Dr. Yasuhiro Iida, Professor, Kanagawa Institute of Technology, Japan

Time: 09:00-12:40, May 19, 2023 (Friday)

Place: Yoshino, 5F, Hyatt Regency Osaka

Title: Fractional Calculus and Hybrid Functions in Optical Spectral of Solids and Photonic sensors

Dr. Mohsen Razzaghi
Head of Department of Mathematics and Statistics
Mississippi State University
USA

Abstract

Studies in low dimensional condensed matter physics revealed that dimensionality has a great influence on the physical characteristics. The dimensional behavior of solids is fully exhibited in the optical properties and the analysis of optical spectra near critical points (cp) might be one of the most effective approaches to the understanding of electronic structure solids. In addition, a fractional integral expression for the interband dielectric functions near various dimensional cp's with several applications has been given in the literature.

Fractional differential equations (FDEs) are generalizations of ordinary differential equations to an arbitrary (non-integer) order. FDEs have attracted increasing attention and interest due to their ability to model complex phenomena. Because of the extensive applications of FDEs in engineering and science, research in this area has grown significantly all around the world.

For mathematical modeling of photonic sensors, images often have properties that vary continuously in some regions and discontinuously in others. Thus, in order to properly approximate these spatially varying properties it is necessary to use approximating functions that can accurately model both continuous and discontinuous phenomena. For these situations, hybrid functions, which are combinations of continuous and piecewise constant basis functions, are more effective.

In this talk, first, an introduction to fractional calculus and hybrid functions are given. Then, an efficient numerical method based on hybrid functions for solving the FDEs is presented and further applications of these functions to advanced optical and photonic sensors are discussed.

Biography

Prof. Mohsen Razzaghi received his Ph.D. degree in Applied Mathematics from the University of Sussex in England. Since 1986, he has been at the Department of Mathematics and Statistics at Mississippi State University, where he is currently a professor and the department head. During the academic years 2011-2012 and 2015-2016, he was a Fulbright Scholar in Bucharest, Romania. He is the recipient of William Giles Distinguished Professor award, one of the highest awards that Mississippi State University bestows upon a faculty member. His area of research centers on optimal control, orthogonal functions and wavelets in dynamical system, optics, and remote sensing. He has over 230 refereed journal publications in mathematics, mathematical physics, and engineering, and one of his papers coauthored with his Ph.D. student has been cited over 650 times.

Title: Photoactivated Capillary Flow for Advanced Droplet Manipulation: ANumerical Study

Dr. Takahiro Tsukahara
Professor
Tokyo University of Science
Japan

Abstract

Non-invasive/contact manipulations of microscale droplets or particles in air/liquid pools have attracted increasing research interest in recent years because of their relevance to medical or biological engineering applications and chemical processes using lab-on-chip technology. Such a technique utilizes a local variation of interfacial tension because the effects of interfacial phenomena are dominant in microfluidics relative to the inertia and buoyancy forces. The laser-induced optical force may be used as a non-invasive precise tool for droplet-based controls, but its force magnitude is limited to the order of a pico newton. We focus on the optically induced thermal Marangoni convection that may provide a larger resultant force that provides a nano-newton order force. Therefore, photoactivated capillary (or Marangoni) flow convection can be a powerful technique for on-demand bubble/droplet handling in a microchannel liquid. We performed a direct numerical simulation of multi-phase flows of droplets accompanied by either photo-induced capillary-flow convection to quantitatively study the force and mechanisms relevant to advanced droplet manipulation.

Biography

Dr. Takahiro Tsukahara, Ph.D., now is a Professor, Department of Mechanical and Aerospace Engineering, Faculty of Science and Technology, Tokyo University of Science (TUS). After received a PhD degree in Mech. Eng. from TUS in 2007, he worked as a post-doctoral researcher at KTH, Sweden. From 2008, he started his academic career in TUS. He published > 60 peer-reviewed journal papers and > 60 peer-reviewed proceedings papers. He received several awards including the Scientific Contribution Award of the Heat Transfer Society of Japan in 2020 and 2021. His interests are in the transition and heat transfer of wall turbulence, viscoelastic flow, multi-phase flow, and turbulence models.

Title: High Throughout Replicative Aging Analysis for Budding Yeast

Dr. Weiwei Dang
Associate Professor
Baylor College of Medicine
USA

Abstract

The budding yeast, Saccharomyces cerevisiae, is one of the most genetically tractable eukaryotic models. Yeast cells undergo asymmetric cell division, producing a smaller daughter cell, and have a finite replicative lifespan. This aging model has been quite fruitful in discovering the molecular mechanisms of the aging process. However, the replicative lifespan is traditionally measured by manually dissecting mother cells from daughter cells, which is a very tedious and inefficient process. Here, we present two high throughput methods for analyzing yeast replicative aging: a microfluidic-based high throughput lifespan assay and a population-based high throughput replicative lifespan screen. We show that the microfluidic-based high throughput lifespan assay provides consistent and reliable replicative lifespan measurements for yeast strains with an increase in efficiency by 300-fold. Screening for mutant library for certain genetic traits has been a powerful approach to under basic biology. However, even with the microfluidic lifespan assay, looking for long-lived or short-lived mutants among thousands of strains remains a daunting task. Our population-based high throughput lifespan screen approach can identify long-lived and short-lived mutants from thousands of mutant strains simultaneously in a week-long experiment. These methods provide modern, reliable, and efficient ways for characterizing aging phenotypes for yeast mutant strains.

Biography

Weiwei Dang, Ph.D., is Associate Professor in the Department of Molecular and Human Genetics, and the Huffington Center on Aging at Baylor College of Medicine. He is a CPRIT Scholar for Cancer Research. Dang received Ph.D. in Molecular Biology, Microbiology, and Biochemistry from Southern Illinois University School of Medicine and pursued postdoctoral training with Dr. Shelley Berger at the Wistar Institute and University of Pennsylvania Perelman School of Medicine. He has published more than 40 peer-reviewed papers in reputed journals and has been serving as an editorial board member of eLife, Aging Biology, Journal of Gerontology, Frontiers in Aging, and Life Medicine. He is an elected board member and serves as assistant secretary for American Aging Association (AGE).

Title: Simulated Hyperspectral Imagery for Remote Sensing Algorithm Design

Dr. Robert Sundberg
President Emeritus
Spectral Sciences, Inc.
USA

Abstract

Development of algorithms for remote sensing applications can be facilitated with accurate scene simulations, where terrain reflectance and topography as well as all atmospheric and illumination conditions are controlled by the investigator. One such scene simulation model is MCScene. The MCScene model is based on a Direct Simulation Monte Carlo approach for modeling 3D atmospheric radiative transport, as well as spatially inhomogeneous surfaces including surface BRDF effects. The model includes treatment of land and ocean surfaces, 3D terrain, 3D terrain objects, and effects of finite clouds with surface shadowing. Simulations can be performed from the UV through the LWIR. In this paper, we illustrate the use of MCScene as a tool in remote sensing algorithm development by simulating a partly cloudy scene and using this scene to test and evaluate a spectral cloud masking algorithm.

Biography

Dr. Robert Sundberg is President Emeritus of Spectral Sciences, Inc., and served as the President (2021-2011), Vice President of Technology Development (2011- 2002) and the Group Leader of Detection and Discrimination Group (2002-1998). His present research activities include the development of hyperspectral scene simulation models, atmospheric compensation algorithms, target detection and identification algorithms, rapid real-time IR target imaging models, high temperature optical models for hypersonic vehicle ablation products, high resolution line- by- line radiation transport models for calculating non-equilibrium infrared vacuum core plume radiation and modeling of atmospheric infrared radiance phenomena.

Title: Development of Novel DNA Methylation Analysis Method in Combination with Recombinant Dnmt1 and Bisulfite Sequence

Dr. Yasuhiro Iida*, Shota Maeda, Ryota Yoshikawa, Mao Hayashi, Toru Uda, and Ryo Futashim
Professor
Kanagawa Institute of Technology
Japan

Abstract

DNA methylation, an epigenetic mechanism, is known to be closely involved in the regulation of gene expression, and an aberrant methylation is associated with various diseases including cancer, mental disorder and lifestyle disease. Therefore, DNA methylation analysis is important. Bisulfite sequencing (BS-seq) is generally used as a methylation analysis, however, Conventional BS-seq detects hydroxymethylation (hmC) of demethylation intermediates as methylation (mC). Since hmC is not recognized as mC *in vivo*, conventional BS-seq does not allow accurate DNA methylation analysis. Therefore, new analytical methods are needed to assess pure DNA methylation.
Our laboratory aims to develop a novel methylation analysis method that combines DnmtI and BS-seq. Our previous studies have shown that DnmtI has *de novo* activity *in vitro*, and an enzyme that does not have de novo activity is required to apply novel methylation analysis. In this study, we constructed several subcloned recombinant DnmtI and evaluated those *de novo* and maintenance activities *in vitro*. As a result, DnmtI (646-1616 a.a.) showed no de novo activity and showed high maintenance activity. From this result, recombinant DnmtI can be applied for accurate copying of DNA methylation patterns and accurate DNA methylation analysis in combination with BS-seq.

Biography

Yashiro Iida, Professor, Kanagawa Institute of Technology, grew up in Japan and he received a Ph. D. degree in Engineering from Tokyo University of Agriculture and Technology in 2000. His research fields are the search for bioactive substances and the evaluation of biological functions, and he has received awards, with Outstanding Paper Presentation Award 2003 IEE Japan, 15th Symposium of Award for Encouragement of MRS Winner (2004), FIA Award for Younger Researchers (2008). He is a member of The Japanese Association for Flow Injection Analysis, Japan Association of Chemical Sensors, the Japanese Society of Epigenetics, The Molecular Biology Society of Japan, etc.

Title: Formation of Metal Cluster Ions in Laser Desorption/Ionization Mass Spectrometry for the Biosensing Applications

Han-Wei Chu and Chih-Ching Huang*
Professor
Department of Bioscience and Biotechnology
National Taiwan Ocean University
Taiwan

Abstract

Pulsed laser irradiation can cause fragmentation of nanoparticles (NPs) which generates cluster ions corresponding to its composition. This allows NPs to be adopted as mass tag/signal amplifiers in laser desorption/ionization mass spectrometry (LDI-MS)-based bioassays. Herein, we demonstrate the potential of pulse laser generated alloy cluster ions for the detection of thrombin activity through a fibrin clot model. Fibrinogen (Fg) functionalized silver and gold NPs (Fg–Ag NPs/Fg–Au NPs) can form clots composed of aggregated fibrin-Au NPs/Ag NPs when reacted with thrombin. These clots analyzed with LDI-MS are noted to form intense Ag-Au alloy cluster ions (especially $[Ag_2Au]^+$) during plasma plume overlap, which were used to detect thrombin concentration down to 5.0 pM. This methodology was also employed for the screening for direct thrombin inhibitors. This research utilized gas-phase reactions of metal ions after pulsed laser irradiation of aggregated NPs and demonstrated a novel development in MS bioassays through a fibrin clot model. We believe that LDS-MS can serve as a new platform for gas-phase reaction-based bioassays.

Biography

Chih-Ching Huang is a Professor at the Department of Bioscience and Biotechnology, National Taiwan Ocean University, Taiwan. He received his PhD degree in Analytical Chemistry from the Department of Chemistry under the supervision of Dr. Huan-Tsung Chang, National Taiwan University, Taiwan (2004). He worked as Postdoctoral fellow at the same laboratory (2006–2008). In 2008, he joined the Department of Bioscience and Biotechnology, National Taiwan Ocean University, Taiwan. His research work is mainly focused on development of nanosensors and nanodrugs. He has received various awards, Taipei Biotech Awards (Technology Transfer Award, 2021), Award for Excellent Contributions in Technology Transfer (Ministry of Science and Technology (Taiwan) (MOST), 2020), 16th National Innovation Award (Taiwan, 2019), and Taiwan Innotech Expo, Platinum Awards (2019).

Title: Spectroelectrochemical Evaluation of the Interaction of Pharmaceutical Compounds with Serum Proteins and Liposomes for Drug Delivery Systems

Dr. Monica Florescu*, Melinda David, and Claudia G. Chilom
Associate Professor
Transilvania University of Brasov
Romania

Abstract

The pathology and diet of the patients influence the bioavailability of the administered drugs that reach the systemic circulation, as well as their binding to the transporter serum proteins and the cell membrane.
In this work, the interaction of bovine serum albumin (BSA) and BSA nanoparticles (BSANPs) with drugs and liposomes as cell models, was evaluated by spectroscopic and electrochemical methods. The used drugs were levothyroxine (LT4), the synthetic form of the thyroid hormone, and folic acid (FA), whose deficiency or high intake can lead to various health problems. The binding mechanism and affinity of the interaction between BSA with LT4 and FA [1, 2], and the effects of four vitamins on the BSA-LT4 complex were studied [3]. The interaction of plain LT4 and drug loaded BSA nanoparticles with liposomes was also studied.
The studies made it possible to characterize the binding mechanisms and the forces involved between each drug and BSA, but also the fact that conformational changes are induced in the BSA structure, due to both drugs and vitamins. This modification leads to an increase in the structural stability of the protein complexed with the drug(s) under the action of denaturing factors and to changes in the retention time in the systemic circulation. The effect of compounds interactions on DPPC liposomes studied allowed the characterization and evaluation of NPs-protein-drug interactions at the membrane level. All findings will be used for future development of drug delivery systems based on BSA and BSANPs.
References:
[1] N. Sandu et. al, J. Biomol. Struct. 2020, 40:3, 1139
[2] N. Sandu et. al, Int. J. Mol. Sci. 2022, 23, 4215
[3] C.G. Chilom et. al, Spectrochim Acta A Mol Biomol Spectrosc. 230 (2020) 118074
Acknowledgments: This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI - UEFISCDI, Project number PN-III-P2-2.1-PED-2021-1323, contract no. 582, within PNCDI III.

Biography

Monica Florescu, Associate Professor of Physics and Biophysics, Transilvania University of Brasov, obtained Ph.D. in Physics (2007) and in Medicine (2020). Her current research interests include development of composite nanomaterials, study of biomolecular interactions, development of label-free (nano)biosensors as detection tool for new diagnostic and treatment methodologies based on nanomaterials and biomaterials. She received several fellowships and travel awards for conferences and research stages. She coordinated and was member of several national and international research projects. She published over 75 articles in prestigious peer-reviewed journals, with over 850 citations.

Title: 2D Mono Detection Spatially Super-Resolved RF Imaging for Radar Applications

Dr. Gabay Isahar
Researcher
Bar-Ilan university of Ramat Gan
Israel

Abstract

Detection and identification of objects by using radio frequency signals is one of the most important tasks of microwave systems. Some systems are an active, which are transmitting a known signal and receiving the reflected signals from metallic objects. Some other systems are passive, which are operating in receiving mode only and relies on direct or indirect signals from external sources. The resolution of the system is very important because of the ability not only to detect signals, but to identify and classify objects which caused the reflected waves. This work presents two novel researches which dealing with:

- 2D mono detection spatially super-resolved imaging for Radar applications
  The solution based on phased array technique. The results are strongly reconstructed the object's form and location.

Biography

Dr. Gabay was born in Marrakesh, Morocco in 1955. He received the B.Sc. and M.Sc. degrees in electrical and computers engineering from Ben-Gurion University of Negev in Beer-Sheba, Israel, in 1981 and 2003 respectively and Ph.D. degree in electro-optics engineering at Bar-Ilan University, Ramat-Gan, Israel in 2017. From 1981 to 1984, he was an electronic engineer officer in the Israeli Air Force. Since 1984, he has been a microwave system designer, Antenna developing and ESM & ECM systems engineer at Israel Aerospace Industries (IAI) ELTA Systems in Ashdod, Israel.
Dr. Gabay is also a lecturer in microwaves and Radar courses at few academic colleges in Israel and from April 2022 he retired from IAA and becomes a freelancer consultant for some security industries.

AnalytiX 12:

Frontiers in Analytical Chemistry

Chair

Dr. Joel B. Tellinghuisen, Emeritus Professor, Vanderbilt University, USA

Co-chair

Dr. Stepan Urban, Professor, University of Chemistry and Technology, Czech Republic

Time: 09:00-12:40, May 19, 2023 (Friday)

Place: Kamo, 5F, Hyatt Regency Osaka

Title: Comparison of Mobile State-of-the-Art Raman Instruments and New Perspectives in Cultural Heritage Studies

Dr. Luc Moens*, Peter Vandenabeele, and Anastasia Roussaki
Professor
Ghent University
Belgium

Abstract

Nowadays, Raman spectroscopy is considered to be one of the first choice techniques for cultural heritage studies. Although micro-Raman spectroscopy, performed with benchtop Raman instruments, is a well established technique, it often requires samples to be taken from the artefact and positioned under the Raman microscope. From the analytical point of view investigations performed with laboratory instruments yield high quality results, although the work of art is jeopardised and possed under risk. The need for conducting non-invasive and non-destructive analysis, positioned mobile spectrometers on the forefront of Raman analysis. Indeed, the number of studies performed with mobile Raman instruments has increased during the last years. These include research on a variety of artistic works from prehistory to mediaeval times, to Renaissance, to modern art and to contemporary street art.
Technological advantages shaped Raman spectroscopy and produced a variety of approaches. These approaches or techniques were designed primarily for benchtop instruments, but today they are successfully implemented on mobile Raman spectrometers. Over the coarse of the years, mobility of the Raman systems became essential. Therefore, Raman spectrometers, became compact and light-weighted, with a miniaturised geometry including advanced software to ease the measuring procedure.
The advantages and possible drawbacks of progressing from to mobile Raman analysis, and as a consequence from the laboratory to the field, will be discussed and illustrated with several examples from field campaigns.

Biography

Luc Moens, and Peter Vandenabeele hold a Ph.D. in chemistry from Ghent University and are full professors at this university. They joined forces to set up a research group on Raman spectrometry and mainly work in the field of archeometry. Anastasia Roussaki holds a Ph.D. in chemistry from the same university and is a Postdoc Researcher in the Raman research group.

Title: The Possibilities of Mass Selected Ion Beam

Dr. Masashi Nojima
Junior Associate Professor
Tokyo University of Science
Japan

Abstract

The information of elemental compositions on manufacturing process brings us the possibilities to reproduce the copies of materials [1]. The elemental compositions help us to understand the definitions of the physical properties and the informatics field of materials. The manufacturing process are ruled by beam formations, such as multilayers productions and implanting process. While the field of material informatics is indicating the final elemental compositions of materials, the ion beam formations on the reproduction process are limited by the ionization methods. The elemental limitations by the ion beam formations had motivated me to develop mass selected ion beam [2]. This speech curves the possibilities to generate mass selected ion beam by two rotating electric fields mass (REF-MS) filter.

Biography

Dr. Masashi Nojima, Ph.D.-engineering, now is a Junior Associate Professor of Engineering, Research Institute of Science and Technology, Tokyo University of Science. He completed his doctorate in micro-beam analysis with a combination of focused ion beam (FIB) and secondary ion mass spectrometry (SIMS) in 2003. After graduate from Department of Applied Chemistry of Engineering in the University of Tokyo, he became a Research Associate of Professor Yoshimasa Nihei lab in Tokyo University of Science. He has invented shave-off depth profiling by utilizing FIB micro-machining and SIMS. The shave-off depth profiling is powerful to rough structured samples and different interfaces. He applied the shave-off depth profiling for failure analysis of nano-devices: electro-chemical-migration phenomena in IC package. He has firstly visualized electro-chemical-migration in IC package within 10 um pitched electrode in the world in 2005-2008. In 2012 he has developed Ar gas cluster ion beam (GCIB) dynamic SIMS system for polymer depth profiling and imaging. In 2013, his team was nominated for development of a new principle mass analyzer for organic materials from JST-SENTAN program and started developing a new principle mass analyzer.

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Title: Calibration: Detection, Quantification, and Confidence Limits Are (Almost) Exact When the Data Variance Function Is Known

Joel Tellinghuisen
Emeritus Professor of Chemistry
Vanderbilt University
USA

Abstract

A simple property of linear least squares (LLS) seems woefully underappreciated by analytical workers: When the data variance function is known, the parameter standard errors are exactly predictable for any x data structure. This reality facilitates design of optimal calibration structures. The only requirement is that the data be inverse-variance weighted in the fitting, hence the need for the data variance function (DVF). If the data error is normally distributed, so are the parameters. Thus in calibration with LLS fitting, confidence and detection limits in the response domain (y) are also exactly predictable. The corresponding quantities in the content domain (x) remain uncertain, from (1) estimation uncertainty for the parameters (especially the slope) and (2) the inherent nonlinearity of the estimator x_0 for the unknown having measured response y_0. Unfortunately, there is a catch: The DVF can never be known exactly, except in the context of Monte Carlo simulations. This presentation will focus on (1) How good is good enough? in the estimation of DVFs, and (2) the use of algorithms that make the evaluation of detection and confidence limits a simple numerical task for any DVF and any calibration response function, including the nonlinear functions that arise in many analytical methods.
An alternative approach for obtaining LS data weights that has gained in popularity in recent years is the use of goodness-of-fit tests. This method fails miserably, as will be demonstrated from Monte Carlo simulations.

Biography

Joel Tellinghuisen earned his undergraduate degree in chemistry at Cornell University and his Ph.D. in physical chemistry at the University of California at Berkeley. He cut his data analysis teeth working on problems in optical spectroscopy, especially diatomic emission spectra relevant to the development of excimer lasers. In recent years he has emphasized problems in other areas, including isothermal titration calorimetry (ITC) and analytical applications of polymerase chain reaction (PCR).

Title: Characterization of Surfactant Amphiphilicity by Chromatography

Dr. Yuji Yamashita
Associate Professor
Chiba Institute of Science
Japan

Abstract

Hydrophilic-Lipophilic Balance (HLB) is a very practical concept to identify the properties of surfactant as an emulsifier. Many methods to calculate the HLB number had been proposed, but some are not opt for general molecules and others are too complicated. For this reason, a new practical parameter to express surfactant properties would be required, particularly for industrial applications, and therefore we have attempted to develop a novel method and parameter using chromatography to characterize the real surfactant nature, that is, hydrophilicity and lipophilicity. It was revealed from our early study that thin layer chromatography (TLC) gives hydrophilic and hydrophobic character of the molecule by using normal phase and reversed phase method for several pure surfactants, and we proposed a practical index of surfactant characteristics as integrated surfactant potency (ISP) expressed by the ratio of two capacity constants. The real nature of surfactant can be well-defined by ISP; the surfactant solution properties such as cloud point (CP) are linearly correlated with ISP. Furthermore, it was found that ISP could be applied for the heterologous surfactants and commercial ones regardless of chain distribution, and lead to good correlation with the solution properties. Thus, ISP is expected to be a promising parameter to utilize surfactant in various applications.

Biography

Yuji Yamashita received his Ph.D. in natural science from Bayreuth University, Germany, in 2005, an M. S. and B. S. from Yokohama National University, Japan. After several years of research work on the thermotropic liquid crystals in industry laboratory at Chisso Petrochemical Co., he began to study dermatology, especially transdermal drug delivery system, as a post-doctor at St. Marianna University, Japan. Since October 2011, he has been engaged in teaching and research concerning the cosmetic science at Chiba Institute of Science. His present position is associate professor. The area of his expertise is the surfactant science such as phase behavior and self-assembly which is related to formulation technology.

Title: Forensic Identification of Persons Using the Scent Trace

Dr. Stepan Urban
Professor
University of Chemistry and Technology
Czech Republic

Abstract

The lecture focuses on chemical analyses of the human scent (odor) samples using the comprehensive GCxGC-MS and on their forensic context, especially within the method of the scent identification of persons. The algorithm of this method has not yet been explained; nevertheless, a concept of the active human scent signature is probably very important for its understanding. The so-called human scent signature represents a group of scent compounds that makes the unique identification of human individuals possible, like with fingerprints or DNA. Detailed knowledge of the human scent signature can have crucial applications in forensic criminology for the unambiguous identification of persons using the scent trace that was obtained at the crime scene. In this lecture, the possibilities of the creation of digital scent signatures will be also discussed as well as their possible applications.

Biography

Stepan Urban was born on March 5, 1950, Prague, Czechoslovakia. He got the "Diploma chemist" (M.Sc.) in Physical Chemistry In 1974 from Faculty of Science, Charles University, Prague, “RNDr.” in Physical Chemistry in 1978 from Faculty of Science, Charles University, Prague, and "CSc." (Ph.D.) in Chemical Physics in 1980 from Department of Physical Chemistry and Electrochemistry, Academy of Sciences of the Czech Republic. He was Associate Professor, habilitation 1995, Institute of Chemical Technology, Prague and Professor, habilitation 2002, Institute of Chemical Technology, Prague, designation 2003.

Title: Surface Reaction Mechanism in a-Si: H Growth at High Temperature

Dr. Yasutake Toyoshima
Renewable Energy Research Center
National Institute of Advanced Industrial Science and Technology (AIST)
Japan

Abstract

Since the growing surface of hydrogenated amorphous silicon (a-Si:H) films is passivated by hydrogen termination in plasma-enhanced chemical vapor deposition (PE CVD) of SiH_4, the film growth is considered as a 2-step mechanism, that is, a first SiH_3 radical, the identified film-growth precursor, to pick up surface hydrogen atom leaving an active site (dangling bond), and a second SiH_3 to stick there. A 2nd order dependence of film growth rate on SiH_3 number density was reported. However, it seems strange that the reported dependence was found in the low density region of SiH_3, contradicting the general concept that a higher order dependence should occur when the concerning species is concentrated. The origin of this funny behavior is successfully identified by applying the method of steady state, with introducing a reverse reaction to the growth. An evidence is also presented to show that such a reverse reaction actually occurs by use of *in-situ* IR monitoring for the surface hydrogen behaviors.
Careful analysis for the increase of film growth rate at high temperature also revealed that, the activation energy (ΔE) of surface hydrogen desorption sometimes showed an extraordinarily low ΔE of 0.8eV, in addition to the commonly known values (1.8eV or more). To explain this quite low ΔE, a sequence of surface reactions, in which H^+ plays a key role, is proposed with an aid of molecular orbital calculations.

Biography

Dr. Yasutake Toyoshima, Doctor of Engineering, has been employed as an Invited Senior Researcher in Renewable Energy Research Center (RENRC), National Institute of Advanced Industrial Science and Technology (AIST) since 2018. In 1983, He started research on thin film solar cells at Electrotechnical Laboratory (ETL), focusing on identifying the film growth mechanism by use of *in-situ* observation technique called IRRAS (Infra-red Reflection Absorption Spectroscopy). After the reconstruction of National Laboratories in 2001, he joined energy technology related divisions of AIST, focusing on the development of renewable energy including photovoltaics. He is also familiar with Material Science, Surface Analysis, Raman Spectroscopy, Spectroscopic Ellipsometry, Molecular Science, Device Technology, and so on.

Title: Phase Separation Dynamics in an Annealed Polymer: Fullerene Blend Analyzed Using the Critical Point Model of the Permittivity

T. Elbaz and R. Shikler*
Associated Professor
School of Electrical and Computer Engineering
Ben Gurion University of the Negev
Beer Sheva
Israel

Abstract

n this work we show for the first time how spectroscopic ellipsometry can be used to analyze the dynamics of morphological changes that take place during the annealing of a film of two bench-mark materials used for organic solar cells that are the most reported on in the literature, poly (3-hexyl-thiophene 2.5-diyl)(P3HT) and [6, 6] phenyl C61 Butyric acid methyl ester (PCBM). Morphological changes within the homopolymer and the blend during annealing process manifest themselves in the optical spectra of the film and are qualitatively attributed to the structural changes. In contrast, we demonstrate that parametric description using the critical point model gives additional information that was previously only accessible by x-ray diffraction based techniques. We analyzed the dimensionality of the excitons as extracted from the model and found a one-to-one correspondence with observed peaks in the x-ray spectra.

Biography

Rafi Shikler got his B.Sc in Mathematics and physics Magna Cum Laude from Tel-Aviv University, his M.Sc in Physic from the Weizmann institute and a Ph. D. in EE from Tel-Aviv University. He then did a postdoc in the Cavendish lab under the supervision of Prof. Sir Richard Friend from the OE group on organic semiconductor. He is currently a member of the ECE school at BGU where his group is focusing on understanding how different fabrication techniques and different device architectures controls and electronic and optoelectronic properties of organic semiconductors based devices

Title: Experimental Investigation of Liquid Film Thickness Between Coalescing Air Bubbles

Dr. Takayuki Morokuma* and Yoshio Utaka
Assistant Professor
Kanagawa University
Japan

Abstract

Despite intensive research into bubble dynamics, detailed information on bubble coalescence is still unavailable. The objective of this study is to investigate the characteristics of the formation, temporal change in thickness distribution, and rupture phenomena of the liquid film that forms between twin approaching bubbles by direct measurement of the thickness of the liquid. A combined laser extinction and laser interferometric measurement system is developed for the measurement of the time variation of thickness distribution of a liquid film formed between colliding air bubbles. The coalescence of twin air bubbles that horizontally come into contact with each other is studied. The variation and distribution of the liquid film thickness between twin bubbles are investigated. The deformation of bubbles is found to increase with the bubble approach velocity, while bouncing occur because of an increase in the area of the liquid film that forms between the bubbles. The minimum rupture thickness just before coalescence and its position varies with the variation in the bubble approach velocity.

Biography

Takayuki Morokuma is a assistant professor of Mechanical Engineering at Kanagawa University, Kanagawa, Japan. He received his Ph.D. of mechanical engineering in 2015 from Yokohama National University, Kanagawa, Japan, and master's degree of mechanical engineering in 2012 and bachelor's degree in 2010 from Kanagawa University. His main research is focused on mechanism of bubble coalescence and investigating the behavior of liquid film between bubbles and he received 2015 JSME Young Engineers Award, Japan.

AnalytiX 13:

Video Forum

Title: Ionophore-BASED Ion-SELective Electrodes: Analysis in Non-Zero Current Modes

Valentina M. Keresten, Anna V. Bondar, Dr. Konstatin N. Mikhelson*
Professor
St. Petersburg State University
Russia

Abstract

Ion-selective electrodes (ISEs) with sensing membranes containing ionophores are widely used as sensors in various analytical applications. For decades, analysis with ISEs implied measurements in zero-current (potentiometric) mode. Non-zero current methods like chronopotentiometry, chronoamperometry, electrochemical impedance and other methods were only used for the fundamental studies of the mechanism of the ISE response. However, in recent years, it was shown that non-zero current modes of measurements with ISEs are promising also for analytical applications. Examples will be presented of (i) the use of ISEs in chronoamperometric/coulometric mode to measure Ca^{2+} in blood serum with the sensitivity of 0.1 % [1], (ii) processing of the results of measurements with ISEs using the signal curve fitting instead of a traditional calibration approach [2], (iii) ion-selective voltammetric sensors with an improved life-time [3] and resistometric sensors which allow for measuring concentrations (not activities) of analytes [4].
Keywords: Ion-selective electrodes, ionophores, chronoamperometry, coulometry, voltammetry, resistometry.
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Biography

Konstatin N. Mikhelson, Dr.Sc., Professor at Chemistry Institute c/o St. Petersburg State University, Russia, grew up in Russia. He received his Ms.Sc. degree in 1975, PhD degree in 1982 and Dr.Sc. degree in 2004, all from the St. Petersburg State University. He worked as visiting scientist in Finland, Switzerland and USA.
Konstantin_Mikhelson@outlook.com
k.mikhelson@spbu.ru

Title: The Gyrotron – Quasi-Optical Relativistic Cyclotron Resonance Maser

Dr. Michael I. Petelin
Professor
Institute of Applied Physics
Russia

Abstract

Among microwave generators based on the stimulated cyclotron radiation of electrons, a sub-class uses a relativistic (Einstein's) effect: the electron mass-on-energy dependence $M=E/c^2$.
In a version of cyclotron resonance masers – called the gyrotron
-dimensions of the RF interaction space may be much larger than the radiated wave length,
-the injected flow of gyrating electrons may be formed with a high-compression magnetron-injection gun,
-the coherence of microwave radiation may be provided by a combination of electrodynamic and "electronic" methods of mode selection.
Presently gyrotrons developed in Europe, Japan, US and Russia produce the highest CW and average powers of coherent radiation at the millimeter wave band.

Title: The Art of Detecting Traces of Explosives

Dr. V. M. Gruznov* and I.I. Zasypkina
Chief Researcher
Trofimuk Institute of Petroleum Geology and Geophysics
Siberian Branch Russian Academy of Sciences (IPGG SB RAS)
Russia

Abstract

Sampling methods for detecting traces of explosives in the air based on various physical and chemical methods are considered. Determined concentrations - down to 10-16 g/cm3 for trinitrotoluene, hexogen. Gas chromatographic and sensor methods are distinguished. Based on the molecular-kinetic theory, express methods for sampling and sample preparation have been developed. The limiting achievements in terms of speed and sensitivity, and the parameters of an ideal promising detector are formulated.

Biography

Gruznov Vladimir Matveevich, Doctor of Technical Sciences, Professor of the Department of Analytical Chemistry, Novosibirsk State University, Chief Researcher of the Institute of Petroleum Geology and Geophysics named after A.A. Trofimuk (IPGG) Siberian Branch Russian Academy of Sciences. Laureate of the Prize of the Government of Russian Federation in the field of science and technology. He received his doctorate in analytical chemistry from the Institute of Physical Chemistry and Electrochemistry named after A.N. Frumkin. The area of scientific interests is the physical and chemical bases of methods for determining traces of organic substances: gas chromatography, ion mobility spectrometry, gas chromatography-mass spectrometry.

Title: Platform of Micro-Thermocouple Array for Single-Cell Temperature Measurement

Dr. Danhong Han and Dr. Shengyong Xu*
Professor
Peking University
China

Abstract

Temperature is an important parameter for characterizing the metabolization and other bio-chemical reactions of cells. In this talk, we will briefly review two major technologies that have been applied to monitor the local temperatures of individual live cells, namely fluorescence nano-thermometry and array of micro/nano-sized thin-film thermocouples. We will discuss some key technical issues that need to be addressed and optimized for practical applications of these techniques. An approach that combines them in a hybrid measurement system could be an ideal solution.

Biography

Dr. Han obtained her Ph.D. degree from the School of Electronics, Peking University in 2020. She is now working on microsensors. Professor Xu obtained his Ph.D. degree in 1999 from the Department of Physics, National University of Singapore. He joined School of Electronics, Peking University in 2006. His group has been working on nano-micro-biosensors, brain-computer-interfaces, artificial vision systems and brain functions.

Title: Topologically Stabilized Spin Configurations in Rare-Earth-Based Systems Using Polarized Neutron Scattering

Amitesh Paul
Senior Research Scientist of Material Science and Engineering
Guangdong-Technion Israel Institute of Technology (GTIIT)
China

Abstract
I will discuss some general aspects of structural and magnetic correlations that can be accessed by various neutron and x-ray scattering techniques at low-angle. Eventually, I will introduce the case of topologically stabilized spin configurations like helices in the form of planar domain walls with magnetic functionalities in transition metal/rare-earth and rare-earth/rare-earth systems. Recently, using magnetization and susceptibility as a function of temperature along with thermo-remanent magnetization measurements we have confirmed the super spin-glass type of behavior within a rare-earth/rare-earth system of Dy/Tb. Interestingly, a detailed analysis of the polarized neutron reflectometry profiles has established evidence of superimposed helical magnetic configurations within both materials of Dy and Tb associated with spin-frustrated interfaces. The realization of such spin configurations opens up the opportunity for scientific and technological applications in increasing the energy density for all-spin-based systems.

Biography
Amitesh Paul, Senior Research Scientist of Material Science and Engineering, Guangdong-Technion Israel Institute of Technology (GTIIT), grew up in India and received his Bachelor's and Master’s degrees from the University of Calcutta in 1991 and Ph.D. degree from the University of Indore in 2002. Since 2001, he spent his early scientific years in Germany at the FZ-Jülich and at the HZB-Berlin before obtaining his Habilitation certificate working at the TUM-Garching in 2017. He is also a scientific advisor at the Centre for Energy Research, Budapest Neutron Centre-Budapest since 2019. The Paul group at the GTIIT is focused on addressing the fundamental aspects of interface magnetism in layers and nanostructures.

Title: The Impact of Heavy Metals on Plants and Soil Samples in Camp2 Quarry Site Akamkpa Local Government Area, Cross River State Nigeria

Dr. Eteng E. Ofem*, Ekpo Grace, Joe Enobong., Moses A. Ceaser, Ugwor I. Emmanuel, James S. Adewale, Ekam Victor, Kenyoh Abam., and Eyong Ubana
Lecturer
Department of Biochemistry
Federal University of Agriculture
Nigeria

Abstract

The Present study was carried out to assess the heavy metals concentration in soil and vegetables plant consumed in Camp 2 Community of Akamkpa local government area of Cross River State (Nigeria). The plant and soil samples were collected at the study site and the control sites in different locations; heavy metals analysis was carried out using atomic absorption spectrophotometer (AAS) after a wet digestion. Heavy metals such as Cadmium (Cd), Lead (Pb), Mercury (Hg), and Chromium (Cr), Arsenic (As), Nickel (Ni) in soil and vegetable plant were determined. The plant sample Cd and Ni levels recorded from the experimental site (AKAMKPA) were significantly ($P<0.05$) higher than that of the control site (UGEP), whereas Pb and Cr level were significantly lower than that of the control site. There was no significant difference in the level of Hg and As recorded from both sites. Also, soil Ni and Cr levels were significantly ($p<0.05$) higher at the experimental site compared with the control site, whereas the Pb and Cd levels were significantly lower at the experimental site than the control site. No significant difference was observed for Hg and As from both sites ($p>0.05$). They were an association between the heavy metals in the plant and the soil sample. Cd level in the plant correlate positively with Ni in the soil ($r = 0.988^{**}$, 0.00). The conversely, there were negative correlations between Cd in plants vs Pb in soil ($r = -0.936^{**}$, 0.006), Ni in plant vs Cd in soil ($r = -0.910^{**}$, 0.012), Ni in plant vs Pb in soil ($r = -0.937^{**}$, 0.006), and Cr in plant vs Ni in soil ($r = -0.880^{*}$, 0.021). Hence, the values of metals recorded were above WHO standard (0.1mg/l) and FAO/WHO standards of (0.2mg/kg) while others were within joint FAO/WHO standard limit. The uptake of these heavy metals from the soil to the plant through transfer factor (TF) could be the reason why the plants were deficient in essential minerals component in Camp 2 compared to the control site. The increase level of these heavy metals contamination on *T. Occedentalis* plants and soil samples could bring about negative impact on both animals and human health within the communities.
Key: Heavy metals, anthropogenic activities, Cadmium, Nickel, Lead, Akamkpa, Ugep, Nigeria.

Biography

Eteng Ofem Effiom Ph.D. Biochemical Toxicology from the Department of Biochemistry, Faculty of Basic Medical Science University of Calabar, I grew up with my parents in Calabar Cross river state Nigeria. I graduated first degree in Biochemistry from University of Calabar in 2008. I am currently a lecturer in the department of Biochemistry College of Bioscience, Federal University of Agriculture Abeokuta Ogun state Nigeria. I have won several awards in my research areas, member Society of Toxicology (SOT), Member Nigeria Society of Biochemistry and Molecular Biology (NSBMB) and member Nigeria Society of Experimental Biology (NISB). I have also, published in international and local journals to my credit.

Title: Lorentz Microscopy Methods for Magnetic Domain Structure Study

Dr. L.I.Kveglis*, M.N.Volochaev and U.U Loginov
Professor
Sarsen Amanjolov East Kazakhstan University
L.V. Kirensky Institute of Physics
Russia

Abstract

It is reviews capabilities of transmission electron microscopes for magnetic domain structure (MDS) study of thin films using Lorentz transmission electron microscopy (LTEM) methods. Two methods of magnetic domain structure study (defocus method and aperture shift method, including low-angle electron diffraction (LAED) method) in thin magnetic films were examined. Present transmission electron microscopy (TEM) methods allow solve extensive range of research problems in solid state physics and material science. Around TEM capabilities LTEM occupy a special place. Lorentz microscopy methods allow obtain direct MDS images of thin films magnetic materials. The combination of defocus, LAED and aperture shift methods can provide full information not only about the size and shape of the magnetic domains as well as the local distribution of the magnetization vector direction in the film plane. The features of LAED method can establish the correlation between domain walls and crystal lattice defects.

Biography

Kveglis Liudmila graduated from Tomsk State University in 1967, worked at the Kirensky Institute of Physics, Russian Academy of Sciences, Siberian Branch, Krasnoyarsk 660036, Russia, where in 1980 she defended her Ph.D thesis and in 2005 her doctoral dissertation.

Since 2006 he has been working at the Sarsen Amanjolov East Kazakhstan University and Siberian Federal University as a professor

Title: Reconstruction of Experimental Data and Images Using Shift Methods

Andrey Novikov-Borodin
Institute for Nuclear Research of the Russian Academy of Sciences
Moscow, Russia

Abstract

Methods of mathematical shift for correction, reconstruction and modeling of experimental data of a linear stationary system distorted during measurements are proposed and analyzed. Shift methods are fast and efficient for reconstructing and simulating both continuous and discrete measurement system data for a wide variety of distortion types. The proposed methods make it possible to increase the accuracy, resolution and scope of measuring systems, which is an affordable alternative to hardware methods associated with intractable scientific and technical problems and expensive technological solutions. Examples of reconstruction and simulation of signals and images with different distortion kernels are given, and reconstruction of real experimental data of the neutron time-of-flight spectrometer at the Institute for Nuclear Research of Russian Academy of Sciences is considered.

Biography

Name: Andrey Novikov-Borodin

Birthday: 01.01.1962.

Nationality: Russian

Professional Title: Doctor (PhD), Senior Staff Scientist.

E-mail: novikov.borodin@gmail.com

Research fields: Experimental data processing and image restoration; nuclear, theoretical and mathematical physics
Scientific biography: MSc degree in physics with an Honor diploma (1985) and PhD degree in physics (1989) from the Moscow Engineering Physics Institute (National Research Nuclear University). A Researcher (1988); a Scientific associate (1989); a Leader of beam diagnostic group at the Accelerator Department (1993-2002); a Senior staff scientist (from 2002 up to now) in the Institute for Nuclear Research (INR) of the Russian Academy of Sciences. The Title `Talented young Russian scientist' with the Russian Federation State Grant (1994-1996).
A Scientific Secretary of Accelerator Department (1997-2005); a Scientific Secretary of Medical Physics Laboratory (2005-2014). A Member of Scientific council of INR RAS (2004-2009).
An Invited Researcher in Los-Alamos National Laboratory (LANL, USA) (1994); in Canada's National Laboratory for Particle and Nuclear Physics (TRIUMF, Canada) (1995 and 1997); in Deutsches Elektronen-Synchrotron (DESY, Germany) (2000 – 2001).
Publications: 131 scientific articles and conference papers, 1 patent.

Title: Combined Hyperspectral and Holographic Diagnostics of Volume Defects in Optical Materials

Victor Dyomin, Mikhail Zinoviev, Igor Polovtsev, Valentin Susliaev, and Iomn Alkabakibi*
Head of Laboratory
National Research Tomsk State University
Russia

Abstract

The presence of inclusions (defects) in the optical material with properties other than those of the matrix medium should significantly affect the dispersion of its optical parameters (absorption coefficient and refractive index) in the non-fundamental absorption region.

The inclusions fixed in the lattice contribute to this dispersion because they apparently change the structure of the resonant frequencies. The wings from the resonances of frequency dependencies of the medium optical parameters are reflected in the considered region of non-fundamental (continuum) absorption lying in the far IR and THz regions of the spectrum. These dependencies may be obtained by direct measurements of the studied plane-parallel sample transmission using the known theory of multiple-beam interference of waves formed as a result of the multiple Fresnel reflection from the faces of this sample. At the same time, the exact model of this interference is based on the dispersion expressions for optical parameters in an explicit form.

The resulting dependencies may be used to diagnose inclusions. Thus, it is proposed to describe the dispersion of optical parameters using simple polynomials, which coefficients reflect the dispersion features associated with inclusions. This allows constructing the frequency dependencies of the refractive index and the absorption coefficient in the working area of a material, which coincides with the area of continuum absorption. The determination of the coefficients of interpolation polynomials allows for rapid diagnostics of the optical material, thus establishing the presence or absence of inclusions in the material. The present study considers the implementation of a method for a non-linear single crystal compound $ZnGeP_2$ with a spectral application in the IR-THz range. With this range of use in mind, we call it the hyperspectral method. It allows prompt determination of the presence, origin and features of defects.

To calibrate the method, the use of digital IR holography is proposed to specify the defects and to determine their localization, shape and size.

Biography

Victor Dyomin is a First Vice-Rector at National Research Tomsk State University (TSU) and Head of the Laboratory of Radiophysical and Optical Methods of Environmental Research. He got PhD in optoelectronics from TSU in 1988.

Professor Dyomin is a Senior Member of the Optical Society of America, Regular Member of IEEE, SPIE. He authored 60+ journal papers, 30+ papers in Proceedings (SPIE, IEEE, OSA, etc.), 14 patents and 2 text books, the whole list of works includes more than 180 items. Scientific interests include optics, holography, digital holography, underwater holography of plankton, and methodology of education in optics.

The 10th Annual Congress of Nano Science and Technology-2023 (Nano S&T-2023)

NANO 01:

Nanotech for Applications

Chair

Dr. Kofi Adu, Associate Professor, Penn State University, USA

Time: 14:00-17:15, May 17, 2023 (Wednesday)

Place: Yamato A, 5F, Hyatt Regency Osaka

Title: Nano Science of Metal Oxide and Their Sensor Applications

Dr. Yoshitake Masuda
Research Group Leader
National Institute of Advanced Industrial Science and Technology (AIST)
Japan

Abstract

Metal oxide nanocrystals have been attracted much attention for functional devices. In this study, sophisticated shapes of SnO_2, TiO_2 or ZnO nanocrystals were developed in aqueous solutions for a molecular sensor, a gas sensor, a hydrophilic coating, an anti-reflective coating, etc. Nucleation and crystal growth were controlled to synthesize characteristic nanostructures.
SnO_2 nanosheets were crystallized on transparent conductive substrates in aqueous solutions[1]. They were modified with dye-labeled monoclonal antibody. Monoclonal antibody reacts with human alpha-fetoprotein in blood serum of hepatocellular cancer patient. Photoluminescence and photocurrent were obtained from the nanosheets under excitation light. Photoelectric conversion was an essence in the sensing system. SnO_2 nanosheets with dye-labeled prostate specific antigen will be used for electrodes of prostate cancer sensors.
A sensor has been developed for detecting 1-nonanal gas present in the breath of lung cancer patients by combining SnO_2 nanosheets with SnO_2 nanoparticles and noble metal catalysts[2]. A significant change in the electrical resistance of this sensor was observed with increasing 1-nonanal gas concentration; the resistance decreased by a factor of 1.12 within the range of 1 to 10 ppm at 300 °C. High sensitivity is attributed to the accelerated oxidation of 1-nonanal molecules caused by the (101) crystal faces of the SnO_2 nanosheets and should provide a simple and effective approach to the early detection of lung cancer.
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Biography

Dr. Yoshitake Masuda is a research group leader at the National Institute of Advanced Industrial Science and Technology (AIST). He was an assistant professor at Nagoya University from 2000 to 2006. He received his Doctor of Engineering degree from Nagoya University in 2004. He has published more than 260 papers in reputed journals and serving as an editorial board member of repute.

Title: 3D Textiles for Technical Applications – State of the Art and Future Prospects

Dr. Wilhelm-Alexander Buesgen
Professor
Niederrhein University of Applied Sciences
Germany

Abstract

Fabrics are commonly two-dimensional and processed in subsequent steps (e.g. cutting, sewing, deep drawing, lay-up) to become the final 3D geometry of an application. Seams, distortions and fiber-free interfaces created by the conventional processing steps however are adverse for many technical applications. To increase the performance of textiles especially for technical applications, a large number of new methods, devices and machines have been developed to manufacture textiles directly threedimensional. At the beginning, many methods were manual driven processes without sufficient degree of automatisation. Subsequently, they were not taken over by industry. Meanwhile, development projects for 3D textiles try to take more advantage of standards and of existing well established manufacturing processes. Today, first industrial applications can be noticed, especially in the area of fiber reinforced composite materials. However, there is a large number of potential applications for 3D textiles with very special geometrical and structural requirements. So far recent technology of 3D textiles does not meet all these requirements. At the same time, intense research and development is ongoing to close the gap a little bit more. That will take long time. And it may be possible, that finally application requirements and 3D textile properties will not always match in a perfect way.

Biography

Dr. Wilhelm-Alexander Buesgen, Professor (Ph.D.-mechanical engineering), is a Professor of textile technology at Niederrhein University of Applied Sciences in Moenchengladbach, Germany. He is specialized in technical textiles, 3D textiles, smart textiles, weaving and fabric technologies. After study of mechanical engineering with specialization to textile machine engineering at RWTH Aachen University, he received a doctorate for his development work on new 3D braiding and new 3D weaving processes in 1993. Two years later, he founded Shape 3 GmbH, Wuppertal/Germany to work on further developments for 3D textiles and for the manufacturing technology of 3D textiles. Dr. Wilhlem-Alexander Buesgen has won the award competition of the German textile machinery association VDMA (Walter Reiners Stiftung) in 1994. He received two times the innovation award of the Techtextil fair, Frankfurt (1994, 1995). In 1998 he received a professorship of Niederrhein University of Applied Sciences, Moenchengladbach/Germany, where he is working until today for teaching, learning and research. Furthermore Dr. Wilhelm-Alexander Buesgen worked as an international expert for the European Commission and for the United Nations Industrialization Development Organisation (UNIDO). He is organizing exchange and internship with Universities of China and Bangladesh.

Title: Binderless Carbon Nanotube Flexible Membranes: Architecture, Device and Energy Applications

Dr. Kofi Adu*, Dr. Ramakrishnan Rajagopalan
Professor
The Pennsylvania State University-Altoona College
USA

Abstract

We will present a post synthesis self-assemble protocol that transforms the trillions of CNTs in powder form into densely packed flexible, robust and binder-free macroscopic membranes with hierarchical pore structure. The processing protocol has limited or no impact on the intrinsic properties of the CNTs. The binder-free CNT membranes could be as thin as < 10 m with mass density greater than that of water (1.0g/cc). As the thickness of the CNT membrane is increased, we observed a gradual transition from high flexibility to buckling and brittleness in the flexural properties of the CNT membranes. We correlate the mass of the CNTs to thickness of the CNT membrane. We have demonstrated the use of the CNT membranes as electrode in two-electrode 1M H_2SO_4 aqueous double layer supercapacitor that shows very high power density ~1040 kW/kg based on the mass of both electrodes and time constant of ~ 15 ms with no degradation in performance even after 10,000 cycles) with good energy (~100%), and coulombic (~94%,) efficiencies at 10A/g. Furthermore, we will show the designing of flexible 3-stack bipolar solid-state ultracapacitor and present results on energy/power densities, voltage, cyclability, temperature stability in relation to flexibility and weight. Preliminary results indicate high temperature stability >85^{o}C and CV voltage ~3V with very low leakage current ~ 10nA.

Biography

Dr. Kofi Adu, Professor (Ph.D.- Physics), currently a Professor of Physics, Graduate Faculty in Materials Science and Engineering, Chair of the Physics Department, Member of the American Physical Society, the Materials Research Society, the African Materials Research Society, the American Carbon Society, and the International Association of Advanced Materials. He received his B.Sc. in Physics and Diploma in Education at University of Cape Coast, Physics Doctoral degree (Ph.D.) at Pennsylvania State University.
Dr. Ramakrishnan Rajagopalan, currently an Associate Professor of Engineering – Applied Materials program at Penn State DuBois. He received his M.S. and Ph.D. in Materials Science and Engineering at University of Cincinnati.

Title: Multisensory Nanotech System for Farming Optimisation

Dr. Janez Trontelj*, Žiga Šmelcer msc and Dr. Janez Trontelj ml.
Professor
University of Ljubljana, Faculty of Electrical Engineering
Slovenia

Abstract

In this paper we are proposing a system for monitoring the parameters of the farm soil. A multisensory grid is proposed to provide the data relevant for optimization fertilizing the soil, for watering and for spraying. We have developed an expert system based on an array of different sensors to be able to optimize the farming by characterisation of soil nutrition contests. The most important contents in question are Phosphorus, Potassium and Magnesium. There are no sensors available to characterise soil in terms of quantity of each nutrition in real time, less than 3 seconds, which is required when is it is used on subsoiler providing the missing components on the fly.
This very challenging project can be solved by implementing classifiers based on AI and deep learning, by developing novel sensors and combining different sensors data.
In the paper we present soil impedance spectrometer, optical analysis, optical spectrometry, droplet analysis.
This can be solved only with N&ST approach.
In the paper we are presenting key results of the experiments in the laboratory and in the field at different farms covering all Slovenia.

Biography

Professor Janez Trontelj is a Head of the Laboratory for Microelectronics. He has established collaborations with US and European users and producers of microcircuits, led workshops on IEEE conferences and was invited speaker in several design and development centres worldwide. He teaches and researches in the fields of telecommunication and automotive microcircuits, as well as in the fields of magnetic and terahertz sensors and in variety of sensor microsystems. He co-authored the first scientific book on mixed circuit design “Analog Digital ASIC Design” published by McGraw Hill in 1989. In 1995, the IEEE Educational Activities Dept. published the world-first two-hour video “Mixed Signal Simulation & Block Compilation” prepared by him. He authored or co-authored 26 granted patents, 12 of them being international. The major results of his research work are the development of telecommunication and automotive microcircuits, as well as magnetic and mechanical microsystems, which are being produced in millions yearly. During the last years, he leads the project of terahertz imaging, which brought impressive results. He is a recipient of many national awards for his research achievement. He is a member of the Engineering society of Slovenia and a member of the Slovenian Academy of Engineering.

Title: Triboelectric Energy Harvesting Devices and How Flash Memory Inspired Structures Impact Conversion Efficiency

Pr. Sylvain Blayac, Aravind Ravichandran, Marc Ramuz, and E. Kharbouche
Professor
Ecole des Mines de Saint Etienne, Flexible electronics Department
France

Abstract

The development of the Internet of Things requires the availability of compact and efficient power sources for the supply of autonomous systems. In recent times, electromechanical transduction devices like triboelectric nanogenerators (TENGs) have gained strong attention as they permit simple, robust, and low cost energy harvesting. A key parameter for the efficiency of these devices is the amount of stored triboelectric charges that electrostatically induce electrical current at the device terminals. We developed a composite triboelectric film made of an insulator-metal-insulator structure where metal islands act as charge storage sites. This structure is inspired from floating gates used for flash memory cells: electrons driven by electric field migrate from the surface of the thin triboelectric film to the metal island and are stored in a potential well. The output power has a quadratic dependence on the stored charge, this results in a strong increase of the output electrical power. This multiplies the output by a factor of 150 in comparison to a conventional device. Working mechanisms of this smart structure will be detailed and application to self-powered air quality sensors will be shown.

Biography

Sylvain Blayac was born in 1972. He received the M.S. degree in electronics from the University of Montpellier, Montpellier, France in 1997, and the Ph.D. degree in electronics in 2001. He then joined Alcatel, Paris, France, as a Device Physical and Electrical Modeling Engineer for high-speed fiber-optic communication circuits. He joined the Provence Microelectronics Center Ecole de Mines de Saint-Étienne, Gardanne, France, in 2003, where he became a teacher of semiconductor devices physics and conducted research on embedded stress sensors. His current research interests include flexible sensors and energy harvesting devices. Professor Blayac authored and co-authored more than 50 communications in refereed international journals and conferencesand holds 7 patents.

Title: Green Synthesys of Si and Al Nanoparticles by Pulsed Laser Ablation in Water for Spartium Junceum L. Fibres Modification

Dr. Zorana Kovačević, Dr. Sandra Bischof* and Dr. Nikša Krstulović
Professor
University of Zagreb Faculty of Textile Technology
Croatia

Abstract

Several environmentally friendly methods for nanoparticles (NPs) production were investigated through last decade and laser ablation in liquids (LAL) gains the most interest within scientific society since high power laser ablates the metal plates without surfactant or aggressive chemicals addition. Fire risk control is important in all types of industry, especially in automotive industry where flame retardancy of used materials is desirable property. Cellulose fibres burn easily when exposed to bright flame therefore must be modified if they are used in any kind of technical textiles. It has been already reported that small amounts of silicon-based compounds can improve flame retardancy of cellulose materials. In this paper *Spartium junceum* L. (SJL) fibres were treated with 0.025 % aqueous solution of SiO_2 and Al_2O_3 nanoparticles. Colloidal SiO_2 and Al_2O_3 suspensions were synthesized by pulsed laser ablation of Si and Al target in water medium. Examination of NPs impregnated SJL fibres were performed by using thermogravimetric analysis (TGA), microscale combustion calorimetry (MCC) and scanning electron microscopy (SEM). The heat release rate (HRR) peak is observed to decrease while residual char yield increase in treated samples. The NPs ablated from Si target and incorporated into SJL fibres using microwave energy show less aglomeration compared with those incorporated into fibre using heated contact press.

Biography

Dr. Sandra Bischof, Professor (Ph.D.-technical science), is a Professor of Textile Chemistry at Department of Textile Chemistry & Ecology, University of Zagreb Faculty of Textile Technology and head of Textile Science Research Centre (TSRC). She got her Ph.D. at University of Zagreb. Her research area include: chemical modifications of cellulose fibers (textiles, wood and paper), functionalization of textiles for advanced and protective purposes (Durable Press, flame retardant, antimicrobial, UV, hydro/oleophobic protection), nanotechnology & nanosafety (nanofibers and nanobiocomposites), advanced technologies (plasma, UV, MW treatments). She has received several awards for the scientific excellence from: Croatian Parliament (2020), Annual State Award for 2019 in the category Scientific Achievemnts in the Technical Field; Croatian Ministry of Science, Education and Sports (2009); University of Zagreb (2009) and City of Zagreb (2012). She holds 2 patents and at the IMB Innovation Award, she won 3rd place in the category Research & Development, for the innovation: Modular Microwave Device for thermal Treatments of Flexible Materials, in Cologne, April 2009.

Title: Plasma Etching Techniques for New Nanostructured Fractal Surfaces

Dr. C. Riccardi* and H.E.Roman
Professor
Milano Bicocca University
Italy

Abstract

Plasmas are widely used to modify surface properties of materials without changing the bulk ones. Surface Plasma modification permits to change the intended use of a material or to improve its functionalities by introducing new chemical and physical properties to their surfaces. With the advancement of engineering and science into the micro/nano-scale, the precise control of the chemical and morphological properties of the treated surfaces is becoming increasingly important both in basic scientific research as well as in engineering applications [1,2]. We discuss plasma etching processes of polymer-based material surfaces with the aim of obtaining super-hydrophilic nanostructured thin films amenable to be used in a variety of industrial applications. A cold oxygen plasma is used as an ablation agent to etch the polymeric surfaces, characterized by low electrical and thermal conductivity.[3] We consider synthetic polymeric surfaces and study their structural properties before and after the treatment, the latter based on the use of a radiofrequency reactor. In this reactor, samples are exposed to the oxygen plasma in which the radiofrequency power, pressure and the flow of oxygen gas are kept constant, but the exposure times (treatment duration) are varied over a period of (1-30) min. We study the morphological characteristics of the treated surfaces as a function of the plasma parameters using an atomic force microscope (AFM), and the sample wettability in air and its oleophobic properties in water using contact angle and roll-off measurements, respectively.

Biography

Claudia Riccardi, Ph.D. in Physics at the University of Milano (Italy). Her scientific interests in the field of plasma physics are also oriented towards applications to materials and nano materials in sectors such as energy, environment, and manufacturing. CR was involved in the development of plasma sources, diagnostics and processing, which expanded the understanding of plasma-material interaction and plasma applications. She is director of the Plasma Prometeo Center dedicated to the research and development of plasma applications and to the technological transfer to industry.

NANO 02:

New Nanomaterials (I)

Chair

Dr. Jean-Louis Bobet, Professor, Université de Bordeaux, France

Co-chair

Dr. Rachel Desfeux, Professor, University of Artois, France

Time: 14:00-16:25, May 17, 2023 (Wednesday)

Place: Yamato B, 5F, Hyatt Regency Osaka

Title: Microstructure, Macro- and Nanoscale Piezoelectric Properties in $Ba_{0.85}Ca_{0.15}Ti_{0.9}Zr_{0.1}O_3$ (BCTZ) Thin Films Grown by Pulsed Laser Deposition on Various Substrates for Energy Harvesting

Dr. M.-H. Chambrier, Mr. M. Azankoud, Mr. R. Valois, Dr. M. Lheureux, Mr. D. Ledru, Dr. A. Da Costa, Dr. A. Ferri, Dr. F. Ponchel, Dr. D. Rémiens, Mrs I. Hamdi Alaoui, Dr. F. Le Marrec, Dr. N. Lemée, and Dr. R. Desfeux*

Professor
University of Artois
France

Abstract

In the frame of a project entitled "Optimization of Piezoelectric Properties in eco-responsible functional oxides for ENergy harvesting (OPPEN)" and supported by the *Hauts-de-France* Region (France), lead-free $Ba_{0.85}Ca_{0.15}Ti_{0.9}Zr_{0.1}O_3$ (BCTZ) thin films have been successfully grown by pulsed laser deposition (PLD) on various substrates including Si and Si/SiO_2 wafers as well as (001)-oriented $SrTiO_3$ and $LaAlO_3$ single-crystals covered by a conductive $LaNiO_3$ (LNO), $SrRuO_3$ or $La_{0.5}Sr_{0.5}CoO_3$ oxide bottom electrode or a metallic Ti/Pt electrode. From the 2θ-ω X-Ray measurements and depending on the "substrate-bottom electrode" combination, polycrystalline, preferentially-oriented or highly-oriented BCTZ films are grown. In the case of the highly-oriented films, epitaxial growth is revealed through *phi-scan* measurements while the out-of-plane relationship $[001]_{BCTZ}//[001]_{substrate}$ is evidenced by reciprocal space map recording. Using the spectroscopic tool of atomic force microscopy which permits to record piezoelectric hysteresis loops on nanoscale, results confirm the existence of piezoelectricity and ferroelectricity in the complete series of our BCTZ films. However, the electromechanical properties of the BCTZ films are shown to significantly depend on the "substrate-bottom electrode" combination. On the macroscale, a d_{33} piezoelectric coefficient of 38 pm/V is measured for a sample BCTZ/LNO/Si. We conclude that the piezoelectric BCTZ material grown in thin film is a very attractive lead-free candidate for applications in energy harvesting.

Biography

Rachel Desfeux received his PhD Degree from the University of Caen, France, in 1994 in the field of Materials Science. As a Post-Doctoral position, He spent one year (1994-1995) in the Solid State Physics Laboratory of the University "Tor Vergata" of Rome, Italy, working on the Synthesis of Novel Superconductors in Thin Films. In 1996, He was promoted Associate Professor at the University of Artois. He conducts his research works within the Unit of Catalyst and Solid State Chemistry (UCCS). In 2003, He defended his Accreditation to Supervise Research. Then, in 2008, He was promoted Full Professor. From 2007 to 2020, He was the Head of the "Thin Films and Nanomaterials" team in the UCCS lab. His research activities cover the field of growth, characterization of microstructure and surface morphology as well as measurement of physical properties of thin films with specific properties (piezoelectric, ferroelectric, ferromagnetic, optical…) keeping in mind their integration in (nano-)devices. His work specially involves nanoscale investigations using various techniques of atomic force microscopy and associated spectroscopic tools (AFM, PFM, c-AFM, piezoloops…). He is working on lead-free oxide piezo/ferroelectric thin films for energy harvesting.

Title: New Magnesium Rich Alloys: Structure, Magnetic and H Sorption Properties. Possible Application to "Light Mobility"

Dr. J-L. BOBET
Professor
Université de Bordeaux
France

Abstract

The presentation will be divided into mainly 2 parts : The first one will deal with the search of new ternary (RE-T-Mg; RE = Rare earth, T = Transition metal) magnesium rich intermetallic candidates for hydrogen storage. Four new compounds have been discovered up to now: $LaCuMg_8$, $Gd_{13}Ni_9Mg_{78}$, $NdNiMg_5$ and $NdNiMg_{15}$. $LaCuMg_8$ crystallizes in the La_2Mg_{17} structure type, the Mg atoms form hexagonal tubes along the c-axis filled by La and Mg. For $Gd_{13}Ni_9Mg_{78}$ the structure was partially deduced using TEM and a modulation along both **a*** and **b*** axis was observed. $NdNiMg_5$ crystallizes within a new structural type with a close-packed array of Mg-atoms. $NdNiMg_{15}$ crystallizes with a new ternary ordered variant of the $V_{15}Sb_{18}$ structural type. To our knowledge, among the ordered Mg-rich phases, this new compound is the richest one. In the 3D network of Mg-atoms the Ni and Nd atoms form linear chains. The preliminary studies of its magnetic properties will be presented.
The second part will be focused on the H sorption properties. All the compounds presented in the first part decomposed under hydrogen. Nevertheless, in some case, the kinetics are better than those of ball milled magnesium which is rather unexpected. Some other properties such as mechanical ones will also be shortly discussed.
Some perspectives about generation of hydrogen from hydrides by the hydrolysis method will be shown. Hydrogen generated from Mg-H hydrolysis reaction was connected directly to a single polymer electrolyte membrane fuel cell (PEMFC). At 0.15 A, the cell voltage exhibited a stable value of approximately 0.52 V for roughly 35 min. Such process can be used for the light mobility (electrical assisted bike).

Biography

JL BOBET has completed his PhD at the age of 25 years from University of Bordeaux France in the field of materials science. After a post doctoral position in Japan, he became Associate Professor in France and became full professor at the age of 37. He was the head of the chemistry departement from 2014 to 2019. He has published more than 170 papers in reputed journals and is the co-inventor of 4 patents. He has been invited researcher at Université du Québec à Trois Rivières (Canada) and Universitad Federal do ABC (Brazil). He established collaborations with Japan, Canada, Brazil, Argentina, USA, Romania, Bulgaria, Russia and Lebanon. His main research activity is on Hydrogen storage in metal hydrides (from the last 25 years) and production by hydrolysis of magnesium (from the last 7 years). He study the relationship between crystal structure and properties.

Title: Atomic Layer Deposition for Nanocomposite Electrodes for Supercapacitors

Professor Daniel Tan* and Dr. Dayakar Gandla
Deputy Head
Department of Materials Science and Engineering,
Guangdong Provincial Laboratory of Materials and Technologies for Energy Conversion,
Guangdong Technion - Israel Institute of Technology
Shantou, Guangdong, China

Abstract

Atomic layer deposition (ALD) has proven its advantage in attaining better conformal surface coating and minimizing the ion diffusion and charge transport path, which results in an optimized energy and power density, good cyclic stability, and rate capability. This work uses some selected examples to summarize the recent advances in ALD toward fabrication and surface modification of advanced hybrid nanocomposite electrodes for supercapacitors. It demonstrates the key role of ALD parameters in influencing the electrochemical performance of hybrid nanocomposites. In addition, the authors point out the current challenges and the strategies for ALD's future utilization to achieve desired high voltage and cycling performance. Manipulating the parameters of ALD and deposited materials may lead to the design of activated carbon-based next-generation supercapacitors.

Biography

Dr. Daniel Tan earned his Ph.D. in Solid State Physics from the Chinese Academy of Science in 1989 and his Ph.D. in Materials Science and Engineering from the University of Illinois at Urban-Champaign in 1998. After working on metallic alloys at the University of Science and Technology of China as an associate professor, he turned his interest in electrical ceramics, polymer-based nanocomposites, and energy storage, working for Honeywell, CTS Corporation, GE Global Research, and W.L. Gore in the USA as a senior scientist. In late 2018, he joined Guangdong Technion Israel Institute of Technology as an associate professor and deputy department head. He has gained first-class experience in academic research, project leadership, and management in industrial research centers and universities. He has published 89 peer-reviewed papers, 5 book chapters, 2 university textbooks, received 55 innovation patents, and delivered multiple invited talks worldwide. He has won many awards, such as first place in the Natural Science Award of the Chinese Academy of Sciences and the General Electric Innovation Award.

Title: Enhanced Organic Optoelectronic Devices by Interfacial Engineering

Dr. Soyeon Kim*
Senior Researcher
Korea Institute of Materials Science
Republic of Korea

Abstract

The usage of solution-processed organic optoelectronic devices has demonstrated great potential as low-cost organic photovoltaics (OPVs) for energy harvesting and as a source of lighting in organic light-emitting diodes (OLEDs). Despite their potential, there are still numerous materials issues that must be addressed to improve the performance and stability of these devices, particularly for flexible devices. One of the primary challenges in solution-processed organic devices is the differing junction characteristics between the hydrophobic and hydrophilic natures of each layer.

In this presentation, we will focus on two specific areas of research aimed at improving solution-processed organic optoelectronic devices. The first area of focus will be the development of a mechanically durable flexible transparent electrode that is both cost-effective and efficient. The second area of research will involve interfacial contact engineering between materials with differing chemical and physical properties in multi-layered devices. Both of these areas of research are critical for improving the performance and stability of solution-processed organic optoelectronic devices.

Biography

Dr. Soyeon Kim received her Ph.D. degree in chemical & biomolecules engineering from Yonsei University, Korea in 2017. She is a senior researcher of energy & electronic materials center at the Korea Institute of Materials Science (KIMS), Korea. Her main research interests are in organic materials including synthesis and applications for energy & electronic devices.

Title: The Role of Nano-scsle Elastic Heterogeneity in Mechanical Tribological Behavior of a Cu-Zr Metallic Glass thin Film During

Dr. Qing Wang,
Professor
Shanghai University
China

NANO 03:

New Nanomaterials (II)

Chair

Dr. Laleh Alisaraie, Associate Professor, Memorial University of Newfoundland, Canada

Time: 09:00-12:40, May 18, 2023 (Thursday)

Place: Yamato A, 5F, Hyatt Regency Osaka

Title: Combined Plane Wave and Localized Basis Sets (CPLB) Approach: A Study of H/D Adsorption on Metal Surface

Dr. Takayoshi Ishimoto
Professor
Hiroshima University
Japan

Abstract

The behavior of atoms and molecules on and in various materials has attracted attention in various fields, including materials science, material physics, and catalytic chemistry. In particular, the interaction between hydrogen (H) and transition metals is a crucial factor in chemical and physical processes. The nuclear quantum effect of proton is sometimes important to determine the chemical and physical properties in nanoparticles. However, in the conventional first-principles calculations based on the Born-Oppenheimer approximation, it is difficult to consider the nuclear quantum effect of proton directly on or in the metals. To overcome this problem, we developed the combined plane wave and localized basis set (CPLB) method. In the presentation, details of theoretical background and application are explained.

Biography

He received his Ph. D. in computational chemistry from Rikkyo University in 2004. His research topic was hydrogen bonding with nuclear quantum effect of proton/deuteron by developing original method. He joined a member of Grid Research Center and Research Institute of Computer Science in National Institute of Advanced Industrial Science and Technology (AIST) in Tsukuba, to extend his method for large scale calculation. After AIST he moved to Kyushu University as Assistant Professor of INAMORI Frontier Research Center in 2009. His research topic in Kyushu University was mainly application and development for materials science from atomistic point of view by using molecular simulations. Since 2016, he had been an Associate Professor at Graduate School of Engineering, Hiroshima University. In Hiroshima University, he started collaboration with companies by using molecular simulations to understand and develop new materials based on model-based research (MBR). Now he is an Associate Professor at Graduate School of Nanobioscience, Yokohama City University. From October 2020, he became a Professor at Graduate School of Advanced Science and Engineering, Hiroshima University. Recent his main interest is development of new methodology for large scale and high accurate electronic structure calculation approach. Some applications are electronic structure and catalytic activity of metal nanoparticles, H/D quantum effects in materials, and materials design based on model-based research.

Title: Inorganic Nanoparticles for Tuberculous Meningitis Treatment

Dr. Alessandra Pinna*, Ieva Ragaisyte, William Morton, Maddalena Cerrone, Dr. Alize' Proust, Rocco D'Antuono, Dr. Katalin Wilkinson, Prof. Robert J. Wilkinson, and Prof. Alexandra E. Porter.
Independent Fellow (ICRF)
Imperial College London
United Kingdom

Abstract

Tuberculous Meningitis (TBM) is the most severe form of tuberculosis infection, arising from mycobacterium tuberculosis (*M.tb)* release into the brain, which triggers an inflammatory cascade. Worldwide around 100K individuals develop TBM each year, of which 60% HIV-infected adults and 20% of children will die. TBM treatment is currently based on the treatment of pulmonary tuberculosis with combinations of antibiotics including rifampicin (RIF). Therapy using these drugs has poor outcomes because suboptimal drug levels reach the brain due to poor blood brain barrier (BBB) penetration. There is an urgent clinical need for alternative vehicles to deliver antibiotics and anti-inflammatory drugs inside the brain to treat TBM locally.
Here, mesoporous silica nanostars (MSNSs) have been proposed as biodegradable carrier of RIF antibiotic and cerium oxide nanoparticles (nanoceria)antiinflamamtory, for their high drug-loading ability, biocompatibility and high BBB penetration. MSNSs were synthesized using a sol gel single-micelle epitaxial growth approach using CTAB as mesoporous template, NaOH as catalyst and TEOS as silica source. RIF and nanoceria were encapsulated into MSNSs using a passive diffusion method. The physicochemical properties were characterised by XRD, TEM, Nitrogen sorption, ICP and DLS. The toxicity and immunogenicity of MSNSs were evaluated in PBMC, astrocyte, pericyte and microglia cells by MTS and Luminex assays. An *in vitro* BBB model was used to assess the efficacy of MSNSs BBB crossing. The present work shows RIF and nanoceria were successfully incorporated into MSNSs with size of 80±10 The 1 µg/ml of MSNSs was set do not induce cellular toxicity. Furthermore, MSNSs showed to better crossed the BBB respect to the spherical NPs. Preliminary results pave the way to a new therapy for TBM.

Biography

Alessandra Pinna is an independent Imperial College research fellow (ICRF) and visiting scientist in Wilkinson's lab at Francis Crick Institute since 2019. Her long-term research interests involve the development of nanostructured ceramic and hybrid organic-inorganic films, nanoparticles, and nanocomposites via a sol-gel method for biomedical applications with particular interest in drug delivery and antimicrobial- antioxidant system. Her academic training and research experience have provided her with an excellent background in multiple disciplines including chemistry, biology, and materials science. She has been working in a research lab for more than 15 years. During this time, she was also part of exchange projects at the University Hospital of Zurich, working on neurodegeneration in Bovine Spongiform Encephalopathy, and at CSIRO in Melbourne developing skills working on composite materials based on Metal Organic Frameworks and cerium oxide.

Title: Development of Sustainable Supercapacitor for Superb Electrochemical Performance

Dr. Anil Kumar
Professor (Emeritus Fellow and G.B. Pant Institute Chair)
Indian Institute of Technology Roorkee
India

Abstract

An increasing domination of nanomaterials for the technological growth has necessitated the development of environmentally benign sustainable nanomaterials and energy storage device(s) to meet out the increasing worldwide energy requirements and fabrication of efficient devices. In this reference, we are working on a number of projects related to the design of greener nanostructures of carbon; semiconductors and their nanohybrids/nanocomposites with plasmonic material. An aqueous electrolyte(s)-based supercapacitor with wide potential window and high energy density is considered to be important as the next-generation energy storage device. The present work reports the synthesis of heteroatom(s)-functionalized reduced graphene oxide nanosheets employing environmentally benign biomolecule(s) as reductant under physiological conditions of pH/mild heating. Aqueous symmetric supercapacitor fabricated by as-synthesized material in optimized water-in-salt" electrolyte(s) (WIS) demonstrated superb electrochemical performance with relatively higher energy density@power density. A mechanism of the occurring processes and recent developments in this area will be discussed.

Biography

Dr. Anil Kumar completed his doctorate in 1977 from Univ. of Roorkee, Roorkee, India. He held the position of Research Associate in the Radiation Laboratory, University of Notre Dame, Indiana, USA from 1979 to 1982, where he investigated the formation/redox chemistry of higher-valent silver species. In 1983, Dr. Kumar joined the University of Roorkee as Lecturer and initiated work on the photochemistry of some inorganic nanosystems. In 1986, he was offered the Guest Scientist position at Hahn-Meitner-Institut, Germany, where he collaborated with Prof. Henglein on radiation chemical aspects of nanomaterials till 1988. Subsequently, he initiated work on photochemistry of metal/semiconductor nanosystems in India through project(s) funded by DST, New Delhi. From his early research work, he received the Khosla Research Award and a Silver Medal in 1993−94. In 2001, he was promoted to the post of Professor at Indian Institute of Technology Roorkee (IITR). He won the First Khosla Research Prize and a Medal in 2002−03. His research contributions were recognized by The National Academy of Sciences, Allahabad, India and was elected as a Fellow of this prestigious Academy in 2003. He initiated a M.Tech. program in nanotechnology at IITR in 2008. He was selected as G.B. Pant Institute Chair Professor at IITR in 2018 and received the prestigious Academy Award - NASI Senior Scientist Platinum Jubilee Fellowship (2019). He is presently working as Professor Emeritus at Netaji Subhash University of Technology, New Delhi.

Title: Nanoparticles and Cytoskeletal Proteins

Dr. Laleh Alisaraie*, Karina Barcelos, Rachel Boyce
Associate Professor
Memorial University of Newfoundland
St. John's, Canada

Abstract

Biocompatible functionalized nanoparticles have exhibited enhanced cellar uptake and reduced cytotoxicity compared to their non-functionalized structures. In this presentation, the physical properties of nanoparticles and their surface coating, which could affect the cellular life cycle, will be discussed. In addition, a feasible approach will be presented for adjusting the structural properties of specific nanoparticles to improve their compatibility with the biological environment when implemented in nanomedicine.

Biography

Dr. Laleh Alisaraie is an Associate Professor at the School of Pharmacy, Memorial University of Newfoundland, in St. John's, Canada.

Title: A Functional Carbon Dots Induce Ferroptosis by Suppressing PLPP4 Activity to Inhibit Glioblastoma Growth

Dr. Minghua Wu*, Dr. Yang Wang, Dr. Kun Deng, and Dr. Lianglin Zhang
Professor
Xiangya Hospital
Central South University
China

Abstract

Glioblastoma is a fatal primary brain cancer lacking effective therapeutic drugs. The presence of the blood-brain barrier (BBB) severely hinders the delivery of drugs to the brain. In recent years, nanoparticles, especially carbon dots (CDs), are promising drug delivery strategy for CNS diseases. Here, we synthesized a novel carbon dots （MGA-CDs） for glioblastoma treatment by hydrothermal method using metformin and gallic acid as precursor. MGA-CDs shows dominant BBB permeability and sensitive anti-tumor activity. In addition, MGA-CDs exhibits significant capability of targeting tumor cells mitochondria without the aid of anyextra targeting molecules, resulting in the shrunken of mitochondria and reduced numbers of mitochondrial cristae. Transcriptome profiling suggested that MGA-CDs disturbs the glycerophospholipid metabolism pathway by inhibiting the expression of PLPP4， thereby inducing ferroptosis. The efficient therapeutic potency of MGA-CDs is further confirmed in human-derived orthotopic glioblastoma mice model. MGA-CDs significantly inhibited the growth of intracranial tumors and prolonged the survival of tumor-bearing mice. This work presents a viable strategy that development of CDs-based novel therapeutic agent for glioblastoma.

Biography

Dr. Minghua Wu, Professor (Ph.D.-medicine), now is a Professor of biomedicine, head of the Department of Strategic Development & Discipline Construction of Central South University, who gets New Century Excellent Talents Support Program of Ministry of Education, Vice President of Hunan Pathophysiology Society of China, Vice President of Brain and Brain Health Committee in Hunan Health Service Industry, the member of China Anti-cancer Association, Executive Director of International Organization Talent Training Working Committee of China Education Development Strategy Association. She got his B.M. in Coal Medical College of North China in 1995, M.D. in Hengyang Medical School in 2003, PhD. in Central South University in 2005. And Dr. Minghua Wu got the Hunan Provincial Natural Science Award. Currently Dr. Minghua Wu' researches focus on the molecular biological mechanism and therapy targets for glioma.

Title: Structure Design and Properties of Fluorinated Benzodifuranone Based Organic Conjugated Nanomaterials

Xin Shi, Zhifeng Deng, Haichang Zhang, Weiwei Bao, and Taotao Ai*
Postgraduate
Shaanxi University of Technology
China

Abstract

In the era of information explosion, the semiconductor industry plays a crucial role. In the whole development process, the most core key technology is the semiconductor material. As the electronic materials used in the manufacturing process of semiconductor devices and integrated circuits, semiconductor materials form the foundation of the development of the entire semiconductor industry. Therein, the development of n-type organic semiconductor materials lag behind seriously, and the material types and device properties are much lower than p-type organic semiconductor materials, which seriously affect the development of organic semiconductor. In this paper, benzodifuranedione (BDF), which had stable electrochemical characteristics and low intrinsic conductivity, was designed and modified by fluorination with intramolecular non-covalent bond interaction, and finally used in the construction of organic field-effect transistor. We mainly completed fluorination regulation on the molecular end group or the central nuclear site of the BDF structural unit, and obtained a series of small molecules finally. In order to confirm the rationality of the designed molecules and provide a better research basis for the subsequent research, the designed molecules were theoretically simulated by density functional theory. Small molecules with desired molecular LUMO energy level were selected for synthesis. Based on the comprehensive analysis of various test results, the internal relationship between the properties of fluorinated materials with different numbers and/or positions were discussed, so as to study the mechanism of fluorination regulation more systematically and more in-depth. The results show that fluorination regulation can not only improve the hole mobility of BDF-based materials, but also convert p-type organic semiconductor materials into n-type organic semiconductor materials, and the effect of end-group fluorination is stronger than that of central nuclear fluorination. The hole mobility of p-type OFET prepared by BDF is 7.67×10^{-4} $cm^2\ V^{-1}\ s^{-1}$, and the highest electron mobility of n-type field-effect transistors prepared by fluorinated BDF-based small molecules is 2.69×10^{-3} $cm^2\ V^{-1}\ s^{-1}$. It is proved that BDF based molecules are expected to become the parent structural unit of new high performance n-type organic semiconductor materials.

Biography

Xin Shi, born in October 1998, Master student of Materials Science, School of Materials Science, Shaanxi University of Technology.Mainly engaged in the preparation and properties of photoelectric functional materials. Currently, she has carried out research on nanosized field effect transistors and published two SCI articles in Frontiers in Chemistry. Participated in the publication of one national invention patent.

Title: Nanostructure Fabrication and Modification on Semiconductor Materials by Focused Ion Beam

Dr. Linjun Wang
Senior Engineer
University of Science and Technology of China
China

Abstract

Focused ion beam (FIB) systems use a finely focused beam of ions (typically gallium ions) that, when operated at high beam currents, can be used to locally sputter or mill a sample surface that is exposed to the ion beam. In FIB milling, typically a gallium (Ga) primary ion beam hits the sample surface and sputters away a small amount of material, which leaves the surface as either secondary ions or neutral atoms. At high primary currents, material can thus be efficiently removed from the sample surface, allowing precision milling of the sample with achievable feature sizes of well below 1 µm. The material removal rate by sputtering, also called the sputtering yield, is dependent on the substrate material and on many other processing parameters, including the ion energy, the angle of incidence of the ion beam, and the milling conditions. At the same time, the sample can be imaged with very high precision during the milling process. As a result, FIB milling has become a popular tool for machining high-quality 3D micro-devices and high-precision microstructures made of high-performance bulk materials.

Biography

Dr. Linjun Wang now is a senior engineer at University of Science and Technology of China (USTC). He got his BS (2005) and PhD (2011) in physics from University of Science and Technology of China. Currently Dr. Linjun Wang' researches focus on nanostructure processing, high-precision microstructures, ion implantation and surface modification based on focused ion beam technology.

Title: Development of Multifunctional Au-Fe_3O_4 Nanoparticles for Cancer Therapy

Dr. Loi Tonthat*
Assistant Professor
Tohoku University
Japn

Abstract

In the last decade, magnetic nanoparticles have been widely studied for biomedical applications, particularly for cancer treatment by magnetic hyperthermia and targeted drug delivery. Magnetic hyperthermia has been gaining great interest as one of the most promising emerging therapies for cancer treatment. This therapy utilizes the heat generated by magnetic nanoparticles when subjected to an alternating magnetic field to induce cancer cell death within the therapeutic temperature range of 45°C without affecting the healthy ones. In previous studies, we succeeded in developing thermosensitive magnetic micro/nanoparticles with high heating efficiency for tumor treatment and considerable permeability change around therapeutic temperature for temperature and position monitoring of magnetic particles. Thereafter, we also developed methods for wirelessly monitoring the temperature of magnetic particles as well as localizing their position in the treated area using simple pickup coils. Recently, we developed a simple and high-accuracy PID-based therapeutic temperature control system with a very small overshoot, and are evaluating the effectiveness of the developed system in cancer-bearing mice. More recently, we succeeded in developing gold-coated magnetite nanoparticles as theranostic agents for computed tomography imaging and magnetic hyperthermia application with their average sizes of Fe_3O_4@Au NPs were 6.1 nm, which are effectively removed by the kidneys. The heating efficiency of Fe_3O_4@Au NPs in water was sufficient to treat the tumor at 43–45ºC, and their high CT value of 851 HU was obtained, which showed great promise as a potential theranostic agent for magnetic hyperthermia and CT imaging applications.

Biography

Loi Ton That, Ph.D. is now an Assistant Professor at Department of Electrical Engineering, Tohoku University, Japan after receiving his Ph.D. from Akita University, Japan in 2019. His research is focused on synthesis of functionalized magnetic particles and their bio-applications, especially in the research and development of magnetic hyperthermia system for clinically-used cancer treatment.

NANO 04:

Nanomedicine and Nanobiotechnology

Chair

Dr. Christelle Monville, Professor, Evry's University, France

Time: 09:00-11:10, May 18, 2023 (Thursday)

Place: Yamato B, 5F, Hyatt Regency Osaka

Title: Optimization of Liposome Manufacturing for Improved Sterilizing Filtration in Drug Manufacturing

Aude Iwaniec*, Dr. Kalliopi Zourna, Dr. Nigel B. Jackson, Dr. John H. Welsh, and Kyle Jones
R&D Team Leader
Pall Corporation
United Kingdom

Abstract

Liposomes are increasingly being used as drug delivery systems for a variety of therapeutics, including mRNA-based vaccines. These liposomal formulations must be aseptically prepared prior to administration, for which the preferred approach is sterilizing-grade filtration. However, the physicochemical properties of these solutions can be challenging, with a higher reported likelihood of premature filter blockage and bacterial penetration compared to other parenteral drug types. It is therefore important to gain a greater understanding of the sterilizing filtration of liposomes so that appropriate decisions are made concerning the selection and validation of sterilizing-grade filters for these applications.

In this presentation, we will discuss ways of optimizing the manufacturing process of a liposome formulation, both in terms of the filtration process (pre-filtration and differential pressure) and the formulation characteristics (size and size distribution), for an optimized sterilizing-grade filtration. More specifically, we will show that (a) the volumetric throughput (L/m^2) can be increased by more than 40-fold by decreasing the size of the liposome by 30%; (b) the volumetric throughput can be improved by more than 18-fold when increasing the differential pressure by 400%, and (c) higher liposome transmission can be achieved when using higher differential pressure.

Biography

Aude Iwaniec is an R&D Team Leader in the R&D Downstream Bioprocessing group at Pall Corporation. Aude obtained a B.Sc. in chemistry and chemical engineering, and an M.Sc. in chemical engineering and biotechnology at the Swiss Federal Institute of Technology (EPFL, Lausanne). Aude joined Pall in 2016 as a research engineer in downstream processing and has since specialized in the different filtration technologies for the biotech market, including monoclonal antibodies and liposomes.

Title: Cell-based Therapy Using Pluripotent Stem Cells for Retinitis Pigmentosa

Dr. Christelle Monville
Professor
Evry's University
France

Abstract

In developed countries, retinal degenerative diseases affecting Retinal Pigmented Epithelium (RPE), including Age-related Macular Dystrophy and inherited retinal diseases such as Retinitis Pigmentosa (RP), are the predominant causes of human blindness worldwide. Despite the scientific advances achieved in the last years, there is no cure for such diseases. In this context, we have developed a cell therapy medicinal product based on our expertise in tissue engineering and in the manipulation of pluripotent stem cells. This novel tissue engineered product (TEP) consists in RPE cells derived from clinical grade human embryonic stem cells disposed on a biocompatible substrate allowing the formation of a 3D functional sheet, suitable for transplantation. After functional validation in a rodent model of RP (Ben M'Barek et al., 2017), our purpose was to test the safety of the surgery and local tolerance in non-human primates (NHP).
A specific device was developed in order to (i) embed the TEP in gelatin, (ii) allow its transport in a specific medium and (iii) cut the transplant at the right format. Non-human primates (NHP, n=6) were transplanted in one eye (right eye) with the TEP in the macular region. Left eye was left untreated. Retinal integrity and functionality were assessed at different time points (week 1, 2, 4, 6 and 7) through Eye fundus, Optical-coherence tomography (OCT) and electroretinography (ERG). Inflammation was also assessed using slit lamp. At the end of the experimental period, histological analysis was performed to evaluate the correct location and integration of the TEP within the host retina.
We successfully developed a device allowing us to prepare and implant the TEP in the subretinal space of six NHP. We showed that ERG responses were not modified by the surgery and that it did not cause any long lasting inflammation. Moreover, transplanted cells were integrated in the retina and were able to phagocyte photoreceptor debris.
We have shown in NHP that our surgical method of implantation was safe and did not provoke any local inflammation or retinal deterioration. Morphologic and histologic studies indicated that RPE cells were integrated into the host retina and were able to interact with photoreceptors (Ben M'Barek et al., 2020). These results allowed us the start of clinical trial in sept 2019 (NCT NCT03963154) with 7 patients treated up to now.

Biography

Christelle Monville obtained a PhD in Neurobiology at the French University of Créteil in 2000. She is currently professor at Evry's University and team leader at the Istem lab (France). Since ten years, the objectives of her group (Istem, www.istem.eu) are (1) to develop pre-clinical studies required for the development of human pluripotent stem cells cellular therapy for the treatment of a number of monogenic retinal diseases and (2) disease modeling and drug discovery using patient-specific human induced Pluripotent Stem (hiPS). Replacement of defective retinal pigment epithelium (RPE) by new RPE cells derived from human embryonic stem cells (hESC) provides a novel rational approach for treating forms of blindness that affect the RPE. First attempts in clinical trials demonstrated safety for the delivery of such cells as a suspension. Transplanting a functional monolayer of RPE cells is the next challenge to effectively cure patients. We successfully developed, under clinically compatible conditions, a tissue-engineered product (TEP) consisting of RPE cells derived from hESCs disposed on a biocompatible substrate: the human amniotic membrane. The future will be to provide more complex tissue and upscale the production of retinal cells.

Title: Unique Intradermal (skin) Interface Platform that Can: Improve Vaccines (Immunity, Durability, Safety, Dose Sparing X5) and Enable Novel Higher-Performance, Painless Aesthetic Delivery

Dr. Shuki Yeshurun and Yotam Levin
Founder
Nanopass technologies
Israel

Abstract

NanoPass developed MicronJet™, the world's first micro-system injection platform for intradermal (ID) injection of vaccines, large molecules and aesthetic injectables. This platform is produced from Silicon single crystal using proprietary MEMS technologies, which provides a robust, scalable and highly precise production capability.
MicronJet™ has been commercialized in over 30 countries, primarily for vaccines (Monkeypox, BCG and PPD) and aesthetics (Botox® and mesotherapy).
MicronJet™ enables the painless, shallow and consistent delivery of vaccines into the skin, thereby harnessing the skin's potent immune properties, to produce strong immune responses. The Company has demonstrated clinical safety and efficacy in over sixty (60) clinical trials including COVID-19, seasonal and pandemic flu, HBV, zoster and polio vaccines. In most of these studies, we have demonstrated that using one fifth of the dose produces an equivalent immune response to full dose delivered intramuscularly or into the fat (see list of clinical studies on www.nanopass.com/clinical and https://www.nanopass.com/publications/).
Additional benefits were demonstrated in non-vaccine clinical trials using insulin for diabetics and lidocaine for local anesthesia. In our insulin study, we were able to demonstrate faster insulin absorption compared with conventional SQ delivery. In our Lidocaine study we have demonstrated the ability to anesthetize the skin in one minute, using a painless injection procedure. The Company secured an FDA 510k for its product, as well as other regulatory approvals in leading territories including the EU, China and Brazil.
The Company intends to register in Japan based on concrete interest from both the aesthetic medicine community and several vaccine opportunities including COVID and Flu.
NanoPass is looking to develop additional second-generation devices, based on its platform. Since the devices are made of Silicon, additional systems could be integrated onto the device using MEMS technology.

Biography

Dr. Shuki Yeshurun was a senior scientists and R&D group leader in several companies. He served as the CTO and CSO in several organizations, including ICL, Plasan Sasa and Shizim medical group.
He founded multiple companies including, NanoPass technologies, Tortech Nano Fibers, recently Terra Biomatrix and Rekamote. He is currently serving as the CEO of Q-Flo (Cambridge).
Shuki is a Doctor of Science (D.Sc.) awarded from the Technion (Israel institute of technology) supervised by Prof. David Brandon and Prof. Dan Shachtman (Nobel Prize Laurent 2011**).**
His Post Doc. Was at Brown university in RI (US) supervised by Prof. Subra Suresh former NSF and NTU president
Shuki has been a lecturer at the department of materials science in the area of micro and nano systems and is a member of CSST Technion committee
He has received several international awards including: US American Ceramic Society (ACS) - "Ross Purdy" award, Paris Capital IT - "Best of the best award for innovation", Israel Ministry of commerce award for the - "best innovative start-up company", Israel Chief of Science award for - "the best Nano technology company of the year"

Title: Hybrid Cyanine/Methotrexate Nanoparticles for Synergistic PDT/Chemotherapy

Dr. Anyanee Kamkaew* and Prapassara Muangsopa
Associate Professor
Suranaree University of Technology
Thailand

Abstract

Typically, a nanocarrier was used to load cargo for particular purposes when preparing nanomedicine. In this study, a simple self-assembly of a dye and a chemotherapeutic agent was used to create a carrier-free nanosystem for imaging and photodynamic (PDT)/chemo combination therapy. The resulting nanoparticles (I_2-IR783/MTX@NPs) had a dimension of 240.6 2.5 nm and spherical morphology. After exposure to NIR light, I_2-IR783/MTX@NPs were significantly internalized in 4T1 murine breast cancer cells and displayed a synergistic anticancer impact. Furthermore, the phototoxicity of nanoparticles in the 3D tumor model is comparable to that in a 2D cell culture. The detection of intracellular reactive oxygen species and the viability/cytotoxicity test after NIR light exposure were both used to demonstrate the PDT effectiveness of the nanosystem in the physiological environment. Finally, optical coherence tomography (OCT) was also used as a substitute instrument to track the patient's response to treatment. I_2-IR783/MTX@NPs have a significant deal of potential for theranostic use in PDT-chemotherapy for breast cancer.

Biography

Dr. Anyanee Kamkaew, Associate Professor (Ph.D.-chemistry), is now head of the School of Chemistry, Institute of Science, Suranaree University of Technology. She got Ph.D. at Texas A&M University, TX, USA under the guidance of Prof. Kevin Burgess. During her Ph.D., she studied the chemistry of aza-BODIPYs and other fluorescent dyes for applications in cancer imaging and therapy. After obtaining her Ph.D. degree in 2015, she moved to the University of Wisconsin-Madison to work with Prof. Weibo Cai as a postdoctoral researcher on a Molecular Imaging project. Since 2017, she has worked as a faculty member at the School of Chemistry, Suranaree University of Technology. SCOPUS ID: 26039254300. ORCID: https://orcid.org/0000-0003-1203-2686.

Title: Serum CCL20 and EGF Detection by SERS as the Promising Tool for Microwave Ablation Outcome Prediction of Hepatocellular Carcinoma Patients

Dr. Minghua Wu*, Dr. Jia Liu, Dr. Pan Chen and Dr. Kun Deng
Professor
Hunan Cancer Hospital and the Affiliated Cancer Hospital of Xiangya School of Medicine
Central South University
China

Abstract

Tumor ablation therapy is recommended for patients with the Barcelona Clinic Liver Cancer (BCLC) stage 0 or A tumors, and microwave ablation (MWA) is promising and widely applied in the treatment of hepatocellular carcinoma (HCC) patients. However, the lack of biomarkers in biofluids restricts efficiency improvement and wider applications of MWA. Given this clinical dilemma, multiple cytokines including CCL20 and EGE are filtered by cell experiments and cytokine expression analysis. The validity of CCL20 and EGF proteins is furtherly testified in clinical serum samples of HCC patients before and after MWA operation with comprehensive analysis such as the survival analysis. Additionally, we also fabricate a SERS immunosensor for non-invasively quantitative detection of CCL20 and EGF levels with high sensitivity based on the sandwich SERS nano-architecture amplification. The lineage detection range of this SERS platform is determined to be 0.1 pg/ml-1 ng/ml for CCL20 and EGF proteins with the limit of detection (LoDs) decreasing to 0.075 pg/ml for CCL20 and 0.096 pg/ml for EGF, respectively. The different concentration in the serum of HCC patients undergoing incomplete or complete ablation is also precisely detected by the fabricated SERS immunosensor, which illustrates its potential for further clinical utility in the field of biomarker detection. Hence, we envision that the non-invasively detection of CCL20 and EGF by SERS strategy can facilitate the ablation outcome evaluation improving HCC patients' survival rate.

Biography

Dr. Minghua Wu, Professor (Ph.D.-medicine), now is a Professor of biomedicine, head of the Department of Strategic Development & Discipline Construction of Central South University, who gets New Century Excellent Talents Support Program of Ministry of Education, Vice President of Hunan Pathophysiology Society of China, Vice President of Brain and Brain Health Committee in Hunan Health Service Industry, the member of China Anti-cancer Association, Executive Director of International Organization Talent Training Working Committee of China Education Development Strategy Association. She got his B.M. in Coal Medical College of North China in 1995, M.D. in Hengyang Medical School in 2003, PhD. in Central South University in 2005. And Dr. Minghua Wu got the Hunan Provincial Natural Science Award. Currently Dr. Minghua Wu' researches focus on the molecular biological mechanism and therapy targets for glioma.

NANO 05:

Breaking Research of Nano Science and Technology

Chair

Dr. Shuji Ogata, Professor, Nagoya Institute of Technology, Japan

Time: 16:00-18:10, May 18, 2023 (Thursday)

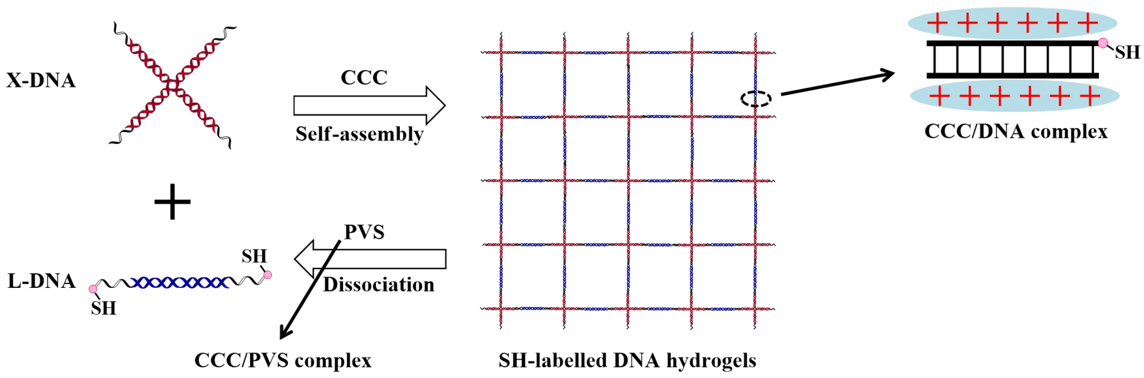
Place: Yamato A, 5F, Hyatt Regency Osaka

Title: Cationic Comb-type Copolymer Assisted Aptamer-patterned DNA Hydrogels

Dr. Jie Du*
Professor
Hainan University
PR China

Abstract

Herein, a DNA hydrogel with low DNA concentration, short sticky end and good mechanical strength was simply prepared via one-pot self-assembly from two kinds of DNA building block (X- and L-shaped DNA units) chaperoned by a cationic comb-type copolymer (CCC). The gelling process was completed under physiological conditions within one minute, and the reversible sol-gel phase transition was achieved at room temperature through the continuous addition of CCC and an anionic polymer poly(sodium vinylsulfonate). Moreover, aptamer was successfully patterned into the hydrogel system *via* click chemistry. Upon the addition of complementary sequences (CSs) of aptamer, the aptamer was hybridized with CSs, leading to the fast dissociation of protein from aptamer with an adjustable release rate in specific regions at prospective times. The hydrogel with excellent cytocompatibility was successfully applied to human serum, a complex matrix. The aptamer-patterned DNA hydrogel is a potential candidate for controlled protein delivery.



Biography

Dr. Jie Du, Professor (Ph.D.-materials), is currently a Full Professor of the College of Materials Science and Engineering at Hainan University in China. He received his B.S. degree in Applied Chemistry from Huazhong University of Science and Technology, China in 2003, and the Ph.D. degree in Polymer Materials from Dalian University of Technology, Dalian, China, in 2008. After that, he had been a JSPS Postdoctoral Fellow for 3 years at Kyushu University, Fukuoka, Japan. His current researches focus on DNA biosensors, structural DNA nanotechnology, and DNA directed self-assembly.

Title: DFT-based Simulations on Protonation Free-Energy and Adhesion Strength of Epoxy Resin in Moist Environment

Dr. Shuji Ogata* and Dr. Masayuki Uranagase
Professor
Nagoya Institute of Technology
Japan

Abstract

Adhesive bonding has attracted renewed interest from the manufacturing industry due to its role in creating composite materials and multi-material designs with the desired arrangements of polymers and metals. The amine-cured bisphenol-A epoxy resin has been used widely as the bonding glue. One of the fundamental problems in the adhesion between metal and epoxy resin is that the adhesion strength reduces significantly in a moist environment. Both cohesive failure and interface failure have been observed in peeling experiments for adhesion bonding between Al and amine-cured epoxy resins, wherein the failure respectively occurred in the adhesive and at the adhesive-adherend contacts. Microscopic understanding of the phenomena is essential to solve the problem. In this talk I will summarize our recent simulations results on that. (1) Large-scale hybrid quantum mechanical (QM)-classical (CL) simulations of the peeling to unraveling chemical reactions that could occur at the contact region between the surface-oxidized Al and the amine-cured epoxy polymers with neutral water molecules inserted [1,2]. (2) (De)protonation free-energy calculation of epoxy resin and substrate surface in a moist environment to understand their pH-dependent surface states [3-5]. Protonation of the amine group of the amine-cured epoxy resin was shown to lower the transition state energy barrier for breakage of the amine group [3-5].

[1] SO et al.: J. Phys. Chem. C (2016) **120**, 13630.
[2] SO & MU: J. Phys. Chem. C (2018) **122**, 17748.
[3] SO et al.: J. Phys. Chem. B (2021) **125**, 8989.
[4] SO & MU: J. Phys. Chem. C (2021) **125**, 22907.
[5] SO et al: MRS Commun. (2022) **12**, 315.

Biography

Dr. Shuji Ogata, Doctor of Science (Ph.D.-physics), is a professor of graduate school of the Nagoya Institute of Technology in Japan since 2005. He got his B. Sc. in 1986 from the Univ. of Tokyo, M. Sc. in 1988 from the graduate school of physics of the Univ. of Tokyo, and D. Sc. in 1991 from the graduate school of physics of the Univ. of Tokyo. After two-year post doc. and assistant professor career of the Univ. of Tokyo, he became an associate professor of Yamaguchi Univ. in Japan in 1995. He has been awarded: Best technical paper award in supercomputing 2001, Best presentation award of computation mechanics of Japan in 2010, and J. Phys. Soc. Jpn. papers award of Editors' choice in 2014. His current interests include developing and applying various large-scale atomistic simulation codes for various materials on supercomputers and their concurrent hybridization.

Title: A Co-evolution Construction Framework for Base Transfer Learning Model Selection in Edge/Cloud Infrastructure Systems

Dr. Jingtao Sun
Senior Researcher
Hitachi, Ltd.
Japan

Abstract

In recent years, smart cities have been attracting more and more attention, and many cities around the world are moving towards their realization. To keep up with this trend, in Japan, the introduction of automation systems is expanding in various fields and regions such as smart ports, smart logistics, and smart transportation. However, since accidents occur frequently due to unexpected human behavior, ensuring safety is a major issue. Therefore, to achieve the goal of co-evolution and co-learning between humans and machines, we have carried out research work on a collaborative system platform for co-evolution between humans and machines. In order to control the diversification and complexity of the system, or to control the machine with low delay and high accuracy, a transfer learning method [1], which is effective even for a small amount of learning data, has been proposed. However, it is not easy to select an optimal base model with existing transfer learning methods. As a general method, there is a method of selecting a base model based on the similarity of data datasets, and it is possible to reduce the processing time and computational resources of transfer learning. However, the operation rules, work plans, and resources (with or without GPUs) of the workplace are uneven, and in the base model selected in the conventional research, whether the re-learning process in time for the application of the new operation rules, or whether the new model operation at the edge work well or not, or the model performance is not guaranteed.
In this research, we examined how to select the optimal base model for transfer learning by linking and managing the existing ML model, the environment of the edge, the operation rules, and the time schedule. In addition, we designed and implemented a co-evolution framework, which is an optimal computing environment for transfer learning. By using this research method, it is possible to suppress the increase in re-learning time and computational resources, and by providing a highly safe and secure edge/cloud platform system capable of autonomous control.

Reference

[1]. Saber, A., Sakr, M., Abo-Seida, O. M., Keshk, A., & Chen, H. "A novel deep-learning model for automatic detection and classification of breast cancer using the transfer-learning technique". IEEE Access, Vol (9), pp.71194-71209, 2021.

Biography

Dr. Jingtao Sun (Ph.D.-Informatics), now is a senior researcher at the services computing department, center for technology innovation, Research & Development, Hitachi, Ltd. Moreover, he is a committee member of the Information Processing Society of Japan. In addition, he is an adjunct lecturer at the school of computer science, Tokyo University of Technology, and an adjunct professor at the school of big data, Qingdao Huanghai University, China. He got his M.Sc. in Computer Science at the Tokyo University of Technology, and an Informatics Doctor's degree (Ph.D.) at The Graduate University for Advanced Studies, Japan. Currently, Dr. Jingtao Sun' research focus on carbon neutralization of data centers, dynamic prediction of renewable energy, invisible computing, edge/cloud computing, image processing (removal and classification of impurities such as rain, fog and snow), semantic segmentation, IoT sensor network.

Title: Alignment of Organic Semiconductors by Solution-shearing in Active Layer Preparation for Organic Filed-effect Transistors

Dr. Yu-Tai Tao * and Dr. Fang-Ju Lin
Distinguished Research Fellow
Institute of Chemistry
Academia Sinica
Taiwan

Abstract

Impressive progresses have been made in various organic electronics because of the developments in materials and device fabrication techniques. Most of these electronic devices have layered structures, with directional charge transport and/or property propagation. In this talk, we will demonstrate the use of solution-shearing process in the preparation of the aligned organic semiconductor for organic field-effect transistor application. Thus Chinese brush-coating process was used to prepare oriented films of hexa-benzocoronene (HBC) derivatives as the conducting channel in thin-film transistor fabrication. By introducing diacetylenic side chains on the HBC core, aligned diacetylenic units and thus polydiacetylene channel along the coating direction was generated upon UV-irradiation to give an order of magnitude increase in charge mobility for the thin film transistor based on such films. Furthermore, solution-shearing of linear diacetylenic acids (DAs) showed a dependence of molecular alignment on the polarity of the solvent used: parallel to the shearing direction when non-polar solvent was used and perpendicular to the shearing direction when polar solvent was used. The presence or absence of H-bonded dimers affects the direction of alignment of the acid molecules. Structural evidences for the alignment and performance of the transistor devices will be presented.

Biography

Yu-Tai Tao completed his PhD degree from University of Rochester, USA and postdoctoral studies from Harvard University, USA. He is currently the Distinguished Research Fellow in the Institute of Chemistry, Academia Sinica, Taiwan. His research interests include Surface chemistry, materials chemistry, self-assembled monolayers, organic molecular electronic materials and devices, including organic light-emitting diodes, organic field-effect transistors, and organic memories. He has published more than 180 papers.

Title: SERS-based Aptasensors for Detection of Viruses, Cells and Small Molecules

Dr. Rugiyya Aliyeva*, Daria Tikhonova, Alexandra Gambaryan, Vladimir Kukushkin, and Elena Zavyalova
Researcher
Department of Chemistry of Lomonosov Moscow State University
Russia

Abstract

Nucleic acid aptamers are prospective recognizing elements for therapy and diagnostics of socially significant diseases. Unique spatial structure of an aptamer is specifically developed for tight binding a target (protein, small molecule or ion) via SELEX method. Aptamers are sometimes named as synthetic antibodies due to similar binding properties reaching nanomolar affinity. In addition to that, they offer several advantages over antibodies 1) availability of non-immunogenic targets; 2) reproducible chemical synthesis, 3) possibility to include modifications in specific sites, 4) simple folding and refolding, 5) high stability during storage. Development of aptamers in sensors is prominent due to possibility of construction of stable and cheap systems for rapid diagnostics. Highly sensitive and rapid technology of surface enhanced Raman scattering (SERS) was combined with labeled aptamers to create aptasensors for respiratory viruses, human cells and low-molecular substances.

Aptasensors with Ag-nanostructured solid substrates in a rapid test version provide high sensitivity and a broad qualitative working concentration range of 10^4-10^8 virus particles in mL of influenza viruses. Whereas colloidal Ag nanoparticles provide a monotonous concentration dependency for a range of 10^5-10^9 VP/mL of influenza A or $5{\cdot}10^4$-$2{\cdot}10^6$ $TCID_{50}$/mL of SARS-CoV-2. Colloidal aptasensors do not require sophisticated equipment, this approach was chosen to create aptasensors for human cells and chemicals. Our aptasensor for human squamous carcinoma detected 10^3-10^5 cells/mL with a monotonous concentration dependence. As for small molecules, the aptasensor for adenosine monophosphate had a monotonous dependence in a range of 5-10^5 nM.

Our results illuminate high promises for combination of SERS and aptamers in detection of supramolecular structures, biologicals and small molecules.

The work is supported by the Russian Science Foundation (grant number 18 - 74 - 10019, https://rscf.ru/project/18-74-10019/).

Biography

Dr. Rugiyya Aliyeva, Ph.D. in bioorganic chemistry, studies aptamers and their applications in biosensing at Chemistry Department of Lomonosov Moscow State University. Daria Tikhonova is a student of Chemistry Department at Lomonosov Moscow State University. Dr. Alexandra Gambaryan, professor, Ph.D. in biology, Doctor in biology now is a head of the laboratory of molecular biology of influenza viruses in Chumakov Federal Scientific Center for Research and Development of Immune and Biological Products RAS. Dr. Gambaryan is a leading specialist in biology of influenza viruses. Dr. Vladimir Kukushkin, Ph.D. in physics, now is a scientific researcher in Institute of Solid State Physics RAS. Dr. Kukushkin specializes in SERS substrates and portable SERS equipment. Dr. Elena Zavyalova, Doctor of Sciences in bioorganic chemistry, now is an Associate Professor of Chemistry Department at Lomonosov Moscow State University. Currently Dr. Zavyalova specializes in theory of aptamers as specific binders as well as in practical implementation of aptamers in biosensors.

Title: - Room Temperature Operation of Single Electron Transistors and Their Hybridization with CMOS

Dr. Rasika Dhavse
Associate Professor
Department of Electronics Engineering
Sardar Vallabhbhai National Institute of Technology
India

Abstract

Quantum confinement is the foundation of many low-power beyond-CMOS devices which are under development. Single electron transistors (SETs) work on Quantum Mechanical phenomena like Coulomb Blockade and Tunneling. They consume very low power as the number of electrons transferred are very less and have a charge sensitivity of 10^{-6} $(e/Hz)^{1/2}$. They have high operating speed and can be used as logic as well as memory devices. High scalability and packing density are additional benefits of SETs. Though SETs have such remarkable features, complete replacement of CMOS by SETs is not possible due to their low current drive, high output impedance, lack of mature room temperature operable technology, large-scale infrastructure, proven design methodologies, and economic predictability. CMOS has benefits such as high-speed and voltage gain that can compensate for the limitations of SETs. CMOS to SET interface is possible as range of currents are very small and voltage levels are manageable, usually in millivolts. Therefore, even though a complete replacement of CMOS by SET is very difficult in near future, hybridizing SET with CMOS can open a window for the new functionality and better performance. This work presents a strategic design for room temperature operation of a SET of viable dimensions for low power applications and a novel SET-MOS hybridization technique.

Biography

Dr. Rasika Dhavse is serving as Head and Associate Professor in the Department of Electronics Engineering of Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat, India. She pursued her doctoral degree in the field of nanocrystal-based flash memory devices. She has more than twenty-five years of academic experience. She has five doctoral theses under her supervision. She has successfully completed one research project funded by Department of Science and Technology of Government of India and four research projects funded by Department of Information and Technology of Government of India, in capacity of Co-Principal Investigator. Her chip titled "Programmable Digital Low Pass Filter using Vedic Mathematics for Portable Biomedical Signal Acquisition" is currently under fabrication.
She has organized more than 50 Seminars, Workshops, FDPs, STTPs and conferences on various topics related to VLSI Design, Semiconductor Physics and Technology, Fabrication and Characterization of MOS Devices, Nanoelectronics and Nanotechnology, Embedded Systems, Robotics, System Automation etc. She has published many papers in national and international conferences and journals.
She is one of the founders and Vice Chair of IEEE Nanotechnology Council, Gujarat Section, India.

NANO 06:

New Nanomaterials (III)

Chair

Dr. Shuki Yeshurun, CEO, Tortech nanofibers, Israel

Co-chair

Dr. Rachel Desfeux, Professor, University of Artois, France

Time: 14:00-16:50, May 18, 2023 (Thursday)

Place: Yamato B, 5F, Hyatt Regency Osaka

Title: Ferroelectric $BaTiO_3$ and Self-oxidized N: $BaTiO_3$ Oxynitride Epitaxial Heterostructures for Water-splitting and Spintronics Applications

Dr. A. Barbier*, A Derj, C. Blaess, H. Lin, M. Rioult, S. Datta, D. Stanescu, S. Stanescu, G. Creutzer, H. Magnan, S. Matzen, J.-B. Moussy, C. Mocuta, F. Charra, M. Silly, R. Belkhou, P. Le Fèvre, J. Leroy, F. Maccherozzi
Research Director
CEA
France

Abstract

Ferroelectric ultrathin films are currently of high technological interest due to their intrinsic internal electrical field; they are expected to lead to key components of a variety of genuine devices in fields as important as spintronics, photovoltaic cells, water-splitting, sensors, memory cells etc. $BaTiO_3$ has reasonable electric polarization, is cheap and is environment friendly. Oxides offer a very wide range of physical properties allowing for a multitude of applications and many have the required chemical stability for photocatalytic applications such as solar water splitting or CO_2 reduction. Unfortunately, they have mostly non-ideal optical and electrical properties. N doping is a seductive route to overcome these issues. The insertion of less electronegative nitrogen into the lattice of an oxide causes an increase in the covalent nature of the chemical bonds and thus a modification of the absorption properties and charge carriers' concentration. Unfortunately, in nature, oxidation is largely more favourable than nitriding and the realization of oxynitrides is generally difficult.
We realized the epitaxial growth of $BaTiO_3$ and N doped $BaTiO_3$ thin films, by atomic oxygen/nitrogen assisted molecular beam epitaxy, that were incorporated in materials stacks dedicated to water-splitting anodes. We used an original approach consisting in using the $SrTiO_3$(001) substrate as the oxygen supplier and atomic nitrogen plasma to incorporate substitutional N atoms into the perovskite lattice. The layers were characterized by *in situ* high energy electron diffraction and Auger analysis, synchrotron radiation X-ray diffraction and photoemission spectroscopies, optical absorbance, ferroelectric behavior as well as photoelectrochemical response. Notably, improved photoelectrochemical performance, persistence of the ferroelectric nature and enhanced light absorption could be evidenced highlighting the potential of this new class of materials for water splitting and spintronics applications.

Biography

Dr. Antoine Barbier * is a research director and "expert senior" scientist at CEA where he is a specialist for the field of synchrotron radiation and oxides thin films studies. He holds a PhD in Solid State Physics (1993) and a "Habilitation to Conduct Research" (HDR) from university of Strasbourg (2003). With a strong background in surface physics/chemistry and magnetic thin films, he joined CEA/Grenoble in 1994 where he used massively ultrahigh vacuum surface X-ray diffraction to study oxides surface structures. His research interests moved to magnetic oxides surfaces and thin films and he joined the oxide group at CEA/Saclay in 2003. Currently, Dr. Antoine Barbier's researches focus on oxide thin films for spintronics and solar water-splitting applications using a large panel of synchrotron radiation techniques.

Title: Thermal and Electrical Properties of Energy Materials in Controlled Nanoparticles

Dr. Xizu Wang* and Chien Sheau Wei, Xu Jianwei
Senior Scientist
Institute of Materials Research and Engineering (IMRE)
Agency for Science
Technology and Research (A*STAR)
Singapore

Abstract

Nanostructuring is an effective way to concurrently improve thermal and electrical parameters in some thermoelectric material systems. Herein, we have established that thermoelectric properties of indium tin oxide (ITO) bulk materials and Al2O3-ZnO (AOZO) nanocomposites are remarkably enhanced by modulating its nano-density and nano-sized porosity via the spark plasma sintering (SPS) process. The nano-sized porosity of nanocrystal ITO AOZO pellets is evaluated in terms of nanoparticle nano-density (duty ratio of from SEM images)of nano-sized material that is defined as the ratio of the nanostructured area to the entire image area of metal-oxide obtained from scanning electron microscopy. The nanosized porosity-density of nanocrystal ITO and AOZO pellets is roughly inversely proportional to the duty ratio.
The NANO-STRUCTURES MATERIALS pellet bulk density is observed to increase with increase of the sintering temperature, and it reaches as high as 6.6 g/cm3 (92% theoretical density) at 1,050 °C. The influence of the nanoparticle nano-density effect on the NANO-STRUCTURES MATERIALS thermoelectric properties is investigated, and it is found that duty ratio increases with the increase in carrier mobility, carrier concentration, electrical conductivity and thermal conductivity, but decrease in Seebeck coefficient, revealing that performance of thermoelectric properties is able to be optimized by judiciously tuning their nanoparticle nano-density, in other words, nano-sized porosity. In addition, further analysis suggests the nano-sized porosity density gives rise to energy filtering, which enhanced the power factor to 483 µWm-1K-2 at 873 K of ITO and 2000 µW m-1 K-2 at 860 K of AOZO, which is the highest reported value for undoped non-nanostructure bulk ITO. This work has demonstrated an essential fabrication strategy to enhance thermoelectric performances of NANO-STRUCTURES MATERIALS, and this method is anticipated to be extrapolated to other categories of polycrystalline bulk materials to improve their thermoelectric performance.

Biography

Dr. Xizu Wang now is a Scientist of IMRE, A-star Singapore, A Scientist & Project Principal Investigator of electrical material department. He hold a PhD in Condensed Matter Physics (experimental) from the Surface Physics Laboratory (National Key Laboratory) of Fudan University and a B. Sc. in Physics (major in Optical-Electronics) from Xi'an Jiaotong University (Department of Applied Physics). He has extensive scientific experience in nano-coating, surface treatment, new thin-film deposition and characterization technique in electrical and food packaging industries. Knowing my efforts can impact the project's success keeps me going every day! It is my professional goal to deliver innovative and significant solutions. His functional expertise lies in Condensed Matter Physics, High-Quality Packaging Technique, Nano-Coating, Degradation mechanism in Electronic Device, Nano-Device Design, Nano-Device Fabrication, Surface/Interface Characterization, and Surface Treatment**.As** a Scientist & Project Principal Investigator, Dr. Wang xizu have extensive scientific experience in nano-coating, surface treatment, new thin-film deposition and characterization technique in electrical and film packaging industries. Knowing my efforts can impact the project's success keeps me going every day! It is my professional goal to deliver innovative and significant solutions.

Title: Unique Properties of Ultra-Long Carbon Nano Tube (ULCNT) that Can Open New Opportunities in the World of Materials

Dr Shuki Yeshurun*, Dr. Martin Pick, Meir Hefetz, Dr. Liron Issman, Prof. Adam Boies
CEO
Tortech nanofibers
Israel

Abstract

Tortech (Israel) and QFlo (UK) are startup companies with unique nano technology process' based on a novel innovation of Prof. Alan Windle from Cambridge university (UK) IP.
The zero-emission process uses Methane gas from natural sources or from landfill producing to produce Ultra-Long Carbon Nanotubes (ULCNT) non-woven mats, ULCNT fibers, dispersions and pure Hydrogen (H2) gas.
The ULCNT have unique properties such as: light weight, high specific electrical conductivity, thermal conductivity, chemical stable, high strength and high toughness.
These unique properties open a wide range of new opportunities in the world of materials such as "smart" textile, high EMI shielding for 5G communication, construction (replacing for example steel reinforcing bars), water and air filters (including corona viruses), energy (electrodes and additives for fast charge of electrical vehicle batteries), de-icing for aviation, hybrid composites for automotive, sport goods, heat dissipation devices, fire barrier, health monitoring and many more.
The novel process also provides a green energy bridge to convert Methane to sequestrated carbon and clean usable Hydrogen which can be used as an energy source or process chemical.
Tortech & Q-Flo are focusing on production scale-up and continue to cooperates closely with researchers in Cambridge University labs.
Proof of concepts trials have been completed with potential customers for most of the applications mentioned above and we are looking forward to building high-volume mass production plant to satisfy worldwide market needs.

Biography

Dr. Shuki Yeshurun was a senior scientists and R&D group leader at RAFAEL. He served as the CTO and CSO in several organizations, including ICL, Plasan Sasa and Shizim medical group.
He founded multiple companies and centers including 2 innovation centers (INNOFENSE), NanoPass technologies, Tortech Nano Fibers, recently Terra Biomatrix. He is currently serving as the CEO of Q-Flo (Cambridge).
Shuki is a Doctor of Science (D.Sc.) awarded from the Technion (Israel institute of technology) supervised by Prof. David Brandon and Prof. Dan Shachtman (Nobel Prize Laurent **2011**).
He has received several international awards including:
US American Ceramic Society (ACS) - "Ross Purdy" award,
Paris Capital IT - "Best of the best award for innovation"
Israel Ministry of commerce award for the - "best innovative start-up company"
Israel Chief of Science award for - "the best Nano technology company of the year"
Current commercial interests include driving Q-Flo through a successful scale-up programme. This includes maximizing the environmental impact of Q-Flo's new ultra-long CNTs based materials and ensuring that the CNT fabrication process plays a full part in providing a source of Turquoise Hydrogen from methane.

Title: Large-Scale Growth of Transition Metal Dichalcogenide Materials and Its Application for Resistive Switching Memories

Dr. Yuanmin Du*, Calvin Xiu Xian Lee, Jia Rui Thong, Wen Siang Lew
Senior Research Fellow
Nanyang Technological University
Singapore

Abstract

Transition metal dichalcogenide (TMDC) materials have attracted great interest in recent years due to their attractive properties for different applications. Weak van der Waals bonding between adjacent layers leads to a very good cleavability perpendicular to the c-axis, which makes TMDC materials suitable for a mechanical exfoliation process, similarly to that of graphene. To achieve scalable growth of TMDC materials, different chemical vapor deposition (CVD) and physical vapor deposition (PVD) methods have been developed. The growth of uniform and high-quality thin films of TMDCs remains a challenge, especially for monolayer TMDCs. For CVD growth of 2D TMDCs, it typically requires a high temperature process and special treatment of the substrates, limiting this method for scalable fabrication of devices. In this talk, after a review of the current status on the growth of TMDCs, a new method to grow large-scale epitaxial TMDCs on silicon substrates will be introduced. A much lower temperature growth process with high repeatability and scalability of epitaxial films has been achieved. The mechanism involved with the process will be discussed. In the end, resistive switching memory devices based on TMDCs will also be presented.

Biography

Dr. Yuanmin Du, now is Senior Research Fellow at School of Physical and Mathematical Sciences, Nanyang Technological University (NTU) in Singapore. He obtained his PhD in 2013 at the Department of Physics, National University of Singapore (NUS). His current research is on the development of resistive switching random-access memory (RRAM) using transition metal oxides for industry applications. He got his BSc in physics from Nanjing University in China in 2001. After more than five years at semiconductor industry for various positions, he started his PhD study at NUS. His main research interests are on metal and oxide thin films, surface and interface analysis, and first-principles modelling. His main achievement during the PhD study is the development of a new mechanism to explain a negative differential resistance behaviour in oxide thin films. After a one-year post-doctoral study at King Abdullah University of Scient and Technology (KAUST) in Saudi Arabia, he did his study at Nation Tsing Hua University (NTHU) in Taiwan, where his main research topic is on magnetoresistive random-access memory (MRAM). At NTHU, besides the achievements in MRAM, he also developed a low temperature process of epitaxial growth of transition metal dichalcogenide (TMDC) materials. At present, he is working on a university-industry project, and in charge of the stack design and device fabrication.

Title: Nanoscale Ferroelectricity in Innovative Ln_2WO_6 (Ln = La, Pr and Nd) Thin Films

Dr. R. Desfeux*, Dr. M.-H. Chambrier, Dr. M. Lheureux, Dr. T. Carlier, Dr. A. Da Costa, and Dr. A. Ferri
Professor
University of Artois
France

Abstract

Due to environmental constraints, the research for new high-performance eco-friendly materials is a real societal challenge. In particular, lead-based piezo/ferroelectric thin films integrated in many electronic devices have to be replaced. In this context, the discovery of new functional lead-free materials is essential. Such a specification imposes an exploration of chemical systems that have been little or not studied. In this presentation, we interest to the little-known Ln_2WO_6 family with Ln = La, Pr and Nd. From high resolution X-ray diffraction and transmission electron microscopy measurements, we show that high-quality epitaxial $\vec{c}$ axis La_2WO_6 thin films along with the high temperature allotropic variety can be stabilized on (001)-oriented $SrTiO_3$ substrates by pulsed laser deposition. A similar structure is obtained for Pr_2WO_6 and Nd_2WO_6. From piezoresponse force microscopy imaging and local piezoelectric hysteresis loops recording, we evidence nanoscale piezo/ferroelectric properties in the films. The ferroelectric domains pattern is displayed, the coercive voltage for domain switching is measured while the electromechanical activity is evaluated. In addition, using the conductive mode of atomic force microscopy, we characterize local conductivity of the films, which appears to be related to common physical phenomena occurring in ferroelectric materials. We conclude that these findings pave the way to new ecologic functional oxide thin films devoted to advanced electronic nanodevices.

References:

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T. Carlier, M.-H. Chambrier, A. Da Costa, F. Blanchard, T. Denneulin, M. Létiche, P. Roussel, R. Desfeux, A. Ferri, “Ferroelectric state in a α -Nd_2WO_6 polymorph stabilized in thin film”, *Materials Chemistry* 32(17) (2020) 7188-7200

M. Lheureux, M.-H. Chambrier, K. Dalla Francesca, B. Vargas, L. Yedra, A. Da Costa, T. Carlier, F. Blanchard, S. Estrade, F. Peiro, P. Roussel, J.F. Blach, A. Ferri, R. Desfeux, “Thin Film Stabilization of a Ferroelectric Orthorhombic α-Pr_2WO_6 Polymorph” *ACS Applied Electronic Materials* 4(11) (2022) 5234-5245

Biography

Rachel Desfeux received his PhD Degree from the University of Caen, France, in 1994 in the field of Materials Science: Growth and Characterization of High T_c Superconducting Thin Films. As a Post-Doctoral position, He spent one year (1994-1995) in the Solid State Physics Laboratory of the University “Tor Vergata” of Rome, Italy, working on the Synthesis of Novel Superconductors in Thin Films. In 1996, He was promoted Associate Professor at the University of Artois. He conducts his research works within the Unit of Catalyst and Solid State Chemistry (UCCS). In 2003, He received his Accreditation to Supervise Research. In 2008, He was promoted Full Professor. From 2007 to 2020, He became the Head of the “Thin Films and Nanomaterials” team at UCCS. His research activities cover the field of growth and (micro-)structural, physical and surface characterization of thin films with specific properties (piezoelectricity, ferroelectricity, ferromagnetism, …). His work involves nanoscale investigations using various techniques of atomic force microscopy and associated spectroscopic tools (AFM, PFM, c-AFM, MFM, piezoloops…). He is working on lead-free oxide piezo/ferroelectric thin films.

Title: Liquid Cell Transmission Electron Microscopy Technique for Polymeric Nanoparticles

Dr. Chisato Takahashi*and Damien Alloyeau
Senior Researcher
National Institute of Advanced Industrial Science and Technology
Japan

Abstract

The structural study of nanomaterials is an essential first step towards the development of innovative nanotechnologies. However, TEM investigations of polymeric materials remain challenging because of the electron beam effects on polymer structure. Especially, the fast deformation of poly (lactic-co-glycolic acid) nanoparticles (PLGA NPs) under the electron beam has drastically limited the structural investigations of these technologically relevant nanomaterials by TEM. Recently, liquid-cell transmission electron microscopy (LC-TEM) has become a promising alternative approach to study the structure and dynamics of synthetic and biological soft materials. This talk will focus on development of LC-TEM technique for deformable polymeric particles using medium solution which can prevent the morphological change. The findings from some of the ongoing researches in my laboratory will be presented and discussed.

Biography

Dr. Chisato Takahashi is a Senior Researcher of National Institute of Advanced Industrial Science and Technology, fellow for Japanese Society of Electron Microscopy Technology for Medicine and Biology and committee member for sectional meeting of the Japanese Society of Microscopy. After her undergraduate and graduate studies, she received Engineering Doctor's degree (Ph.D.) at Nagoya Institute of Technology at Japan. She got her B.Sc. in Biology from Tottori University. During the Doctoral studies, her research focused on both the fabrication of innovative nanomaterials and the development of electron microscopy techniques dedicated to the study of nano-objects. And she got the International Federation of Societies for Microscopy School for Young Scientist Award in 2014, and the Academy of Pharmaceutical Science and Technology, Japan Global Education Seminar Presentation Award in 2014, the Japanese Society of Electron Microscopy Technology for Medicine and Biology Award in 2018, and the Nagai Foundation for Science and Technology Award in 2021. She has been currently working on a number of projects to (1) design of effective polymeric nanoparticles for drug delivery system and iron oxide nanoparticles for magnetic tape, and (2) development of in-situ electron microscopy technique with a simple sample pretreatment.

NANO 07:

Nano Electronics, Nano Optics, Nano Photonics and Nanomagnetism

Chair

Dr. Ken Morita, Professor, Chiba University, Japan

Time: 09:00-12:15, May 19, 2023 (Friday)

Place: Yamato A, 5F, Hyatt Regency Osaka

Title: Ultrafast Magnetic Vortex Control for Energy Saving Spintronics

Dr. Chenglong Jia*, Dr. Dongxing Yu, and Dr. Jamal Berakdar
Professor
Lanzhou University
China

Abstract

Opto-magnetism is widely regarded as most promising for fast and precession handling of magnetic data. Here, we will discuss a scheme for accurate spatiotemporal control of magnetic vortices or skyrmions via magnetoelectric interaction utilizing a simple sequency of ultra-short, low average-energy electric near-fields created around a biased nanoscale scanning tip. Magnetic textures can be trapped, accelerated, or stopped without undesired effects such as a transversal Hall drift. The intrinsic qualities of magnetic patterns, such as the sense of rotations and polarity display a well-defined reversal tendency as well. The method is applicable to a wide class of noncollinear magnetic structures and promotes the promise of functionalizing near-fields for information storage and processing.
[1] Dongxing Yu; Yonglong Ga; Jinghua Liang; Chenglong Jia; Hongxing Yang, Voltage-controlled Dzyaloshinskii-Moriya interaction torque switching of perpendicular magnetization, Phys. Rev. Lett. 130, 056701 (2023);
[2] Dongxing Yu; Chaowei Sui; D. Schulz; J. Berakdar, Chenglong Jia, Nanoscale Near-Field Steering of Magnetic Vortices. Phys. Rev. Applied 16, 034032 (2021);
[3] Dongxing Yu, Jiyong Kang, Jamal Berakdar, and Chenglong Jia, Nondestructive ultrafast steering of a magnetic vortex by terahertz pulses, NPG Asia Materials 12, 36 (2020)

Biography

Dr. Chenglong Jia, now is a Professor of Physics, deputy director of Key Laboratory for Magnetism and Magnetic Materials of the Ministry of Education, Lanzhou University. He got his Ph.D. in physics in 2004 at Lanzhou University, China. His researches focus on quantum magnetism, including spin dynamics, magneto-electric effects, and topology in magnetism.

Title: Higher-order Spin States Generated by Focused Higher-order States of Photon

Dr. Ken Morita*, Toshiki Matsumoto, and Sota Sato
Professor
Chiba University
Japan

Abstract

The Poincaré sphere (PS), representing the polarization state of a photon, and the Bloch sphere (BS), representing the electron spin state, have a direct one-to-one connection, and coherent transfer via spin angular momentum is realized. Higher-order photons, attracting much attention in recent years, are represented on the higher-order Poincaré sphere (HPS), which is an extension of the PS. Since it has an azimuth-dependent polarization state, it can produce z-polarization which is the longitudinal wave of light when strongly focused, extending the conventional polarization state. We have previously proposed a spin state of the higher-order Bloch sphere (HBS) with extended BS corresponding to HPS. In this study, we propose the generation of higher-order spin states which are new kinds of spin states that cannot be described on conventional HBS, by using focused higher-order photons. Space distribution of spins in semiconductors irradiated with focused high-order photons is obtained by simulation. The light intensity and polarization distributions of the focused higher-order photon were obtained using vectorial diffraction theory. Furthermore, the spatial distribution of spins was obtained by using the optical transition selection rule by considering the light intensity and polarization distributions for the focused higher-order photon.

Biography

Ken Morita (Ph.D. -Engineering) is a professor of the Electrical and Electronic Engineering Course, Graduate School of Engineering, Chiba University. He specializes in quantum optics and semiconductor physics, with a focus on the measurement of quantum spin dynamics in semiconductors using ultrafast spectroscopic optical techniques. Toshiki Matsumoto and Sota Sato are graduate students at the Graduate School of Engineering, Chiba University.

Title: Development of $BiFeO_3$-based Multiferroic Thin Films with Large Magneto-Optical Kerr Effect for Spatial Light Modulator Driven by Electric Field

*Dr. Satoru Yoshimura*and Mr. Soumyaranjan Ratha*
Professor
Akita University
Japan

Abstract

A spatial light modulator is very important element for realization of wide viewing angle holographic 3D display. To control the reflected light of bright or dark with sub-micron size, many patterned magnetic arrays with large magneto-optical Kerr effect should be contained in the spatial light modulator. The bright or dark is determined by magnetization direction of the patterned magnetic arrays. Because direction and angle of magneto-optical Kerr effect of reflected light against incident light is determined by direction of the magnetization and its magnetic material of patterned magnetic arrays. The large power consumption of current spatial light modulator with patterned metallic magnetic arrays driven by magnetic field or spin injection is serious problem for actual device application. If we can drive the spatial light modulator by using electric field with not metallic magnetic materials but mulitiferroic materials, the large power consumption of the device will be drastically decreased. However, the multiferroic materials with large magneto-optical Kerr effect are not reported. To realize the spatial light modulator driven by electric field, to demonstrate the control of magneto-optical Kerr effect by applying electric field, we are developing BiFeO3-based multiferroic thin films with large magneto-optical Kerr effect. A new reactive sputtering method to obtain high quality $BiFeO_3$-based multiferroic thin films, and various substitution element to obtain large magneto-optical Kerr effect will be presented and discussed.

Biography

Dr. Satoru Yoshimura, Professor (Ph.D.-Engineering), now is a Professor of Materials Science and Engineering Course, Department of Materials Science, Graduate School of Engineering Science, Akita University, Japan, and director of Research Center of Advanced Materials for Breakthrough Technology, Graduate School of Engineering Science, Akita University, Japan. He got his B.Sc. in electronic engineering (1998), M.Sc. in electronic engineering (1999), Engineering Doctor's degree (Ph.D.) (2002) at Tohoku University, Japan. Dr. Satoru Yoshimura became a JSPS Research Fellow at the Graduate School of Engineering, Tohoku University (2001), a Research Associate at the Graduate School of Engineering, Nagoya University (2005), an Assistant Professor at the Graduate School of Information Science and Electrical Engineering, Kyushu University (2007), an Associate Professor at the Graduate School of Engineering Science, Akita University (2008), and a PRESTO Researcher of JST Strategic Basic Research Programs (2015-2019), now is a Professor of Materials Science and Engineering Course, Director of Research Center of Advanced Materials for Breakthrough Technology. And Dr. Satoru Yoshimura got the Presentation Award in 2003, 2013, and 2022 from Conference, and a Research Award from several Foundations and Public Office in 2012, 2012, 2016. Currently Dr. Satoru Yoshimura focus on the development of high-functional film materials and their fabrication with high quality, especially the development of highly functional multiferroic thin films for electric field-driven magnetic devices. Dr. Satoru Yoshimura is also Chief Editor of "Field of hard and soft magnetic material" of The Magnetic Society of Japan, Organizer of The Society of Materials Engineering for Resources of JAPAN, and Organizer of Multi Media Storage Study Group of The Institute of Image Information and Television Engineers.

Title: Magneto-optical Properties of Wider Gap Magnetic Semiconductor Films Prepared by MBE, and an Inquiry into the Practicality of These Films

Dr. Masaaki Imamura*
Emeritus Professor
Fukuoka Institute of Technology
Japan

Abstract

II-VI based magnetic semiconductors (II-VI MS's) with a direct and wide optical band gap are expected to show high potential for optical applications utilizing short wavelength laser diodes, such as 532-nm green and 475-nm blue LD's. We have confirmed that the Faraday rotation θ_F in ZnMnTe films deposited on quartz glass (QG) substrates is large near the optical absorption edge. This presentation reports the magneto-optical characteristics of ZnMnTe and ZnMnSe films synthesized on QG and sapphire substrates, and shows the results of a direct Faraday rotation observation successfully made for the ZnMnTe film under ac magnetic fields. The optical transmission characteristics of these films grown on crystal substrates by molecular beam epitaxy (MBE) are discussed from the viewpoint of photo-luminescence, and the practicality of II-VI MS's is also discussed taking the transmission properties of II-VI MS films into consideration.

Biography

Dr. Masaaki Imamura, Engineering Doctor (Ph.D.-electrical engineering), now is a Professor Emeritus. From 1977 to 1984, he worked at the Department of Electronics at Gifu University, Gifu, Japan as a research fellow. Since 1985 he has been at the Department of Electrical Engineering, Fukuoka Institute of Technology (FIT), Fukuoka, Japan; from 1985 to 1987 as an associate professor, from 1988 to 2015 as a professor, and from 2016 as an emeritus professor. He was involved in a variety of FIT activities including serving on several university committees as a chair or director. Chairs: Committee on Admission, Educational Improvement and FIT International Exchange. Directorships: Electronics Research Laboratory at FIT, Undergraduate Academic Affairs and Graduate School Academic Affairs. His papers on education have been published in the journals of IEEJ and JSEE. Dr. Masaaki Imamura got the Education Award in 2022 from Japanese Society for Engineering Education (JSEE), Tokyo, 2022. He got his B. Sc and M. Sc in electrical engineering, Engineering Doctor's degree (Ph.D.) at Kyushu University, Fukuoka, Japan. His interests include the magneto-optics of II-VI diluted magnetic semiconductor films synthesized using MBE. Recently, he also interested in the spin-thermoelectric generators with the spin Seebeck effect incorporating liquid phase epitaxial magnetic garnet films. Dr. Masaaki Imamura got the Best Poster Award in 2022 from International Council on Electrical Engineering Conference (ICEE), Seoul, 2022, and a Research Award from the Institute of Electrical Engineers of Japan (IEEJ), Tokyo/Fukuoka, 2022. He is a member of the Magnetic Society of Japan and the Japanese Society for Engineering Education, a life member of the Institute of Electrical Engineers of Japan, and a life senior member of the IEEE Magnetics Society.

Title: Piezoelectricity Temperature Limits of Sol-gel Composite Materials

Dr. Makiko Kobayashi*
Professor
Kumamoto University
Sweden

Abstract

High temperature ultrasonic transducers have been desired for industrial fields. Ultrasonic transducers made by piezoelectric sol-gel composite films are one of the candidates because of thermal durability, low cost, and thin film structure. Piezoelectric sol-gel composites consist of three phases, ferroelectric powder phase, sol-gel phase, and air phase. Temperature limits of sol-gel composite ultrasonic transducers are mainly determined by Curie temperature of ferroelectric powder phase. However, there are other factors, such as top electrode materials, poling direction, internal stress, etc. Temperature limits of PZT/PZT, $Bi_4Ti_3O_{12}$/PZT, and $LiNbO_3$/TiO_2+$SrCO_3$ sol-gel composite ultrasonic transducers will be demonstrated.

Biography

Dr. Makiko Kobayashi is Professor of Division of Informatics and Energy, Graduate School of Science and Technology, Kumamoto University, Japan. She got her B.Eng. and M.Eng. degrees in the Department of Electrical and Electronic Engineering, Chiba University, Chiba, Japan, and Ph.D. degree in the Department of Electrical and Computer Engineering, McGill University, Montreal, QC, Canada. From 2007 to 2011, she was a Research Associate at Industrial Materials Institute, a division of National Research Council of Canada. Since 2012, she had been an Associate Professor at Kumamoto University, Japan before her promotion in 2022. Dr. Kobayashi was a recipient of the Young Scientist Award for on “Integrated and flexible piezoelectric/ultrasonic sensor research”, the 26th Symposium on Ultrasonic Electronics, Tokyo, Japan, in 2005. She also received “The National Research Council of Canada's Intellectual Property Achievement Awards” in 2022. Her research interest includes the development and application of piezoelectric sol-gel composite materials for nondestructive evaluation (NDE) and piezoelectric other applications.

Title: Synergistic Effect of P Doping and Mo-Ni-based Heterostructure Electrocatalyst for Overall Water Splitting

Feihong Jia* and Xiangyu Zou
Postgraduate
Shaanxi University of Technology
China

Abstract

Heterostructure construction and heteroatom doping are powerful strategies for enhancing the electrolytic efficiency of electrocatalysts for overall water splitting. Here, we report a P-doped MoS_2/Ni_3S_2 electrocatalyst on nickel foam (NF) prepared using a one-step hydrothermal method. The optimized $P_{0.9}$-MoS_2/Ni_3S_2@NF exhibits a cluster nanoflower-like morphology, which promotes the synergistic electrocatalytic effect of the heterostructures with abundant active centers, resulting in high catalytic activity for the hydrogen evolution reaction (HER) and oxygen evolution reaction (OER) in alkaline electrolytes. The electrode exhibits low overpotentials and Tafel slopes for the HER and OER. In addition, the catalyst electrode used in a two-electrode system for overall water splitting requires an ultralow voltage of 1.42 V at 10 $mA \cdot cm^{-2}$ and shows no obvious increase in current within 35 h, indicating excellent stability. Therefore, the combination of P doping and heterostructures provides a new avenue for the development of highly efficient electrocatalysts for overall water splitting.

Biography

Feihong Jia, born in June 1998, a postgraduate student at School of Materials, Shaanxi University of Technology. His research interests are the preparation and catalytic performance of functional materials. Currently, her publications include《Research progress of TMSs catalyst in hydrogen production from electrolytic water》and《$CoSe_2$@NF bifunctional electrocatalyst for efficient overall water splitting under alkaline condition》.

Title: Ultrathin MoS_2 Nanosheets Decorated on NiSe Nanowire Arrays as Advanced Trifunctional Electrocatalyst for Overall Water Splitting and Urea Electrolysis

Dr. Yan Li* and Weiwei Bao
Postgraduate
Shaanxi University of Technology
China

Abstract

Developing highly-efficient and low-cost electrocatalysts act as pressing impacts on the flourishing of hydrogen energy, including electrochemical water splitting is a kind of prevailing energy conversion technology. However, it is hampered by the high activation barrier of oxygen evolution reaction (OER). Herein, a hybrid electrocatalyst with trifunctional and 3D core-shell structure is designed by hydrothermal process in order to achieve outstanding OER, hydrogen evolution reaction (HER) and urea oxidation reaction (UOR) properties. NiSe@MoS_2/NF catalyst is composed of the heterogeneous interface formed by NiSe nanowire arrays which supported by nickel foam and MoS_2 nanosheets. The synergistic effect and strong electronic interaction between the interface display the dominant impact of OER, HER and UOR. Especially in basic electrolyte, the potential is as low as 310 mV at 100 mA cm^{-2}, even Tafel slope is 70.8 mV dec^{-1}, representing the predominant OER property. The HER and UOR also demonstrate enormous prospect with 210, 233 mV at 100 mA cm^{-2}. When NiSe@MoS_2/NF||NiSe@MoS_2/NF catalyst as anode and cathode, only requires potential of 1.48 V at 10 mA cm^{-2} for overall water splitting test. The work offers a plain, high-efficiency and inexpensive method to evolve the progressive trifunctional electrocatalysts for other energy-related applications.

Biography

Yan Li, born in August 1999, a postgraduate student at School of Materials, Shaanxi University of Technology. Her research interests are the preparation and catalytic performance of functional materials. Currently, her publications include 《Preparation of self-supported NiMoP@NiFeP heterojunction electrode and its electrocatalytic oxygen evolution performance》 and 《Ultrathin MoS_2 nanosheets decorated on NiSe nanowire arrays as advanced trifunctional electrocatalyst for overall water splitting and urea electrolysis》.

NANO 08:

Video Forum

Title: Interstitial Flow: Two Elucidating Examples of First-principle Modeling Applied to Microscale Bioflows

Dr. Francesco Romanò
Associate Professor
Arts et Métiers, Campus of Lille
France

Abstract

Two examples of first-principle modeling applied to microscale interstitial flows are here discussed to elucidate about the potential of such theoretical methods in unravelling new physics:

1. The first example employs a first-principles approach to model the flow inside the perivascular space (PVS) and examine how cerebrospinal fluid (CSF) enters the brain through a permeable layer of glial cells. The flow within the thin annular gap of the perivascular space, situated between an impermeable artery and brain tissue, is analyzed using lubrication theory. The artery undergoes a peristaltic deformation, and the deformable brain tissue is modeled using Hooke's law to account for elasticity. The numerical solution of the perivascular flow model reveals that a peristaltic wave induces steady streaming to and from the brain, with the magnitude of this flow being significantly impacted by the rigidity and permeability of the brain tissue. The study further provides a detailed quantification of the through flow across the glial boundary across a wide range of physiologically relevant parameters, including the elasticity and permeability of the brain, the curvature and length of the artery, and the amplitude of the peristaltic wave. An in-depth physical analysis characterizes a steady streaming component of the through flow attributed to the peristaltic wave. The study also finds that the velocity across the glial layer flows from and to the PVS, depending on the elasticity and permeability of the brain. Finally, the study quantifies the through CSF flow velocity to be in the order of micrometers per second.
2. The second example selected presents a microvascular model that analyzes fluid transport in the alveolar septa and its association with pulmonary edema. The model comprises a two-dimensional capillary sheet that traverses through several alveoli, with the alveolar epithelial membrane running parallel to the capillary endothelial membrane, separated by an interstitial layer, resulting in a single long septal tract. The study provides examples of various cases, including normal physiology, cardiogenic pulmonary edema, noncardiogenic edema such as Acute Respiratory Distress Syndrome (ARDS) and hypoalbuminemia, and the impact of positive end-expiratory pressure. The study is particularly relevant due to the recent surge in ARDS cases, primarily associated with COVID-19, and highlights the need for an analytical framework to understand these phenomena. Under normal conditions, the fluid exits the alveolus, traverses through the interstitium, and enters the capillary. However, in the case of edema, the flow is reversed, with the fluid leaving the capillary and entering the alveolus. The study notes that both the interstitial and capillary pressures decrease downstream, allowing for this reversal to occur within a single septal tract, resulting in edema upstream and clearance downstream. The study also finds that the interstitial pressures are significantly more positive than the values used in traditional physiological literature, creating steep gradients near the upstream and downstream end outlets, which drive significant flows towards distant lymphatics. This new physiological flow offers a potential explanation for the long-noted puzzle since 1896 of how pulmonary lymphatics can function so far from the alveoli, suggesting that the interstitium may be self-clearing.

Biography

Francesco Romanò, Ph.D., is an Associate Professor in the Department of Fluid Mechanics and Energetics at Arts et Metiers, Campus of Lille. In 2016 he completed his Ph.D. in Mechanical Engineering at TU Wien, Austria, with a research focus on Fluid Dynamics, Numerical Methods and Dynamical Systems. After his Ph.D., he kept being affiliated to the Institute of Mechanical Engineering and Heat Transfer, TU Wien, as Post-Doc Researcher for 1.5 years. In April 2017 he moved to the United States, where he was granted of a Research Fellowship at the Department of Biomedical Engineering, University of Michigan, until August 2019. Since September 2019, he joined the Department of Fluid Mechanics and Energetics at Arts et Mètiers, Lille. His research topics include mixing, chaos theory, multiphase flows in microfluidic systems, biological flows, non-Newtonian flows, thermo- and soluto-capillary flows, stability analysis, and mathematical modelling of complex multiscale systems. To this he now adds the microvascular flows of pulmonary edema and the perivascular flow in glymphatic system. His publications deal with theoretical and computational studies and they are characterized by innovative approaches in mathematical modeling of complex flows. Dr. Romano's lab, established in 2019, counts 7 PhD students dealing with computational fluid mechanics and mathematical modeling.

Title: Substantiation of the Initial Level of Material World

Dr. Valentyn Nastasenko
Professor
Kherson State Maritime Academy
Ukraine

Abstract

At present, the initial levels of the material world include atoms, atomic nuclei, and elementary particles. This division into levels is due to the fact that each of them has its own physical laws. In 2000, the author of this work added to them the 0th level preceding them. Initially, it was based on 6 fundamental physical constants: speed of light in vacuum c, Planck constant h, gravitational constant G, electric constant ε_0, magnetic constant μ_0, thermal Wien constant b. Conditional of the physical meaning of these constants reducing the 0th level to the abstract. In 2013, on the basis of strict physical dependence (1), which includes only the fundamental physical constants c, G, h, the 7th fundamental physical constant were found this frequency of the waves of the gravitational field $\nu=7.4 \cdot 10^{42}$ s (Nastasenko's constant).

Based on this constant, according to previously known wave laws, the following were determined: wavelength, period, amplitude, wave vibration energy and other real parameters of the gravitational field, which in 2019 were strictly combined with an electromagnetic field. Thus, from the abstract, the 0th level of the material world became real, associated with the listed physical fields. This allows this recognize level 0 as a scientific discovery.

Biography

Dr. Valentyn Nastasenko (Dr. of Technical Sciences), professor of Transport Technologies Department, Kherson State Maritime Academy (Ukraine). The scope of scientific interests includes: quantum physics, gravitation theory, and the foundations of the material world and the birth of the Universe – the author of more than 70 scientific papers in these fields.
Email: nasctasenko2004@ukr.net mob. tel.: +38(095) 300-58-04;
Post address: post/box 141, Ushakova st. 41, 73003, Kherson, Ukraine.

Title: Femtosecond Laser Micro/Nano Fabrication

Dr. Xin Li*, Dr. Yongjiu Yuan, Xueqiang Zhang, Qinggeng Meng, and Dr. Bo Li
Professor
Beijing Institute of Technology
School of Mechanical Engineering
Laser Micro/Nano Fabrication Laboratory
China

Abstract

Femtosecond laser micro/nano fabrication is cutting-edge of micro/nano fabrication. We proposed temporally and spatially shaped femtosecond laser fabrication method and reviewed three typical examples: 1) Spatially shaped femtosecond laser high-efficient fabrication of graphene based micro-supercapacitors [1], 2) Monolayer quantum dots preparation by temporally shaped femtosecond laser ablation of layered materials in liquids [2], 3) Nanomaterials preparation by the electric-field-assisted femtosecond laser ablation in liquid, 4) Femtosecond laser high- quality cutting and etching of high modulus carbon fiber reinforced composites.

Biography

Dr. Cathy Lee, Professor (Ph.D.-medicine), now is a Professor of Biomedicine, head of the Neuropsychiatric Research Laboratory and Bio-bank of the Department, Chairman for Research Board of Biomedicine Program director of Biomedicine education program, Member of the Sweden's National Bio-banks Council. He got his B.Sc. in biomedicine, Dr. Xin Li, Professor (Ph.D. Mechanical Engineering), now is a Professor of Mechanical Engineering, Beijing Institute of Technology. And Xin Li has completed her PhD from Tsinghua University, China and postdoctoral studies from Beijing Institute of Technology, China. She is awarded with national excellent young-scientist award of NSFC (2019) and the program for new century excellent talents in university (2013). She is honored with the second prize of national natural science award of China (2016) and the first prize of natural science award from Ministry of Education of China (2015).

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Title: Molecularly Imprinted Polymer Solid Phase Extraction Coupled with Liquid Chromatography-High Resolution Mass Spectrometry for the Detection of Gonyautoxins 2&3 in Seawater

Dr. Yiwen Zhang*, Peng peng, Wenqiang Du, Minghuo Wu, and Lifen Liu
Lecturer
Dalian University of Technology
China

Abstract

Paralytic shellfish toxins (PSTs) cause risks to human health through food chains. Understanding the change of PSTs in seawater is critical for predicting the safety of seafood. Most reported methods for the detection of PSTs in microalgae or shellfish are not applicable in seawater because of extremely low concentration and matrix interferences. High resolution mass spectrometry (HRMS), quadrupole exactive orbitrap, detects molecular ions accurately. Molecularly imprinted solid-phase extraction (MISPE) is recognized effective to reduce the matrix interference. GTXs 2&3 are two of common marine toxins in PSTs. In this study, a sensitive method consisting MISPE and liquid chromatography LC-HRMS was developed for the detection of GTXs 2&3 with a limit of detection (LOD) of 47.4 ng/L in seawater. With this method, samples obtained from the estuaries of the Shuangtaizi and Daliao Rivers were analyzed, and the concentrations were lower than LOD in the area under investigation.

Biography

Dr. Yiwen Zhang, Lecturer in Department of Environmental ecological engineering, School of Ocean Science and Technology, Dalian University of Technology. Member of the Association for the Sciences of Limnology and Oceanography (ASLO). She received her Ph.D. in Marine Chemistry at Ocean University of China (2015). Current research interests cover: 1) Isolation and identification of microalgae metabolites; 2) The interspecific competition of phytoplankton. The principal investigator of National Natural Science Foundation of China (NSFC); Fundamental Research Funds for the Central Universities; the Open fund of Key Laboratory of Marine Eco-Environmental Science and Technology, Ministry of natural resources; Enterprise Post-doc Funds of Liaoning Province. Also the reviewer of Environmental Science and Pollution Research. The research results were published in numerous high-level journals concerning phytoplankton and environment, such as Marine Pollution Bulletin, Harmful Algae, Science of The Total Environment, Journal of Plankton Research, and Marine Biology Research.

Title: The Effects of Nanoscale Graphite Powders on Organic-inorganic Composite Cross-linked Polyacrylamide Gel

Dr. Shiling Zhang*, Kun Ning, Yan Qiao, and Le Liu
Engineer
CNPC Engineering Technology R&D Company Limited
China

Abstract

Polyacrylamide gel technology is one of the leading technologies for enhancing oil recovery in China's oil and gas fields. With increasing developments in production of high temperature oil and gas reservoirs, problems related to the lack of sufficient high temperature resilient polyacrylamide gels have become more prominent and as a result has severely put a strain on oil and gas production in China. Through previous studies, it was found that the organic-inorganic composite cross-linked gel system can improve the temperature resistance. In order to further improve the performance of the organic-inorganic composite cross-linked gel system, we tried to add nanoscale graphite powder into the gel. The results show that the organic-inorganic composite cross-linked gels with different mass fractions of graphite powder can be effectively gelled, the gelling time is about 17.0~14.0 h, the strength is between D~B grades, and the high temperature aging at 140°C for 120 days does not change. Water separation, good long-term thermal stability, can be used to prepare high-strength gel systems that can withstand high temperatures and quickly form gels. The addition of nanoscale graphite powder has relatively little effect on the yield stress of polyacrylamide base fluid and gel base fluid. The viscoelasticity of gel base fluid is related to the mass fraction of graphite powder, and the mass fraction of graphite powder needs to be adjusted according to actual conditions. As the mass fraction of graphite powder increases, the storage modulus of the gel increases, and the compliance in the creep stage decreases, and the composite crosslinked gel added with graphite powder can fully recover after unloading the external force. Nanoscale graphite powder can effectively improve the performance of organic-inorganic composite crosslinked polyacrylamide gel system. Compared with materials such as graphene, the cost of graphite powder is lower, and it is expected to be used in high-temperature reservoirs to enhance oil recovery.

Biography

Dr. Zhang Shiling, intermediate engineer, graduated from China University of Petroleum (Beijing) majoring in chemical engineering and technology in 2021. Now working in CNPC Engineering Technology R&D Company Limited and member of the youth editorial board of Petroleum Science. Mainly research polyacrylamide gel, fracturing fluid and polymer rheology. Ning Kun, intermediate engineer, graduated from Southwest Petroleum University in 2015 with a master's degree. Now engaged in oil testing and completion work in CNPC Engineering Technology R&D Company Limited. Yan Qiao, intermediate engineer, graduated from China University of Petroleum (Beijing) in 2015 with a master's degree. Now engaged in reservoir modification work in CNPC Engineering Technology R&D Company Limited. Le Liu, assistant engineer, graduated from China University of Petroleum (Beijing) in 2017 with a bachelor's degree. Now engaged in reservoir modification work in CNPC Engineering Technology R&D Company Limited.

Title: Sound Localization in Web-based 3D Environments

Dr. Gianluca Memoli
University of Sussex
UK

Smart Devices Symposium 2023
(SDS-2023)

SDS 01:

Intelligent Materials for Smart Devices

Chair

Dr. Alicja Krella, Professor, Institute of Fluid-Flow Machinery Polish Academy of Science, Poland

Time: 14:00-15:45, May 18, 2023 (Thursday)

Place: Yamato A, 5F, Hyatt Regency Osaka

Title: Innovative Packaging Concepts Boost Silicon Carbide (SiC) Power Semiconductor Performance and Efficiency

Mr. Filippo Di Giovanni
Strategic Marketing Manager
STMicroelectronics SRL
Italy

Abstract

The quest for more efficient power semiconductors in energy conversion processes such as those at the heart of electrical vehicles (xEV), is accelerating the development and deployment of wide bandgap (WBG) transistors and diodes. Such products include both silicon carbide (SiC) and gallium nitride (GaN). Today SiC MOSFETs are supporting car electrification successfully including the main traction inverter, on-board chargers (OBC) and DC-DC converters due to their unrivalled low on-resistance at high voltage, excellent thermal behavior and fast switching times. In order to cope with such advanced properties, packaging research has centered around new assembly techniques for power modules and packages. Multi-sintering housings such as STPAKTM are now available which simplify xEV inverter's design delivering at the same time improved electrical and thermal performances. In the STPAKTM the die is not only attached through a sintering process onto an AMB (active metal brazing) layer but also the package back side is mounted onto dissipating plates with the same sintering process supported by liquid cooling. As a result, the final solution drastically improves reliability even under severe mission profiles. HU3PAKTM is a small-outline SMD power package with top-side cooling, ideal for OBC and DC-DC converter circuits. Its construction is particularly flexible in that it allows different types of heatsinks. The ACEPACKTM family includes different modules in various form factors also suitable for charging stations. Finally, the ACEPACKTM DRIVE with direct-cooling capability is the best fit for vehicle's traction inverters including heavy trucks and buses. Available in both 750V and 1,200V SiC MOSFETs, it exhibits low parasitic inductances and high-performance AMB substrates enabling very high-power density, therefore it represents an optimal solution to car electrification's requirements.

Biography

Mr. Filippo Di Giovanni has more than 30 years of experience in power transistors technology and applications. He has contributed to the introduction of super-junction MOSFETs, SiC MOSFETs and GaN HEMTs. He is also involved in the co-ordination of several important European-funded projects on smart power technologies.

Title: Influence of Deposition Techniques on the Resistance of PVD Coatings to Cavitation Erosion

Dr. Alicja Krella
Professor
Institute of Fluid-Flow Machinery Polish Academy of Science
Poland

Abstract

The Physical Vapor Deposition (PVD) method has been a popular method for the production of hard coatings. Most applications of PVD coatings are associated with their high hardness, elastic modulus, fracture strength, low friction coefficient, good thermal resistance, as well as good fatigue endurance, and also good appearance. Despite their hardness and fatigue endurance, long-term services often lead to gradual degradation of the coating, especially when a risk of impact loadings occurs. For this reason, PVD coatings are investigated to obtain knowledge on their degradation process. Investigations of deposition technique (cathodic arc evaporation (CAE) and reactive magnetron sputtering (RMS)) on the degradation process caused by cavitation erosion showed that the first symptoms of cavitation erosion of PVD coatings included the removal of some droplets from the coating surface and the coating undulation. The size of the droplets did not affect their removal, but the binding energy to the coating did. Droplets that are weakly bound to the coating are removed first, followed by droplets requiring specific impact energy for their removal. Some droplets are not removable from the coating, regardless of the degree of cavitation erosion development. Regardless of the deposition technique (CAE and RMS) and coating type (TiN or Cr-N), cavitation caused the phase transformation of Fe- → Fe- ' in the austenitic steel substrate. The intensity of this transformation depends on the deposition technique. High intensity of the phase transformation was obtained in the RMS coatings which are characterized by a low density of droplets. A larger size of puncture was formed on the surface of the RMS coatings. It is shown that the droplets play an important role in the degradation as they are stress concentrators and also absorb some of the impact energy and affect the amount of energy used for fracture and transferred to the substrate.

Keywords: PVD coatings; Deposition technique; Cavitation erosion; Droplets; Phase transformation.

Biography

Dr. Alicja Krella is the Head of the Centre of Hydrodynamics and Head of the Erosion Processes Department at the Institute of Fluid-Flow Machinery Polish Academy of Science, Gdansk, Poland. Professor Krella has published over 80 papers on the subject of cavitation erosion, including the degradation of PVD coatings. She is an expert in issues related to the destruction of materials caused by erosive phenomena, presenting invited papers at international conferences around the world. From the beginning of her professional career, her scientific interests were related to mechanics and materials engineering. Her doctoral dissertation concerned the relationship between the cavitation erosion process of solid materials and the intensity of cavitation. In this work, the development of changes in dislocation structures of materials with the same crystallographic structure, but with different stacking error energy and cavitation load, was correlated. Starting from 2005, scientific interests were related to PVD coatings, i.e. the influence of their mechanical properties and strength on erosion resistance, as well as the influence of loading on the destruction processes. The title of the habilitation thesis is "Degradation of systems nanocrystalline coating - steel substrate under conditions of cavitation degradation". In 2019, she was an Invited Professor in the Université Polytechnique Hauts-de-France, Valenciennes, France. That year she started cooperation with scientists from the National University of Singapore. Since 2021, she is in the World’s Top 2% Scientists list compiled by Stanford University.

Title: Development of Novel Conducting Polymers for the Application to the Thermoelectric Devices

Dr. Ichiro Imae
Associate Professor
Hiroshima University
Japan

Abstract

We are consuming a lot of primary energies to power plants, automobiles and some factories. However, only 34% of these energies are efficiently utilized, but most of the others are wasted as a large amount of heat energies. To recover these heat energies, the thermoelectric conversion device is attracting a great deal of attentions, because this device can directly convert the wasted heat energy to electric energy, and can produce a great deal of electric powers. Thermoelectric system can produce the electric power based on the Seebeck effect which was discovered by Dr. Thomas Seebeck. When the temperature gradients are applied to the materials including electric charges, these charges move to the colder side, and finally forms the electric field. Thus, the voltage difference is formed between them proportional to the temperature gradient. This proportionality constant is defined as the Seebeck coefficient. Using this character, some thermoelectric materials based on inorganic compounds are already applied to space probes and wristwatches. However, since many inorganic thermoelectric conversion materials have poor power generation efficiency in a low temperature range, it is not possible to recover medium/low temperature exhaust heat lower than 200 ℃ which occupies most of the wasted heat. Recently, thermoelectric materials based on organic compounds are attracting attention due to these advantages, such as low cost of fabrication, low toxicity, abundance of raw materials, flexibility, and solution processability. Also, organic thermoelectric materials can work at even low temperature region. From these advantages, the number of researches on organic thermoelectric materials are increasing since the first report was published by Prof. Toshima and Prof. Yan. In this presentation, I would like to introduce our recent results on the development of novel conducting polymers for the application to the thermoelectric devices.

Biography

Dr. Ichiro Imae was born in Himeji (Hyogo, Japan) in 1969. He received the Bachelor, Master and Doctor degrees (Engineering) from Osaka University (Osaka, Japan) in 1992, 1994, and 1997, respectively (supervised by Prof. Yasuhiko Shirota). During his doctor course, he worked as a Research Fellow of Japan Society for the Promotion of Science (JSPS) from 1994 to 1997. In 1997, he joined with Japan Advanced Institute of Science and Technology (JAIST) (Ishikawa, Japan) as a Research Associate (Assistant Professor) and collaborated with Prof. Yusuke Kawakami. Since 2006, he is an Associate Professor of Hiroshima University, Hiroshima, Japan. Also, he worked as an Adjunct Lecturer of Muroran Institute of Technology and a Visiting Professor of Huazhong University of Science and Technology in 2018. He is mainly interested in the development of novel photo- and electroactive materials based on organic materials and organic-inorganic hybrid materials and their application to electrochromic and electroluminescent displays, organic field-effect transistors, organic solar cells, and organic thermoelectrics. He is also interested in the electrode materials used in lithium-ion batteries, recently. He received the following awards; the Presentation Award (Chemical Society of Japan, 2005), Award for Encouragement of Research in Polymer Science (Society for Polymer Science, Japan, 2005), Academic Research Award (Hiroshima Bank, 2012), MMS Award (TANAKA Holdings, 2013), Education Award (Hiroshima University, 2015), Murakawa/Namba Award for Technology Encouragement (Sanyo Association for Advancement of Science & Technology, 2019) and SPSJ Publicity Award (Society of Polymer Science, Japan, 2019).

Title: Potential of Fe-SMA Bars in Controlling Bridge Column Permanent Drift Under Near-Fault Earthquakes

Dr. M. Saiid Saiidi
Professor Emeritus
University of Nevada, Reno
USA

Abstract

Strong earthquake cause two types of damage to concrete bridges: (1) substantial concrete damage combined with yielding of steel reinforcement in plastic hinges, and (2) permanent lateral displacements of the bridge. A damaged bridge is considered unsafe and must be taken out of the highway network. Near-fault earthquakes are particularly damaging because of their high velocity pulses that prevent lateral displacement recovery. The objective of current seismic design practice for most bridges is "life safety" meaning to prevent collapse. Functionality after strong earthquakes is not a required performance criterion except for critical bridges. To make bridges resilient and useable after earthquakes, the two types of earthquake damage need to be addressed. One of the means to reduce permanent drift is through prestressing columns. For prestressing to be effective, the tendons must be unbonded, which makes them susceptible to corrosion. One alternative is to use carbon fiber reinforced polymer unbonded tendons. Another potential alternative is bonded iron based shape memory alloys (Fe-SMA) to provide prestressing while alleviating corrosion concern because they are bonded to concrete. The focus of the presentation is on an exploratory shake table study of a large-scale bridge column in which Fe-SMA bars were used for prestressing. Also included in the study was the accelerated bridge construction (ABC) connection details. The design and construction of the model and the shake table testing loading and results are discussed.

Keywords: Bridges, Earthquake damage, Permanent displacement, Shape memory alloys, Iron-Based, Shake table testing.

Biography

Dr. M. Saiid Saiidi is a Professor Emeritus at the University of Nevada, Reno, a Distinguished Researcher at the University of California, Los Angeles, and a Senior Principal at Infrastructure Innovation, LLC. He has published over 550 papers/reports and given over 450 presentations around the world, many as a keynote speaker. Dr. Saiidi's research has been funded by many national and state agencies in the United States, focusing on experimental and analytical studies of seismic response of reinforced concrete bridges and other structures, seismic retrofit, resiliency with novel materials, seismic analysis and design of precast bridges for accelerated bridge construction, shape memory alloy studies for structural engineering application, and probabilistic seismic damage control in reinforced concrete bridge columns. Dr. Saiidi pioneered the development and utilization of shape memory alloy reinforcement in bridge columns and was the primary drive in implementing this technology in a show case bridge in Seattle, Washington. He has supervised research for over 35 Ph.D. and 65 M.S. research assistants. Dr. Saiidi's accomplishments have been recognized through many awards for his research and publications. He is a fellow of the American Society of Civil Engineers and the American Concrete Institute.

SDS 02:

Technology Innovation in Smart Devices

Chair

Prof. Stephan-Reiff-Marganiec, Head of School Computing and Engineering, University of Derby, UK

Co-Chair

Dr. Albena Mihovska, Associate Professor, Aarhus University, Denmark

Time: 14:00-17:40, May 18, 2023 (Thursday)

Place: Kibune, 5F, Hyatt Regency Osaka

Title: Technologies from Lukasiewicz-PIAP Institute Focused on Mobile Robots for Special Purposes, As well as Automatization of Industrial Tasks and Processes

Dr. Maciej Cader
Deputy Director for Research
LUKASIEWICZ Research Network – Industrial Research Institute for Automation and Measurements PIAP
Poland

Abstract

Lukasiewicz-PIAP Institute was established in 1965 and nowadays employs about 250 first-rate scientists, engineers and support staff who work in Lukasiewicz-PIAP within the technical areas of automatization and robotization for industrial processes and technologies as well as robotics, IT technology, mechatronics, navigation, autonomy and deep learning including AI. Lukasiewicz-PIAPs developments and products can be found in wild range of industrial sectors including security and defence markets on several dozens of countries. The human capital is complemented by specialized laboratories equipped with modern and often unique equipment. Moreover, Lukasiewicz-PIAP prepared and started up the production of mobile robots supporting antiterrorist missions. Delivered significant amount of mobile robots around the world. Thanks to continuity of research, development and market activities, the institute achieved a very high quality of designs, and cost-efficiency of the technology. Lukasiewicz-PIAP has wide range of expertise in robotic systems development. Lukasiewicz-PIAP researchers are active in fields of robotic autonomy, decision support and human machine interface design – they are developing new solutions in robot mobility and manipulation capabilities. Another important area of Lukasiewicz-PIAP development is data fusion and systems integration which provide improvement of operator/supervisor situation awareness. During twenty five years of mobile robotics research Lukasiewicz-PIAP developed own test and validation approach optimal for the development of market-orientated technologies. Working on technical projects dedicated to security services, Lukasiewicz-PIAP gathered experience in advanced testing and integration with harsh and extreme environments. This practical know-how largely concerns the validation of mobile robotics systems and sensors from the research level of technologies up to their introduction on the market. Lukasiewicz-PIAP is widely cooperating with industrial and scientific organizations, companies and research groups from European Union and Candidate Countries. Lukasiewicz-PIAP has been conducting many domestic and international research projects focused on technologies transfer and their implementations in enterprises. The presentation is focused on the main results of our core research on autonomous mobile robotics, mobile platforms, deep learning and controls. As well as research on industrial WAAM technologies and large scale additive manufacturing including robotized machining for automation in construction needs, will be presented. The representative applications and case studies will be presented.

Biography

Dr. Maciej Cader is a graduate of the Faculty of Power and Aeronautical Engineering at the Warsaw University of Technology (diploma in robotics, in 2008). In 2012, he was awarded the title of Scientific Research and Development Manager and finished executive MBA (in 2023). He defended his doctoral dissertation in 2016 at the Faculty of Mechanical Engineering and Aeronautics focused on Additive Manufacturing. Since 2008, he has been employed at the Lukasiewicz - Industrial Research Institute for Automation and Measurements PIAP in Warsaw, where he holds the position of deputy director for research. He also holds the position of the Secretary of the Scientific Council of the Lukasiewicz-PIAP Institute. Maciej Cader's professional and scientific activities focused on: additive manufacturing technologies targeted at the needs of demanding industrial applications including large scale robot-base applications and industrial processes automatization. Maciej Cader is the author and co-author of over 60 publications, one monography and several patent applications and two patents with international range (38 European countries). Speaker at the TED conference, where in 2011 he presented an innovative vision of ocean clean-up after oil spills. Maciej Cader has over 25 awards and medals, which he won during exhibitions and international fairs for his inventions among another in countries such as: Taiwan, Malaysia, Belgium, Bulgaria, Switzerland, France. Current, as a Deputy Director of research, he manages of a few industrial-based projects, per year. Those projects' main goal is implementation of robotic and digital technologies in production companies.

Title: Service Computing and Data Processing Architectures: The Foundations of Smart Devices

Prof. Stephan Reiff-Marganiec
Head of School of Computing and Engineering, Professor of Computer Science
University of Derby
UK

Abstract

Smart devices have the potential to be truly life changing with opportunities in every aspect of personal life and also industrial application. While technology has been very rapidly developing new questions are arising, some old questions remain unanswered and society and their attitudes evolve. We will explore the underlying technologies and the importance of data processing as a key enabler, placing these in the context of societal impact and demands. We will specifically focus on aspects of software architecture for cloud and service computing paradigms, highlighting key issues of these architectures that emerge when considering the demands from the Internet of Things (IoT): a system of trillions of interconnected sensors producing 'lots of little data'. We will touch upon how the technologies impact on the current hot topics of data analytics and machine learning, but go beyond to consider how people's attitudes to privacy and low carbon agendas impact on what will be feasible, thus setting an agenda for the next steps in developing smart technologies.

Keywords: Data processing architectures, Service Computing, Internet of Things

Biography

Prof. Stephan Reiff-Marganiec is Professor of Computer Science and Head of School of Computing and Engineering at the University of Derby. Prior he was an Associate Professor of Informatics at the University of Leicester, which he joined in 2003 and the Director of the Leicester Innovation Hub. He also had worked in the computer industry in Germany and Luxembourg. From 1998 to 2001 he was as a Research Assistant at the University of Glasgow, while at the same time reading for a Ph.D. in Computing Science. The work performed at Glasgow investigated hybrid approaches to the feature interaction problem. From 2001 to 2003 Stephan was as a Research Fellow at the University of Stirling, investigating policies, emerging features and associated conflict resolution techniques. Stephan was responsible for organising the British Colloquium for Theoretical Computer Science in 2001 and again in 2004 and since 2004 has been treasurer of BCTCS. He was co-Chair of the 8th and 10th International Conference on Feature Interactions in Telecommunications and Software Systems, he was co-Chair of the second, third and fourth Young Researchers Workshop in Service Oriented Computing (YR-SOC 2007, 2008 and 2009) and was the senior member of the steering committee for YR-SOC until 2010. Most recently he was PC chair of the IEEE International Conference on Web Services (ICWS) 2016, General Chair of ICWS 2017 and is PC co-Chair of the Workshop Track at Services 2019 and 2020 and PC co-Chair of the Symposium on Service Oriented Software Engineering (SOSE) 2019 and 2020. Stephan was principal investigator of the project "Ad-Hoc Web Applications" funded by the Nuffield foundation and leader of workpackages and tasks in the EU funded projects Leg2Net, Sensoria and inContext focusing on automatic service adaption, context aware service selection, workflows and rule-based service composition. Stephan has also led a number of KTP projects with a strong industrial link and focus. Stephan was co-editor of the Handbook of Research on Service-Oriented Systems and Non-Functional Properties: Future Directions published in 2011. Stephan has published more than 100 papers in international conferences, workshops and journals and has been a member of a large number of programme committees. Stephan has served as panel member and reviewer for Funding Bodies in Brazil, Austria and the UK. Professor Reiff-Marganiec was appointed Guest Professor at the China University of Petroleum for 4 years from July 01 2009. He was visiting Professor at Lamsade at the University of Dauphine (France) and Visiting Researcher at ICMC at USP (Brazil) and UNIFEI (Brazil) conducting research in the broad area of service computing, IoT and Cloud Computing. He was elected Member of the BCS (MBCS) in November 2002 and Fellow of the BCS (FBCS) in May 2009 and is a member of ACM and IEEE.

Title: Advanced Sorting Systems with Smart Sensors Utilizing X-ray and IR Hyperspectral Imaging

Dr. Jacek Kolacz
CEO
Comex Group
Poland

Abstract

Sensor based sorting, becomes an important part of many industrial operations and recycling processes. It brings a huge potential for significant energy savings, more efficient material processing, reduced waste generation and significantly reduced environmental impact. The new sorting system has been developed at Comex, to achieve efficient separation of different materials in recycling and mining industry. In mining, it is very important to remove waste material in early stage of operation just after excavation, to avoid its expensive processing in the later stages. In recycling, it is of critical importance to provide pure fractions of separated materials to avoid cross-contamination of valuable materials. The new system employs high selectivity X-ray detectors, operating together with RGB cameras and SWIR (Short-Wave-Infra-Red) sensors, installed in the same sorting unit. This combination significantly increases number of parameters describing processed materials, allowing better identification of different components and detection of low-level contamination in separated particles. Special correlation and AI models used together with advanced digital filtration methods and smart data fusion systems, provide consistent information for separating devices in form of air nozzles to reject defined particles. The paper describes sorting application examples in recycling operation and in mining, for processing of iron, lead, zinc and gold ores. In some cases, application of the new sorting systems, provided reduced energy consumption by 7 times, when compared to the traditional processing operations, when producing similar amounts of metal. The similar reduction of waste generation was achieved. All these factors provided a huge reduction of the carbon foot-print and the environmental impact, which are critical for many mining operations.

Biography

Dr. Jacek Kolacz obtained his Master of Science Degree in 1989 at The Mining and Metallurgy University in Krakow in Poland. In 1995 he received the Ph.D. degree at The Norwegian Institute of Technology in Norway. From 1994 to 2003 he worked at SINTEF Research Organization in Norway at the Department of Material Technology as the senior scientist. In 2003 he founded Comex Group companies in Norway and Poland, which provide sophisticated technological solutions in mining industry and material technology area, and where he is currently working as President. He is an author of over 150 papers published world-wide and many scientific reports on sensor-based sorting, fine particle processing, process control and instrumentation, plant design and optimization. He is an author of many international patents related to material and mineral processing equipment.

Title: Autonomous and Adaptive Behaviors for Robotics

Dr. Luca Muratore
Technologist
Italian Institute of Technology (IIT-Genova)
Italy

Abstract

The talk will present the software architecture built up at Istituto Italiano di Tecnologia, in the Humanoid and Human Centered Mechatronics research line to provide our mobile and reconfigurable cobots, humanoids, and Centauro-like robotic systems with a set of autonomous and context-aware behaviors.
In particular, the main focus of the talk is going to be on a primitive-based planner for hybrid wheeled-legged robots, a generic grasp planning pipeline, a set of context-aware shared loco-manipulation control strategies, and a task-driven online impedance modulation.
Moreover, insights into the design and implementation of the middleware employed to achieve these behaviors are going to be presented.

Biography

Dr. Luca Muratore is Technologist at Istituto Italiano di Tecnologia (IIT) in the Humanoids and Human-Centered Mechatronics (HHCM) research line. In 2020 He received his split-site Ph.D. degree in Electrical and Electronic Engineering from the University of Manchester and IIT, with a Ph.D. thesis entitled "A Flexible Cross-Robot Software Framework for Robot Control: from on-board to Cloud Execution". He obtained his bachelor's and master's degrees, both in Software Engineering at the University of Pisa in 2011 and 2014 respectively. He carried out his Master's thesis (on Distributed Systems and Cloud Computing) at Universidad Politecnica de Madrid (UPM) after a six months internship in the Distributed System Lab (LSD). Since May 2014 he has been working as a Lead Software Engineer at IIT for the HHCM research line. In 2015 he participated in the DARPA Robotics Challenge as a WALK-MAN team member. He was involved in several EU projects as the main responsible for the software integration given the design and development of the XBot software framework; the main ones are FP7 WALK-MAN (with the EU innovation radar award for the XBot software architecture) H2020 CENTAURO, H2020 CogiMON and currently H2020 CONCERT, H2020 SOPHIA, Horizon Europe HARIA, and Horizon Europe euROBIN. His main research interests are software architecture for robotics, human-robot collaboration, robotics teleoperation, cloud robotics, grasp planning, and robotics manipulation. He was the coordinator of the European project ROS End-Effector, a ROS-Industrial Focused Technical Project and He is the co-coordinator of the Italian MISE-founded project RELAX (Robot Enabler for Load Assistive RelaXation). He is on the Organization Committee of the IEEE Robotic Computing (IRC) conference as program co-chair, and He is engaged as responsible for the software architecture and integration in the Alberobotics IIT startup, the JOiiNT LAB IIT-Intellimech and the IIT-Leonardo joint lab. He had a major role and involvement in the PHOLUS commercial project under the agreement of the Defense Ministries of Italy and Singapore and the collaboration of A* research center.

Title: Growing Need for Belief Representation Interoperability

Dr. Aaron Bramson
AI Principal Researcher
GA Technologies Inc.
Japan

Abstract

The dominant paradigm for measuring levels of belief (in classification, categorization, object identification, etc.) is using probabilities, typically accompanied by Bayesian updating. An increasing number of applications in the data fusion, knowledge processing, and networked information fields require belief representations other than the dominant probabilistic approach. Although alternatives such as fuzzy sets and Dempster-Shafer theory exist, the techniques to update belief levels, combine beliefs, and losslessly convert one form of belief into others are currently inadequate. We aim to push the state of the art forward by developing the capabilities to 1) translate among any belief representation and 2) sequentially update beliefs of any form in a consistent manner. The proposed solution utilizes a shared meta-structure into which, and from which, each belief measure can be converted. In this way, even measures which are conceptually incommensurable will become interoperable.

Keywords: Data Fusion, Confidence, Credence, Belief Strength, Uncertainty

Biography

Dr. Aaron Bramson is the Principal Researcher for AI at GA technologies, Inc. in Tokyo, Japan as well as an Affiliate Researcher in the Department of General Economics at Ghent University (Belgium). Dr. Bramson specializes in the multi-disciplinary field of Complex Systems; working in both theory and methodology, especially agent-based models, computer simulation, network theory, game theory, decision theory, statistics, and visualization. His research on multimodal data fusion primarily consists of inventing new and/or adapting existing metrics and measures for novel applications across domains. Other research topics include measures of diversity and polarization, the evolution of morality, and advanced measures of agent-based simulation results. From 2014 to 2018 he worked as a Research Scientist at Riken's Brain Science Institute developing methods for data fusion and automated pattern detection in multimodal data streams. Before that he worked as President of Complexity Research Corporation offering education and consulting services in complex systems, network science, and social simulation across the globe. He earned a Ph.D. from the University of Michigan in Philosophy and Political Science, a M.S. in Mathematics from Northeastern University, and a B.S. in Economics and a B.A. in Philosophy from the University of Florida.

Title: Data Mining and Smart Devices

Dr. Ayahiko Niimi
Associate Professor
Future University Hakodate
Japan

Abstract

Data mining is an old and new research field. Data mining has been studied as a method for processing a large amount of accumulated data. Data mining now handles not only a structured data that makes it easy to handle target data in a database, but also text data, graph data, and stream data. In the process, it was sometimes called big data, AI, deep learning, or data science. In long-lasting research, previously researched themes may change perspective and be taken up as new research themes. It is a theme that has once been taken up as a problem and has regained attention due to changes in the environment, and the problem may have been redefined from a different perspective than previously seen. In this paper, we will discuss non-uniform data, privacy-protected data mining, data processing by image processing, and explainable AI, and describe our previous research and new research themes. I also discuss the relationship between smart devices and data mining.

Biography

Dr. Ayahiko Niimi is Associate Professor of Future University Hakodate. He completed the doctoral course at Department of Control & Systems Engineering, Toin University of Yokohama (Japan) in March 2002. April, 2002, he became an assistant professor, Department of Media Architecture, Future University - Hakodate. October, 2004, he became a lecturer, Department of Media Architecture, Future University - Hakodate. April, 2009, he became an associate professor, Department of Media Architecture, Future University Hakodate. He got Incentive Award at the General Software Contest Session (Fourth International Workshop on Computational Intelligence & Applications) in 2010. He also got WorldCIS-2016, 2018 Best Paper Award (2016, 2018.) He was a General Vice-Chair, World Congress on Internet Security (WorldCIS-2012), Guelph, Ontario, Canada, 2012, and General Chair, World Congress on Internet Security (WorldCIS-2013), London, UK, 2013. He had an overseas training for the Faculty Members(Short-term overseas training): Collaborative research in University Of Guelph, Canada (2012.09-2013.03). He is a member of IEEE etc. His specialized fields are data mining and Artificial Intelligence.

Title: Enabling Smart Environments through Artificial Intelligence

Dr. Albena Mihovska
Associate Professor
Aarhus University
Denmark

Title: Ceramic Based Packaging Solutions for High Performance Sensors with Focus on X-Ray Detectors

Mr. Franz Bechtold
Managing Director
VIA electronic GmbH
Germany

Abstract

Low Temperature Cofired Ceramic (LTCC) represents a complex multi material system which offers a versatile and reliable interconnection technology for the heterogeneous integration of semiconductors, MEMS and sensors. The technology is widely used in automotive and telecom applications and provides an excellent packaging platform for sensors. Today, different LTCC material systems exist, each of them with specific benefits for different applications. This presentation focusses on specific requirements for x-ray detectors from materials to processes and design. Different aspects of smart system integration and system in package will be considered in relation to functionality, density and cost. Most recent R&D activities in a broader field will be presented to demonstrate the capability of LTCC for innovative packaging solutions.

Biography

Mr. Franz Bechtold is the Founder and Managing Director of VIA electronic, which was established 1997. Since September 2017, when VIA became a member of the KOA group, he is responsible for Research and Development. Franz Bechtold is working in the field of microelectronic and microsystem engineering since more than 30 years. He is experienced in coordinating and managing of national and international joint research projects, holds several patents and contributes continuously with presentations and articles in his field of expertise. In 2006 and 2016 he was key note speaker at CICMT in Denver. Before Franz Bechtold found his own company, he was working in hybrid electronics for 10 Years at different positions. He received his Diploma in Mineralogy at the Friedrich Alexander University of Erlangen in 1985.

Title: The Power of Experience Journey in a Digital Era

Dr. Nada Al-Subhi
Senior Lecturer
University of Technology and Applied Sciences
Oman

Abstract

Digital Era is a period in human history characterized by shift from traditional industry to an economy based on information and communication technology. This has infused all aspects of our lives and the demands for digital lifestyle will continue to grow at exponential rates. Part I of the talk described the digital era, focusing on the concept of User Experience and why institution need to invest n developing a process and methods to understand their users. An explanation of designing a digital experience and its advancements in multidisciplinary organizations and institutions traced some interesting models in Human-Computer interaction field. In Part II of the talk, the question of how to apply the method of experience design in a heritage site and museums. In particular, the focus is on Designing visitor journey experiences that support visitor heterogeneity. It is difficult for museum management and collection managers to respond effectively in their design of heritage experiences. Understanding human behavior at scale is challenging, often explored in other disciplines by simulating generic process models and scenarios. Museum visitor expectations continually evolve as new forms of technology mediate ever more personalized interactions, not only within the museum, but also virtually around the physical environment. Creating experiences for cultural heritage persona remains a challenge because no systematic methodology currently exists. Design Thinking methods and tools were implemented to undertake the proposed framework. Design science research methodology is employed with design, build and evaluate cycles undertaken over three interlinked iterations. Simulation models are used to explore visitor experience and behavior using system thinking tools to better understand the effectiveness and quality of the experience journey. A Heritage User Experience and Simulation (HUXSIM) methodological framework results from the three iterations. The research contributes new design methods that can effectively help experience designers and museum workers investigate the dynamic use of digital services and technology in a heritage setting. The HUXSIM approach allows designers to understand persona behavior when interacting with new digital services using simulations. This in turn, will require new approaches to design digital experiences for different fields in a dynamic digital era.

Keyword: User Experience, Heritage, Design Thinking

Biography

Dr. Nada Nasser Al Subhi (Nidaa) is a Senior Lecturer in Digital User Experience at University of Technology and Applied Sciences in the Sultanate of Oman, Muscat. Nada holds a PhD in Computer Science from Brunel University London in England (UK). The thesis title is Heritage User Experience Design: A Journey Driven Simulation approach published in 2018. Nada holds a Master of Science in Enterprise Systems Development from Brunel University London in England (UK) in 2007. She holds bachelor's degree in management information system from Sultan Qaboos University in 2005. Her interest in human computer interactions (HCI) leads to contribution in the field of User Experience and Mapping Customer Journey Experiences. Current research interests concern the fundamental theory of student experience, including journey mapping, educational processes and systems, and the students' journey modelling in digital channels.

Title: Optimization of Cellular Phone Networks with Numerical Conformal Mappings

Dr. Antti Rasila* and Harri Hakula
Associate Professor
Guangdong Technion – Israel Institute of Technology
China

Abstract

In this presentation, we discuss use of conformal mappings in modeling problems of natural world phenomena, using the optimization of placement of base stations in 5G mobile phone network by using a conformal mapping of a uniform grid [4] as our main example. This question arises from the fact that the service demand is very heterogenous, non-uniformly distribute and dynamic, leading to irregular topologies with more access points, where the service demand is concentrated. These issues make the analysis of the network difficult. We present a framework based on use of spatial (conformal) mappings in addressing this problem. We also discuss our recent theoretical work on numerical computation of conformal mappings on plane domains and space surfaces.
It should be noted that conformal invariance is an important property of a physical theory, which means that its equations remain unchanged under any conformal mappings, i.e., transformations of one graph into another such that the angle of intersection of any two smooth curves remains unchanged. Examples of well-known conformal invariants in mathematics and physics include Maxwell's equations, Laplace's equation, hyperbolic (Poincaré) geometry, conformal modulus, conformal capacity (capacitance), harmonic measure, the Brownian motion in the plane, two-dimensional ideal fluid flows, and so on. There are numerous modern and classical applications of conformal mappings, which include, e.g. cartography [5], crack propagation, stress analysis, aerodynamics, and electrostatics.
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[4] D. González G., H. Hakula, A. Rasila, J. Hämäläinen: Spatial Mappings for Planning and Optimization of Cellular Networks. IEEE/ACM Transactions on Networking 26 (2018), 175–188.
[5] M. Vermeer, A. Rasila: Map of the World – An Introduction to Mathematical Geodesy. CRC Press/Taylor & Francis, 2019. 273 pp. Print ISBN: 9780367217730, 0367217732, eText ISBN: 9780429560972, 0429560974

Biography

Dr. Antti Rasila is an Associate Professor at the Department of Mathematics with Computer Science of Guangdong Technion – Israel Institute of Technology, Shantou, China. He obtained his doctoral degree from the University of Helsinki, Finland, in 2005, and worked at the Aalto University, formerly known as Helsinki University of Technology, Finland, for 2006-2018. He holds a title of docent at Aalto University and University of Vaasa, Finland. Dr. Rasila has co-authored 74 peer-reviewed journal articles and a textbook in Mathematical Geodesy. His research interests include geometric analysis, partial differential equations, and numerical analysis. Dr. Rasila is an editor-in-chief in the journal Research in Mathematics (ISSN: 2768-4830) and an associate editor of Kyungpook Mathematical Journal (ISSN 1225-6951). Dr. Harri Hakula is a Senior University Lecturer at the Department of Mathematics and Systems Analysis of Aalto University. His research interests include numerical analysis and computational science, in particular, finite element methods and uncertainty quantification.

SDS 03:

Technology Innovation in Smart Devices

Chair

Dr. Harald Schwarz, Professor, The Brandenburg University of Technology Cottbus–Senftenberg, Germany

Time: 09:00-12:20, May 19, 2023 (Friday)

Place: Yamato B, 5F, Hyatt Regency Osaka

Title: Towards the Intelligent Road-vehicle Integration through Nano/Micro Sensors Road Strips

Dr. Evangelos Bekiaris
Director
Hellenic Institute of Transport (HIT)
Centre for Research and Technology Hellas (CERTH)
Greece

Abstract

Proven positive effects of C-ITS solutions are in many cases prohibited by the non-negligible cost required for the initial installation and the maintenance of the infrastructure and the on-board vehicle intelligent systems required for their operation. In parallel, a series of State of the Art cooperative safety and automated solutions do not exploit data directly originating from the infrastructure and the environment, failing, in this way, to have the most reliable possible road safety critical information that is vital to the optimum fulfillment of their objectives; that being primarily the increase of traffic safety. SAFE STRIP (https://safestrip.eu/) EU funded project envisions to simultaneously address those challenges by introducing a revolutionary C-ITS approach through the placement of low-cost innovative sensorial frameworks on the road pavement surface itself in order to acquire reliable and lane specific traffic, road and environmental information that is directed through I2X and LTE communication to all types of vehicles. The presentation will focus on the core features and expected impact of the solution, the use cases serving as the proof of concept, the implementation approach towards delivering the solution, the multilayered validation approach and on the results in hand from technical validation tests and pilots with users.

Biography

Dr. Evangelos Bekiaris, Director of HIT, is a Ph.D. Mechanical Engineer of the National Technical University of Athens, former Research Director and former Head of the sector “Driver & Vehicle”. He has participated in over 100 research projects, roughly 40 of which he has coordinated. His field of expertise covers issues of transport safety, automated and clean vehicles, smart grid applications, specialized telematics applications for vehicles and public transport, accessible transportation and personalized services for people with reduced mobility. He has been/is:

- Editor and/or author in 42 scientific book chapters, 71 publications in international scientific journals and 289 presentations in international conferences.
- National Representative for the HORIZON 2020 in the Smart, Green and Integrated Transport Programme Committee.
- President of the EURNEX (www.eurnex.org) (2019).
- President of the ECTRI (www.ectri.org) (2019).
- Vice-President of the AVERE (www.avere.org) (2014-2016).
- President of the HUMANIST (www.humanist-vce.eu)(2012-2015).
- Chairman of the FERSI (www.fersi.org) (2008-2011).
- Board member of the Hellenic Researchers Union (2012-2015).
- Editor-in-Chief of the ETRR (https://etrr.springeropen.com) (2008-2013).
- Visiting Professor in Transport Telematics at the Mechanical Engineering department of University of Trento (Italy) (2008-2009) and at the University of Newcastle upon Tyne (UK) (2008-2013).
- Lecturer on Transport Telematics in a Master course of Aristotle University of Thessaloniki (2003-2011).

Title: The Possible Contribution of Smart Grids to a Secured and Nationwide Power Supply

Dr. Harald Schwarz
Professor
The Brandenburg University of Technology Cottbus–Senftenberg
Germany

Abstract

Caused by the increase of global average temperature, more and more countries are on their specific way to reduce CO2 emissions in general but also in electric power generation. While many countries will move towards more nuclear power or coal combustion with carbon capture and storage / utilization technology, German government decided to focus on renewable energies, mainly based on wind energy and PV-photovoltaics. The conference contribution will this specific "German Way" with special respect to the past and coming winter at the beginning, followed up by the presentation of the BTU-SmartCampus, a 20 kV Smart Grid in the size of about 3 MW installed power. By over installation of PV a residual load will be created within the campus power grid, which will simulate the situation in the real East German power system. Electricity, Heat and Gas storages, as well as sector coupling devices will be used to balance generation and load by new developed grid control strategies. Together with Volkswagen and BMW, also Vehicle-to-Grid technologies will be used to stabilize the power supply on the university campus.

Keywords: *German Energy Revolution, BTU-SmartCampus, Vehicle-to-Grid with Volkswagen and BMW*

Biography

Prof. Harald Schwarz (65) graduated in electrical engineering from the Technical University of Berlin in 1982 and received his doctorate in electrical engineering from the University of Dortmund in 1986. In the following years, from 1987 to 1994, he worked with ASEA BROWN BOVERI (ABB), first in the field of large transformers and then in high-voltage switchgear, before being appointed as full professor and head of the Chair for Power Distribution and High-Voltage Engineering at the BTU-Brandenburg Technical University in Cottbus in 1995. He is also acting head of the Chair for Decentralized Energy Systems. From 2002 - 2004 he was Vice Dean of the Faculty of Mechanical, Electrical and Industrial Engineering and from 2004 - 2014 Executive Director of the CEBra - Centre for Energy Technology Brandenburg at the BTU Cottbus, a central scientific institution under the direct responsibility of the university president. He was/is also programme director/chairman of the examination board of the international, English-language Master's programme in Power Engineering, for which a global cooperation network has been established and for which seven double degree programmes have currently been developed with Shanghai, Beijing, Taiwan, St. Petersburg, Moscow and Poland. Prof. Schwarz is Visiting Professor at the University of Shanghai for Science and Technology and Professor of Honours at the Shanghai University for Electric Power. He is also Professor at the Russian National Research University Peter-the-Great St. Petersburg Polytechnic University and Professor of Honours at the Russian National Research University Moscow Power Engineering Institute. Furthermore, Prof. Schwarz was member of the scientific advisory board of HIGHVOLT Ltd in Dresden, the world-leading manufacturer of high voltage testing and measuring equipment. He also was member of the scientific advisory board of ENVIA Ltd, a regional power supply company and 50Hertz Transmission Ltd, the east German transmission system operator. For several years, he was shareholder and member of the managing board of German e-Cars Research & Development Ltd. Since July 2022, he is member of the supervisory board of T-Cell AG.

Title: Scheduling Multiple Maintenances and Production Scheduling through a Three-level Particle Swarm Optimization Algorithm

Xiaoyue Fu, Dr. Felix T. S. Chan*, Ben Niu, Nick S.H. Chung, and Ting Qu
Professor and Vice Dean
Macau University of Science and Technology
Macao, China

Abstract

Due to the significance of the mould in the plastic industry, some researchers try to consider the mould maintenance in the production scheduling with maintenance problem. However, in most of the research on the production scheduling problem with mould maintenance, only preventive maintenance is considered, and preventive maintenance is usually perfect maintenance. In practice, except for perfect maintenance, there are other kinds of maintenances, and these maintenances may bring a machine to a state between as good as new and as bad as old. In this connection, multiple maintenances problem is considered in the production scheduling problem with mould maintenance. In this research, the maintenance depends on the states of the resource and for different states, the maintenance strategies may be different. To minimize the overall makespan, a problem of decomposition mechanism is used, and a three-level particle swarm optimization (TLPSO) algorithm is proposed which divides the integrated problem into three interrelated problems: the production scheduling problem, the machine maintenance problem, and the mould maintenance problem. To show the advantages of the proposed TLPSO algorithm, particle swarm optimization (PSO) algorithm variants are used as the comparison algorithms. The numerical experiment shows that TLPSO algorithm surpasses other PSO variants.

Keywords: multiple maintenances, production scheduling, mould maintenance, three-level particle swarm optimization

Biography

Dr. Felix T. S. Chan received his B.Sc. Degree in Mechanical Engineering from Brighton University, UK, and obtained his MSc and Ph.D. in Manufacturing Engineering from the Imperial College of Science and Technology, University of London, UK. Prior joining Macau University of Science and Technology, Prof. Chan has many years of working experience in other universities including The Hong Kong Polytechnic; University of Hong Kong; University of South Australia; University of Strathclyde. His current research interests are Logistics and Supply Chain Management, Decision Making, AI Optimisation, Operations Research, Production and Operations Management, Distribution Coordination. To date, Prof. Chan has published over 16 book chapters, over 390 SCI refereed international journal papers and 320 peer reviewed international conference papers. His total number of citations > 11900, h Index= 56. Prof. Chan is a chartered member of the Chartered Institute of Logistics and Transport in Hong Kong. Based on the recent compilations (2020) and (2021) from a research group of Stanford about the impact of scientists (top 2% listed). The work is published in the following websites: https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3000918; and doi: 10.17632/btchxktzyw.3. Prof. Felix Chan is categorized in the field of Operations Research, ranked 10 out of over 23,450 scientists worldwide, i.e., Top 0.04% worldwide, for TWO consecutive years (2020 and 2021).

Acknowledgement

The work described in this paper was substantially supported by grants from Macau University of Science and Technology Faculty Research Grants (FRG) under grant number FRG-22-108-MSB, The National Natural Science Foundation of China (NSFC) under grant number 71971143.

Title: Stress Comparison between Working and Relaxing with Woman's Wearable Smart Underwear

Mr. Pai-En Yang, Dr. Sheng-Fu Chiu, Dr. Chien-Lung Shen, Mei-Chuan Tseng and Szy-Yu Liao
Associate Research Fellow
Taiwan Textile Research Institute
Taiwan

Abstract

Wearable technology is one of today's important evolving industries. Many studies are focusing on physiological signal detection. Accordingly, life styles changing make people face greater stress during daily life, increase the risk of human health. The stress can be show in the balance of autonomic nervous system (ANS), consisting the sympathetic (SNS) as low frequency band (LF, 0.04-0.15Hz) and parasympathetic nervous systems (PNS) are a high frequency band (HF, 0.15-0.4Hz), the LF-HF ratio (LF/HF) has been used to quantify sympathy balance. A smart wearable female bra was development, a conductive fabric based electrode combine with a normal bra, to detect the LF-HF ratio as stress response, to study the difference between female stress during working and relaxing. 10 female average age 29.8 years old office workers participated in 2 experiments, one hour of normal working in office and 20 minute in the electric massage chair. The result shows that the average of sympathy balance LF-HF ratio in the working time was 2.77 and in the electric massage chair LF-HF ratio is 1.14, which shows that in the relaxing time sympathy balance reduce 59% of the LF-HF ratio. The smart bra can be used as daily stress monitoring system.

Biography

Associate Researcher Pai-En Yang specializes in two major fields: biomedical engineering and sports science. He is proficient in analyzing electromyography signals, gait analysis, and developing algorithms. He is currently an Associate Researcher in the Smart Textile Division of the Product Department at Taiwan Textile Research Institute (TTRI). He mainly conducts research on smart apparel related to the medical and sports industries, helping many domestic hospitals, schools, and companies with related developments. In 2021, he developed functional electric stimulation lower limb muscle control-assisted smart fabrics, and in March 2022, he developed a self-regulating nervous system monitoring system in collaboration with hospitals to research autonomic dysfunction. In October of the same year, he also worked with Tailung Capital INC. to jointly develop a home rehabilitation boxing system, which has been applied to hospitals such as the Far Eastern Memorial Hospital, the Taipei Medical University Hospital, and the Tri-Service General Hospital. In the sports market, he developed a real-time movement detection system that combines gait and electromyography parameters through a smart electromyography leg brace and mobile phone system.

Title: Management of Thyroid Dysfunction Induced by Anti-Cancer Agents Used for the Cancer Therapy of Other Organs

Dr. Yukiko Nakata
Director
Osaka-kizugawa Health Co-operative Association, Minato Seikyo Clinic, Japan
Specially Appointed Associate Professor, Osaka University, Japan

Abstract

Aging has caused a rapid increase in cancer cases worldwide and cancer has been the first causes of death in Japan since 1981. Anti-cancer agents such as molecular-targeted drugs and immune checkpoint inhibitors, including PD1 and PD-L1 inhibitors, are very effective but they sometimes have serious side effects such as thyroid dysfunction and fulminant type 1 diabetes mellitus. However, because of the proven fatal nature of cancer, therapy using these anti-cancer agent cannot be terminated, even if they have such side effects. For this reason, we sometimes have to treat cases with thyroid dysfunction induced by anti-cancer agents. It is difficult to distinguish general fatigue induced by cancer and its treatment from clinical symptoms caused by hypothyroidism. Our aim as thyroidologists is to stabilize the patients' thyroid function during the cancer therapy and help them feel more comfortable. Thyroid function can change easily, as a result of stopping the administration of anti-cancer drugs or switching to different anti-cancer drugs because of serious side effects or insufficient drug efficacy. We therefore need to control thyroid function each time a change occurs. Patients with hypothyroidism need sodium levothyroxine (LT4) replacement therapy, usually by oral administration, while cases with eating disorders resulting from the invasion by cancer of the gastrointestinal tract, need suppositories or intravenous treatment with LT4. For patients whose thyroid function has been normalized through intravenous treatment with LT4, the LT4 replacement therapy needs to be changed from intravenous to oral administration for the patient to be able to continue the treatment at home. Doctors administering cancer treatment consult us when patients show marked thyroid function abnormality after cancer therapy in a clinical situation. However, it is important to test thyroid function and manage systematically aligned with the chemotherapy schedule from pretreatment. Here we present several relevant cases with hypothyroidism induced by anti-cancer agents, and more such cases need to be reported for the further development of effective medical treatment.

Biography

Dr. Yukiko Nakata is a physician and thyroidologist and is currently working at Minato Seikyo Clinic (Osaka-Kizugawa Health Co-operative Association), Japan as well as at the Department of Metabolic Medicine of Osaka University, Japan, as a specially appointed professor. She initially was employed at Osaka University Hospital as an internal medicine resident and obtained her Ph.D. there in 1996. From 1998 to 2002, she worked in the U.S.A. as a postdoctoral fellow at the Department of Pathology and Laboratory Medicine, University of North Carolina at Chapel Hill in the same laboratory of which one of the members won the Nobel Prize in Physiology or Medicine in 2007.

Title: Robotic-Assisted Tele-Echography

Dr. Rui Cortesao
Professor
University of Coimbra
Portugal

Abstract

The main objective of this talk is to present a prototype for the telemedicine market based on recent advances of robotic assisted tele-echography. The prototype has been successfully tested in gynecological/obstetric exams, paving the way to market uptake. A new tele-diagnosis paradigm is presented, where physicians and patients can interact without requiring physical proximity. Each system includes two robotized ergonomic stations (one at the physician side, and the other one at the patient side), a set of ultrasound probes with classical functionalities, patient database systems and safe internet-based communication facilities. The developed system allows the interaction of multiple physicians and patients, mitigating traveling shortcomings from both sides, and creating new services such as technical tele-mentoring, and international collaboration. From the imagiology perspective, robotic assistance allows precise control of the ultrasound probe in position and orientation, improving also physician and patient comfort, based on ergonomic designs and compliant interactions. Presently, there are no mature market solutions to solve the problem of robotic-assisted tele-echography. All commercial systems so far have had small market impact. The main reasons for the unsuccessful attempts are: 1) Lack of intuitiveness during tele-manipulation due to the absence of contact sensations at the physician side; 2) No full control of robot position/orientation by the physician, requiring an active assistant during medical procedures. Our solution tackles these two issues, relying on torque controlled lightweight robots and compliant tele-control architectures with haptic feedback.

Keywords: Robotics, Tele-Medicine, Ultrasound

Biography

Dr. Rui Cortesao received the B.Sc. degree in electrical engineering, the M.Sc. degree in systems and automation, and the Ph.D. degree in control and instrumentation from the University of Coimbra, Portugal, in 1994, 1997, and 2003, respectively. He was Visiting Researcher at the German Aerospace Center-DLR, Oberpfaffenhofen, for the period 1998–2003, where he did his Ph.D. work, Stanford University, USA, in 2002, LIRMM-CNRS, France, in 2004, 2006, and 2008, and Barrett Technologies, USA, in 2007, having worked on robot control, surgical robotics, haptic tele-manipulation, compliant motion control, data fusion and human-robot skill transfer. He is currently Professor at the University of Coimbra, Head of the medical robotics group at the Institute of Systems and Robotics (ISR-UC), and Director of the technology transfer lab IPN-LAS. Prof. Rui Cortesao is Associate Editor of the robotics conferences ICRA and IROS.

Title: High Efficient Data Center in Smart City: A Survey of TCP Incast Solutions to Improve Data Center Network Performance

Dr. Cheng-Yuan Ho
Associate Professor
National Taiwan University
Taiwan

Abstract

The smart city concept is no longer just a science fiction idea. However, as fully integrated smart cities emerge, existing data infrastructure, especially for data centers, will be put under tremendous strain. With the vast amount of data being collected on a regular basis and the intense computing demands of AI-driven machine learning analytics, the sheer volume of traffic and processing workload will force networks to optimize or collapse under their own weight. Additionally, the increasing popularity of internet applications and the demands of many-to-one transmission in data center networks (DCNs) will result in a large number of packets being injected into the switch at the same time, competing for the same output port. This can cause the bottleneck buffer to overflow and many packets must be dropped. Furthermore, the proximity of servers in data centers can result in a very short packet round-trip time, leading to depressed network performance if the retransmission timeout timer is not set correctly. This issue is known as TCP Incast. To address this problem, we present a comprehensive survey of TCP Incast solutions in DCNs. We develop a classification scheme based on multiple levels of criteria, including the TCP/IP protocol stack and various sublevel classifications such as loss-based congestion control, delay-based congestion control, and probabilistic schemes. We evaluate each solution's performance in terms of its ability to alleviate network congestion during incast conditions, highlighting their respective strengths and weaknesses. Finally, we outline the open challenges and issues in mitigating TCP Incast in DCNs, which we believe will serve as a valuable guide for researchers and engineers in designing future DCN protocols.

Biography

Dr. Cheng-Yuan Ho is an Associate Professor in Department of Information Management, National Taiwan University. He received his Bachelor degrees in Mathematics (Major), and Information and Computer Education (Minor) from National Taiwan Normal University in 2003, and the Ph. D. degree in Computer Science from National Chiao Tung University (NCTU) in 2008. He was a winner of Microsoft Fellowship 2005. In 2006, he was an intern and worked for the Wireless and Networking Group of Microsoft Research Asia, Beijing, China. During this period, he assisted in developing Compound TCP (CTCP), which is embedded in Windows XP, Vista, 7, 8, and 10, Windows Server 2003, 2008, and 2016, and Linux. He was a postdoctoral researcher of D-Link NCTU Joint Research Center at NCTU from July 2008 to July 2010 and an assistant researcher of Microelectronics and Information Systems Research Center under NCTU's Diamond Program from August 2010 to July 2011. He worked at Advanced Research Institute (ARI) at Institute for Information Industry (III) as a R&D manager from July 2011 to November 2014. He joined LOFTechnology, Inc. as a business operation manager from November 2014 to January 2017. Dr. Ho was an Associate Professor in Department of Computer Science and Information Engineering, Asia University from February 2017 to July 2022. His main research is focusing on computer networks, network protocols and algorithms, artificial intelligence in applications, big data (especially transportation information analysis), and Internet of Things (IoT).

This work is supported by the National Science and Technology Council (NSTC), Taiwan, under Grant Nos. MOST 109-2221-E-468-008-MY3.

Title: Designing Streets for Autonomous Vehicles, A Survey of Possible Changes in Stockholm

Mr. Zeev Bohbot
Lecturer
KTH Royal Institute of Technology
Sweden

Abstract

The technique of autonomous vehicles is developing fast and is possible to change the way we travel in the future. One consequence is how the street design can be affected by autonomous vehicles in the cityscape. New mobility services are mentioned to be strengthened with autonomous vehicles, which can be a possible substitute for traditional private cars. This means travelers can, to a major extent in the future, use a sharing economy when traveling in the transport system. Several studies point to advantages in the use of autonomous vehicles in traffic such as environmental gains, reduced congestion and higher traffic safety. There is a possibility to better utilize the land in the streets. One important qualification is that the streets also need to be adapted to the autonomous vehicles' technology. The City of Stockholm is growing and also the traffic, which poses challenges to solve. How can the goals in City of Stockholm’s street planning be achieved with the consequences of autonomous vehicles? We suggest that political and technological development are two factors of great importance. The speech is based on a thesis work done by my students: Natalie Ruuska and Mathias Unell under my supervision and examination.

Biography

Mr. Zeev Bohbot, Architect and former chairman of the division of Building and Design, Department of architecture and Civil Engineering, KTH, Royal School of Technology.

Title: Medipost as a Smart Electronic System Dedicated to Imbalance Disorders Monitoring

Dr. Michal Szermer*, Dr. Piotr Amrozik , Dr. Piotr Zajac, and Dr. Mariusz Jankowski
Assistant Professor
Lodz University of Technology
Poland

Abstract

Since the end of the 20th centuries people have been living longer and longer. More and more of them suffer from civilization disorders in their old age. One of them is the imbalance disorders. Before introducing treatment, it is necessary to make the correct diagnosis. This can be done through constant monitoring. Base on this doctor make the decision to start treatment and rehabilitation.
Authors of this paper have designed a small and portable dedicated electronic system which can be used for monitoring patients. This device is attached to his or her back. It collects data, preliminary process them, send them to a smartphone which finally send them to the proper medical center. Thanks to use electronics, MEMS structure especially, the dedicated system is small and can be used at home.
This system called Medipost includes two important component which are ASIC (Application Specific Integrated Circuit) and MEMS (Microelectromechanical System). MEMS consists of inertial sensors such as accelerometers and gyroscopes necessary to collect data related to patient movement. ASIC was used to collect data from MEMS, convert it into digital data and send it to a smartphone. In this paper the authors focus on the description of ASIC and MEMS which are the heart of the Medipost system.

Biography

Dr. Michal Szermer was born in Lodz, Poland, in 1973. He received the M.Sc. and Ph.D. degrees from Lodz University of Technology, Poland, in 1998 and 2004, respectively. He is author and co-author over 100 papers related to integrated circuits design and modelling. His research focuses on the integrated circuits design with special consideration of mixed-signal circuits. He took part in many projects related to ASIC design. Recently, he is involved in modeling, design and analysis of MEMS structures for medical purposes. He is concentrated on inertial sensors necessary for assessment and rehabilitation of imbalance disorders.

SDS 04:

Video Forum

Title: Gerontechnology with Social Robots

Dr. Kelvin Tan
Senior Lecturer
Singapore University of Social Sciences
Singapore

Abstract

The use of technology in expanding the potential of seniors and facilitating them to live independent lives is pervasive across the world. Gerontechnology aims to fulfill the needs of an ageing society. The focus on scientific research and advances in technology that can enhance the physical and mental health, social participation and safety of the seniors is fast becoming an important topic. As educators and researchers, we have been engaging group project with communities (nursing homes and households) to innovatively addresses the challenges faced by seniors by either designing a product or a service. As longevity increases, technology can be tapped to prevent age-related diseases and age-related losses through exercise, therapeutic intervention and affordable treatment. In the area of social robots, we are working to humanize the experience from simple stuff toy like robots to sophisticated AI ones which can support different needs. Companionship to improve loneliness and depression will be discussed. The studies being explored and conducted will shed some light on the future for frontline workers and caregivers of seniors. Through the developments, the quality of life of seniors can be improved by integrating the multi-disciplinary knowledge of different stakeholders and actors.

Biography

Dr. Kelvin Tan is a Senior Lecturer with Singapore University of Social Sciences (SUSS). He teaches in Master/PhD in Gerontology Programme, Impact Startup Challenge Programme and also Mentors startups in Venture Builder department. He is also an active advocate of ibasho Japan on seniors empowerment program with community volunteers. In teaching and research, he specializes in innovations with startups/corporates in innovations and gerontology. He is passionate about humanizing technology for age-friendly environment/community. As such, he has published joint reports with Bayer on Asian editions of Healthy Hearts, Healthy Ageing and co-authored articles on technology acceptance research by nursing and healthcare professionals. Previously, he had set up the Corporate Partnerships team to spearhead open innovation and transformation initiatives with government agencies (Defence Science, LTA), corporates (Bayer, Loreal, SIA, Danone, P&G) and startups. The team he led was responsible for developing leading accelerator initiatives with corporates to imbue startups and research communities into their transformation roadmap. He also co-chaired¬ the organizing team of Innovfest unbound, SE Asia biggest annual flagship Innovation Festival week with IMDA, Smart Nation Program Office and other IHLs for 5 years. He had headed the business development and technology translation responsibilities of NUS Smart Systems Institute. It comprises of 3 International Research Centers and 2 labs for translation of research and technologies in AI, Cognitive technologies, Social Robots and NUS Living Lab for ambient technologies testbed with video analytics/sensors with bus-stops/amenities/hostels/parking spaces. In his career, Kelvin has cofounded a start-up, worked across diverse management roles in technical, consumer engagements, strategic alliances, sales/marketing in AT&T, HP, M1 and KDDI.

Title: Advance Power Supply Units for the Structural Health Monitoring of the Bridges

Dr. Rahul Kalyankar
Engineering Specialist
Loram Technologies Inc.
USA

Title: Ultra High Performance Concrete: A Solution for Accelerated Bridge Pier Cap Rehabilitation and Replacement

Dr. Atul Patil
Structural Engineer
HNTB Corporation
USA

Title: Smart Adaptation of Bone Tissue at the Nanoscale within Hierarchical Organization of the Skeleton

Dr. Andrey Pavlychev
Professor
Saint Petersburg State University
Russia

Abstract

The problems originated from skeletal pathology are of great socio-economic importance associated with medical treatment, rehabilitation and care of patients. Osteoarthritis is the fourth most common cause of hospitalization. Bone is the most complex hierarchically organized matter in nature. Two strongly interacting mineral and organic hierarchical organized subsystems extend from atoms to ecological spheres. At the nanoscale we encounter great difficulties in understanding because electronic and atomic structure and molecular architectonics of bone is not understood. This gap blocks successful solutions of many fundamental and clinically relevant problems such as the development of new methods of medical diagnosis of skeletal pathology at the early stage and innovational technologies in medical treatment of diseases associated with skeletal pathology. Our recent investigations have revealed that skeletal pathology produces various changes in nanostructure in intact and sclerotic areas of femoral bone in knee compartments. The strongest distortions are concentrated in the region where the mineral matrix interacts with the erased cartilage. Our efforts are aimed to find the ways of smart adaptation restoring the damaged bone nanostructure. The research of relationships between hierarchical organization of the skeleton and nanostructure of bone tissue is supported by the Russian Basic Research Foundation (19-02-00891)

Biography

Dr. Andrey Pavlychev is researching the electronic and atomic structure and atomic dynamics in free molecules, clusters, encapsulated molecules and solids. Recently, his main interests have been focused on hierarchical nanostructures, in particular, on bone that is the most complicated matter in nature. Since 1996 Dr. Pavlychev is a professor at the St. Petersburg State University in the Solid States Electronics department. He lectures “Electronic structure of solids”, “Quantum chemistry of polyatomics”, “Nanophenomena in solids”. Professor Pavlychev has published more than 150 papers on Molecular and Cluster Physics, Condensed Matter, Hierarchical Nanostructures, Material Science, Medical Physics. Professor Pavlychev actively and successfully collaborates with research groups in Leipzig and Bonn Universities, Free University (Berlin), Tohoku University and Photon Factory in Japan and other scientific centers. He succeeded in studies of spatio-temporal localization of core-excited polyatomics, angular distributions of the photoelectrons in fixed-in-space molecules, nanolevel hierarchical organization of bone tissue and the hierarchy effects in electronic and atomic structure in bone. Since 2015, he successfully collaborates with Russian Research Institute of Orthopedics and Traumotology.

Title: Maraging Steel Reinforced with Carbon Fiber for Flywheel Rotors

Dr. Carlos Frajuca
Professor
Instituto Federal de Sao Paulo
Brazil

Abstract

The work presents a study focused on a specific type of inertia wheel, known as Flywheel, capable of accumulating kinetic energy when in motion. Computational analysis was performed on the geometry and proportion of conjugate materials for the rotor. These wheels are used in electromechanical batteries which hold a longer life span compared to other commercially known types of battery. This study aims at analyzing a rotating inertia wheel at a rotational speed of up to 150,000 rpm, thus concentrating more energy and reducing material dimensions and costs. For this purpose, several types of inertia wheel geometries were created and simulated by the Finite Element Method, with the intention of verifying the behavior of the tensile strengths of the material at its high speed of rotation. With this data the geometry and the material that together obtained the best performance for the development of a wheel of inertia of low cost and high yield with results obtained of rotations beyond 170,000 rpm was chosen.

Keywords: Maraging steel, Carbon fiber, Flywheel rotor

Biography

Dr. Carlos Frajuca graduate in Mechanics at Sao Carlos Federal University (1986), Graduate in Physics at Sao Paulo University (1987), master's in Sciences at Sao Paulo University (1992) and Ph.D. in Sciences at Sao Paulo University de Sao Paulo (1996). Areas of Expertise 1. Electromechanical Instrumentation 2. Relativity and Gravitation 3. Particles and Fields 4. Vocational Education. Has experience in Electric Engineering, focusing on Electromechanical Instrumentation, acting mainly in gravitational waves detectors. Main Management and Administrative Positions: Institution Brasilia Federal Institute: 08/2009 - 02/2010 PosGraduation and Research Pro-Rector; 03/2009 - 07/2009 UnderGraduation Pro-Rector 03/2009 and 02/2010 Substitute Rector. Currently in a position of Full-Professor at Sao Paulo Federal Institute, with a fellowship in research in Mechanics, Naval, Oceanics and Aerospace Engineering from the National Council for Research. Referee for the Classical and Quantum Gravity and Journal of Physics:Conference Series. Member of the editorial board of the journals: International Journal of Mechanical Engineering and Applications, Journal of Gravity(formerly) and Sinergia (ISSN: 2177-451X) and editor of the Sinergia for two years. My score in the researchgate (43.33) is higher than 97.5% of ResearchGate members'.

Inaugurate World Chemistry Congress 2023
(IWCC-2023)

IWCC 01:

Chemistry and Catalysis Science

Chair

Dr. Edwin J. Routledge, Associate professor of Aquatic Ecotoxicology, Brunel University London, UK

Co-chair

Dr. Christine Hahn, Associate Professor, Texas A&M University Kingsville, USA

Time: 14:00-18:20, May 17, 2023 (Wednesday)

Place: Kibune, 5F, Hyatt Regency Osaka

Title: Targeting Translational Mechanism for Autoimmune Disease Therapeutics

Dr. Xian Chen
Professor,
Dept. of Biochemistry and Biophysics, School of Medicine at University of North Carolina (UNC)-Chapel Hill.
USA

Abstract

Rates of new diagnosed cases of Type 1 Diabetes (T1D), a chronic autoimmune disease with no cure currently, are on the rise among children. The clinical feature of T1D is insulin loss, which occurs because the insulin-secreting β-cells are damaged by infiltrating immune cells (i.e., insulitis) in the pancreatic islets. Current treatments mostly focus on alleviating symptoms by supplying insulin rather than preventing or reversing insulin loss. As a result, younger age of T1D diagnosis with long-term insulin injection tied to various complications and higher mortality risk. Here we describe a novel mechanism-based therapeutic approach to prevent and reverse T1D. At early stage of T1D when some β cells still remain so interception is likely to be effective we discovered that small molecule inhibitors of two histone methyltransferases significantly reduced the pathogenic immune cells residing in the pancreatic islets of nonobese diabetic (NOD) mice, the 'gold standard' model for T1D. Additionally, using our chemoproteomic approach with the biotinylated version of the same inhibitor we captured and identified new biomarkers that define T1D pathology and drug response. We therefore created a drug-diagnostic co-development platform for a safe and precision medication of T1D.

Biography

Dr. Xian Chen is a Professor in the Dept. of Biochemistry and Biophysics, School of Medicine at University of North Carolina (UNC)-Chapel Hill. He is also the Director of Technology Development at UNC Proteomic Center. Dr Chen has multi-disciplinary expertise in mass spectrometry (MS)-based proteomics and multiomics, immunology, signaling and epigenetic regulation of inflammation, proteogenomics, cancer biology, molecular and cellular biology. His pioneering work on introducing mass tags with stable isotopes, termed amino acid-coded mass tagging (AACT), a.k.a. SILAC, as a new strategy for proteomic research, was recognized in 1999 with the prestigious Presidential Early Career Award for Scientists and Engineers, the highest award in US to the scientists at their early careers. He is also the inventor of an array of functional proteomic approaches for the discovery of disease markers and new drug targets, including Chromatin-activity-based Chemoproteomics (ChaC) and ChaC-based multi-omics. Dr. Chen has a long-standing interest in understanding the molecular pathways and mechanisms underlying chronic inflammation-associated diseases such as cancer, sepsis, Alzheimer's disease, and diabetes. In these research areas he has authored and co-authored more than 150 papers including some in high impact journals such as Nature, Science, Cell, Cell Stem Cell, Nature Immunology, Molecular Cell, Immunity, Cancer Discovery, Nature Cancer, Cell Reports, Science Advances, Nature Communications, Cell Chemical Biology, iScience, etc. He also holds five patents for his technology innovations and a provisional patent application for 'New Therapeutics for COVID-19'. His H-index is at 60 with 29527 citations.

Title: Towards A Sustainable Chemical Future

Dr. Edwin J. Routledge
Associate professor of Aquatic Ecotoxicology
Brunel University London
UK

Abstract

Since the start of the Industrial Revolution, society has become increasingly reliant on chemicals, including pesticides, pharmaceuticals, plasticizers and personal care products. In 2016, EU chemical sales alone were valued at 507 billion Euros, with 80,000 chemicals reported to be in common use worldwide. Alongside the many benefits of chemicals to society, concerns about the impacts of certain chemicals to both human and wildlife health, including the so-called 'endocrine disrupting chemicals', is a topic of increasing concern. Since the term 'endocrine disruptor' was coined in 1991, extensive research into the effects of various chemicals, and chemical mixtures, on human and wildlife health has been conducted globally. More than 1,300 studies have suggested connections between endocrine-disrupting chemical (EDC) exposure and serious health conditions such as infertility, diabetes, obesity, hormone-related cancers and neurological disorders in humans. The range of endocrine targets captured by regulatory tests is expanding rapidly, and new mechanistic insights, such as epigenetic mechanisms of chemical-induced disease, continue to challenge the regulatory frameworks designed to protect society and the environment. Difficulties still exist in balancing the trade-offs between the benefits of chemicals to society at point of use, with the burden of proof needed to demonstrate the adverse consequences of the same chemicals once they are allowed to disperse in the environment. When dealing with such complexity, is it possible to achieve a vision of a sustainable society where chemicals are managed carefully throughout their lifecycle and where people benefit from their use and thrive within nature's limits? What strategies and insights can sustainability science offer to help society balance the Tox-Eco system?

Biography

Dr. Edwin Routledge is an experienced molecular endocrinologist and aquatic ecotoxicologist investigating the effects of endocrine active chemicals on aquatic wildlife. He is an internationally recognized innovative researcher, policy influencer and inspirational educator in environmental science and sustainability as evidenced by awards and high impact citations. With a portfolio of 50 publications (cited over 6500 times) he is ranked in the global top 2% of scientists. He is committed to ensuring a high quality and inclusive experience for STEM students – our next generation of environmental practitioners and change makers. He has successfully engaged in commercial enterprise through industry and academic partnerships, and now leverages his knowledge and experience in peer review as an Independent Scientific Expert for UK REACH.

Title: Microstructural Analysis of Activated Carbon-based Electrode Materials for Supercapacitors

Dr. Wenliang Zhu*, Naoki Hoshida, Haonan Zhang, Yumi Yoshida, Elia Marin, and Giuseppe Pezzotti
Professor,
Kyoto Institute of Technology,
Japan

Abstract

Exploring the transformation from insulator polymer-based mixtures to **conductive carbon-based nanocomposites** shows a new possible and promising way to incorporate activated carbon in the materials for applications as electrode materials for supercapacitors because of their high availability and low manufacturing cost. However, the properties of the carbon-based materials strongly depend on the fabrication procedure and experimental conditions. Here Raman spectroscopy has been applied to evaluate the variations of carbon microstructure and to clarify their association with the material performance in different carbon-based systems with various fabrication parameters. Based on the spectrally resolved analyses, the results revealed that the microstructure and composition of the generated activated carbon can be significantly altered, and the structural disorder induced by the alteration of sp^2/sp^3 carbon content, and the incorporation of oxygen and hydrogen are mainly responsible for the variations of material performance.

Biography

Wenliang Zhu, Full Professor at Kyoto Institute of Technology, received his Bachelor’s degree in Chemical Physics from University of Science and Technology of China, and Ph.D. degree in Material Sciences from Kyoto Institute of Technology. He became a project assistant professor and then a project associate professor in the medical school of Osaka University in 2010-2017, before he went back to work at Kyoto Institute of Technology. His main research field is on evaluation, characterization and clarification of microstructure as well as defects and stoichiometric deviation, and their associations with material properties in electrode materials, semiconductor devices and biomaterials, by developed high resolution photo-/electro- stimulated spectroscopies. Up to now, he has published more than 200 papers on different international peer-reviewed journals.

Title: To Fix Nature's Mistake: Repairing Human Faulty Genes By Small Molecules

Dr. Timor Baasov
Professor Emeritus,
Technion, Israel Institute of Technology, Haifa 3200003
Israel

Abstract

Nonsense mutations that generate premature translation-termination codons (PTCs) are responsible for approximately one-third of human genetic diseases. Thousands of such mutations are known and several were shown to account cases of fatal diseases including cystic fibrosis, Duchenne muscular dystrophy, Hurler syndrome, several types of cancer and more. While major advancements have made in gene therapy, it is still far from achieving clinical success for the treatment of genetic diseases caused by PTCs. One alternative approach that has emerged recently is suppression of pathogenic PTCs through inducing translational read-through of the in-frame premature stop mutations. Aminoglycosides were the first drugs that gave promising results in this respect. However, high toxicity of these drugs and reduced suppression activity at sub-toxic doses has limited their clinical use in suppression therapy.

To address these issues, we have designed and synthesized a series of new derivatives of aminoglycosides, and their ability to read-through PTCs examined in both in-vitro and animal models of various diseases. By systematic tuning the structure-activity-toxicity relationship of the designed molecules, we developed five generations of lead structures; these leads demonstrated exceptional improvement in stop-codon read-through activity while maintained low toxicity. The research focuses on fundamental mechanistic aspects of aminoglycoside-induced read-through of PTCs and on the major chemical and biochemical mechanisms of aminoglycoside-induced toxicity to mammals. One of the lead compounds (NB124 or ELX-02) is currently in clinical trials, phase-2, for the treatment of cystic fibrosis by Eloxx Pharmaceuticals. In this talk, the observed biochemical data will be analyzed in terms of structure-activity-toxicity relationships of designed structures and in terms of 3D crystal structures of designed molecules in complex with the ribosomal A-site RNA constructs.
Keyword: Aminoglycosides, Nonsense mutation, Readthrough of premature stop codon, Cystic fibrosis

Biography

Prof. Baasov was born in Georgia (part of former Soviet Union) in 1954 and immigrated to Israel in 1974. He received his B.Sc. (1977) and M.Sc. (1999) degrees from Tel-Aviv University, and his Ph.D. (1986) from the Weizmann Institute of Science, Israel. Before joining Technion in 1988, he was at Harvard University as a postdoctoral fellow in chemistry with Professor Jeremy R. Knowles. Since 2004 he is Full Professor at the Schulich Faculty of Chemistry, Technion. His research interests revolve around chemical biology and drug discovery. His long list of prizes and awards includes the Hershel Rich Technion Innovation Award (2005, 2008, 2010), the Technion Excellence in Teaching Award (2002, 2006, 2007, 2008, 2010, 2014, 2015) and the Jacknow Award for excellence in teaching (2006), the 2016 ICS-ICL Prize for Technological Innovation, and the 2020 NCK Prize for an Outstanding Medicinal Chemist in Israel. He holds the Irving and Jeanette Benveniste Chair in Life Sciences. He is national representative of Israel at the European Carbohydrate Organization (ECO), at the International Carbohydrate Organization (ICS), and during 2013-2015 he acted as the President of ECO.

Title: From Fossil Refineries to Green Refineries

Dr. Anton Friedl*, Dr. Michael Harasek
Head of Research
TU Wien
Austria

Abstract

Classical or fossil refineries are based on fossil resources and deliver fuels and platform chemicals needed in many chemical industries with the drawback of releasing large quantities of carbon as CO2 to the atmosphere. This leads to a fast increase of the CO2 level along with worldwide industrialization followed by severe climate change.
Green chemistry and chemical engineering concepts are based on sustainable feedstocks, recycling of materials and closed CO2 cycles with the target to receive sustainable materials, chemicals, fuels and energy. Therefore, classical refineries need a transition to circular refineries, to biorefineries and CO2 refineries to build a sustainable basis for industry as well as society.
Successful examples for a sustainable carbon management will be presented for the production of pharmaceuticals, cosmetics, industrial materials, chemicals, fuels and renewable energy supply with high potential of recycling of carbon and CO2. Along with the chemical production strategy it is important to incorporate the (bio)chemical synthesis power of nature – plants and microbiological systems which provide already many interesting feedstocks and production chains on a sustainable basis. Further, green chemistry concepts make use of the complex natural macromolecules extracted from biomass and allow a synergistic combination with innovative (bio)chemical production chains based on CO2 and green hydrogen. As such, CO2 refineries may be understood as an advancement of green biorefinery concept towards innovative CO2 utilization strategies.

Biography

Dr. Anton Friedl, Doctor of technical Sciences (Dr. techn.), now is Full professor of Chemical Engineering in the Faculty of Technical Chemistry at TU-Wien. He got his B Sc in Chemistry, M Sc in Chemical Engineering, with focus on biofuel chemistry, Technical Doctor's degree at TU-Wien with a research period at the Department of Biotechnology, Massey University, Palmerston North, New Zealand from 1989 to 1990. Followed by a postdoc research period at University of California, Department of Chemical Engineering, Berkeley in California US. Dr. Friedl has been awarded with the title Doctor honoris causa from the Gheorghe Asachi Technical University of Iasi in Romania in 2008. The appointment as full University Professor in Chemical Engineering at TU Wien has been received 2010. The scientific focus of Dr. Friedl is the development of sustainable processes with a focus on biorefineries systems for the production of materials, chemicals, fuels and bioenergy applying also process simulation and live cycle assessment.

Title: Development of an Efficient Acid-Free Palladium(II) Catalyzed Hydroarylation of Acetylene

Dr. Christine Hahn*, Leonel Garcia, and Ngoc T. B. Nguyen
Associate Professor,
Texas A&M University-Kingsville,
USA

Abstract

Hydroarylation of alkynes is a useful organic reaction to generate aryl alkenes as building blocks for more complex molecules. The direct addition of arenes to alkynes may serve as efficient methodology to shorten lengthy multi-step synthesis of natural products or drug molecules. While the intramolecular hydroarylation is relatively easy to realize, the intermolecular version is far more challenging regarding chemo-, regio-, or stereoselectivity. In the last two decades a large number of catalytic systems containing transition and main group metals have been develop, which still display certain limitations including high catalyst load, large amount of acid co-catalyst, higher temperature, relatively long reaction time, and a narrow scope of substrates.
We have studied the hydroarylation reaction using dicationic PtII and PdII pincer complexes. Initially stoichiometric reactions were performed to elucidate the Friedel-Crafts type mechanism. Screening a series of PtII and PdII complexes, a dicationic PdII complex containing SbF6– counter-anion was found to be the most active catalyst. Further optimization of various reaction parameters afforded a TON of 200 and completion of the hydroarylation test reaction at room temperature within 24 h in the absence of any acid co-catalyst. The rule of water as co-catalyst will be discussed. Overall, a methodology for direct C-H addition of an arene to acetylene as unfunctionalized alkyne substrate was developed working efficiently under mild and acid-free reaction conditions.

Biography

Christine Hahn grew up in the former German Democratic Republic and studied Chemistry at the former College of Technology Leuna-Merseburg. She received her Master's (1993) and Ph.D. (1997) degrees from the Martin-Luther University Halle-Wittenberg in Germany. After spending one year as Research Assistant at the University of Würzburg with Professor H. Werner, she received a fellowship from the German Academy of Sciences Leopoldina spending three years (1998-2001) at the University of Naples, Italy, as Postdoctoral Associate. In 2002 she joined the research group of Professor J. A. Gladysz at the University of Erlangen-Nuremberg, working on industrial projects in collaboration with TOTAL. In 2005 Christine Hahn was appointed as Assistant Professor of Chemistry at The University of Texas of the Permian Basin in Odessa, Texas, and moved in 2012 to the Texas A&M University-Kingsville, where she is currently Associate Professor and since 2017 Chair of the Department of Chemistry. Christine Hahn is member of the American Chemical Society, of the Society of German Chemists, and the Circle of Friends of the Leopoldina. Her research interests are in the fields of organometallic and coordination chemistry and homogeneous catalysis.

Title: Scalable Synthesis of Metal-Oxide Nanocatalysts by Flame-Spray-Pyrolysis Technology: Fine Tuning of Catalytic Efficiency via Control of Nanolattice

Dr. Yiannis Deligiannakis
Professor
Lab of Physical Chemistry of Materials and Environment, Department of Physics, University of Ioannina, Greece

Abstract

Establishing methods & protocols for synthesis of highly-efficient metal-oxide nanocatalysts is a long-sought aim in science and economy. Successful transition from Lab towards Industrial Engineering and commercialization of research achievements requires scalable synthesis methods. Flame Spray Pyrolysis (FSP) is an established technology for production of nano metal oxides at industrial level. Herein we discuss the use of FSP-technology towards production of High-Performance Catalysts and exemplify its connection to the advancement of Technology-Readiness-Level (TRL). As a working-topic we focus on two types of *Light-Controlled Catalytic Processes*: [i] Artificial Photosynthesis, [ii] Plasmon Controlled Oxidation Catalysis. Currently Artificial Photosynthesis this is considered among the most challenging high-end photocatalytic technologies. Plasmon Controlled Oxidation Catalysis is a novel concept we have introduced recently [*ACS Catalysis* (2022) 12, 9908, DOI 10.1021/acscatal.2c02287]. We discuss how by optimizing the FSP-process to each-one of these processes, pose great challenges on nano-physical chemistry, and process engineering. Defect engineering vs. lattice integrity, surface configuration vs. selectivity, cocatalyst-particle synergy vs. inhibition are among the challenges that the FSP process is owing to face and optimize. Herein we will discuss these aspects for innovative FSP-made oxide nanomaterials [e.g. *Scientific Reports* 12, 2022, 15132, DOI 10.1038/s41598-022-19382-3].

Biography

Yiannis Deligiannakis is a Professor at the Department of Physics of University of Ioannina, Greece, head of the Laboratory of Physical Chemistry of Materials and the Environment (nanomaterials.physics.uoi.gr). He is an elected Visiting Professor at the Department of Mechanical Engineering at ETH Zurich (https://ptl.ethz.ch). He has worked at the "Democritos" Research Center, Athens Greece, and at the Section de Bioenergetique Nuclear Research Center (CEA) of Saclay, Paris, France (https://www.i2bc.paris-saclay.fr/). He has served as President-elect of the International Humic Substances Society (2018-2020). His research focuses on the development of new nanocatalysts at Industrial Scale, using Flame-Spray-Pyrolysis (FSP) technology and their applications in Green Environmental Technologies with emphasis on "Artificial Photosynthesis" production of H2 from H2O and the conversion of CO2 into next generation liquid fuels. In addition, his research includes understanding of the physicochemical basis of environmental behavior of new nanomaterials, understanding their environmental impacts and their life cycle. He has published >200 research articles (h=43). He holds 14 Patents in applied materials technologies.

Title: Hybrid Molecular Catalysts for H_2 Production from C1-substates at near Ambient Conditions: the Challenges of High-efficiency *vs.* Cost and Versatility

Dr. Maria Louloudi
Professor
Lab of Biomimetic Catalysis and Hybrid Materials, Department of Chemistry, University of Ioannina, Greece

Abstract

Catalytic production of H_2-gas from C1-substrates e.g. HCOOH, CH_3OH, COH, is emerging as an exploitable technology, in the context of the forthcoming Hydrogen economy. Molecular Catalysts based on low-cost metals e.g. such as Fe, can be engineered to achieve performances comparable to noble-metal e.g. Ru, Ir, based catalysts with H_2-prouction rates >>10^3Lt/Kg catalyst/hour. Hybrid Molecular Catalysts (HCM), where a Metal-complex catalyst is grafted on an appropriate solid matrix, emerge as a next generation technology i.e. when efficiency is asked to be combined with reusability, cost efficiency and versatility vs. different C1-substrates. Herein we discuss highly-efficient HCM catalysts for H_2 production from HCOOH or CH_3OH with focus on the techno-economical aspects connected with synthesis routes and concepts, as well as catalyst-role and concept. Key-issues in the Catalytic-cycle are highlighted and inhibitory factors are identified.

Biography

Maria Louloudi is a Professor at the Department of Chemistry of University of Ioannina, Greece, head of the Laboratory of Lab of Biomimetic Catalysis and Hybrid Materials (***catalysis.chem.uoi.gr***). She has worked as research fellow at University Rene Descartes/CNRS, Paris, France. Her research focuses on the development of hybrid catalysts based on molecular complexes associates with nanosurfaces, functional materials, antioxidants and biomimetics. H_2 production form C1 substrates is among the key-research topics in her lab aiming to establish connection of laboratory technologies with industrial production of H2. In addition, her research includes understanding of the physicochemical basis catalytic mechanisms in connection with redox, plasmonic photoexcitations, and thermodynamic aspects. She has published >110 research articles and holds 18 Patents in functional materials.

Title: The Economics/ Supply Chain Bottlenecks in Materials Needed for Wind Turbine Manufacturing

Dr. Mariya Trifonova
Chief Assistant Professor,
Faculty of Economics and Business Administration, Sofia University St. Kliment Ohridski
Bulgaria

Abstract

Wind energy is set to become Europe's number one source of electricity, providing as much as 50% of all power consumed in the EU by 2050. However, the supply chain for wind turbine manufacturing faces numerous bottlenecks that limit the industry's potential for growth. This study aims to identify the major bottlenecks in the supply chain of materials needed for wind turbine manufacturing. A comprehensive review of existing literature, coupled with interviews with key industry stakeholders, was conducted to identify the key challenges. The results indicate that the supply chain bottlenecks include inadequate raw material supplies, a lack of skilled labor, and insufficient transportation infrastructure. Additionally, the high cost of materials and lengthy lead times for procurement and delivery of components were identified as significant challenges. The study highlights the need for collaborative efforts between suppliers, manufacturers, and policymakers to address these challenges and promote sustainable growth in the wind energy sector. The findings of this study contribute to the existing body of knowledge on supply chain management in the renewable energy sector and provide insights for policymakers, industry stakeholders, and researchers.

Biography

Dr. Mariya Trifonova is a Chief Assistant Professor at the Faculty of Economics and Business Administration at Sofia University, holding a PhD in energy and industrial economics from the same institution. With over 12 years of experience, she has gained extensive knowledge on technological and socio-economic developments in the energy sector from a range of perspectives. Dr. Trifonova is actively involved in supporting think-tanks in the SEE region to bridge the gap between academic research and evidence-based policymaking. As a research fellow at CSD and member in the Steering Committee of European technology and innovation platform ETIPWind she works on unlocking the potential of marine renewable energy in the Black Sea. Dr. Trifonova's contribution to the development of methodological tools for stakeholder engagement and the promotion of social acceptance towards innovative low-carbon technologies has resulted in numerous publications. She has participated in various EU research projects, including PV Grid, Nanophosolar, MEDEAS, SHAREs, DUST, and JustWind4All, and served as a national expert to the 2020 & 2021 editions of the World Energy Trilemma Index. Furthermore, she co-chairs the Energy Transition Commission, a sub-committee of the Consultative Council on the European Green Deal at the Bulgarian Council of Ministers and serves on the Academic Sounding Board of the Cohesion for Transitions (C4T) platform led by EC's DG REGIO. Dr. Trifonova is also a member of the Horizontal Stakeholder working group of the Just Transition platform, also supervised by DG REGIO.

Title: Bio-plastic from Banana Pseudo-Stems with Help of Ionic Liquid

Dr. Kenji Takahashi
Professor
Department of Natural System, Institute of Science and Engineering, Kanazawa University,
Japan

Abstract

In 2015, our group demonstrated a facile homogeneous transesterification reaction of cellulose with isopropenyl acetate in 1-ethyl-3-methyl-imidazolium acetate (EmimOAc) to yield cellulose triacetate without any additional catalyst or corrosive chemicals. This synthetic strategy was found to be applicable to various polysaccharides, and it was verified that the EmimOAc could be easily recycled at least four times with a good recovery ratio (≥96 wt.%) and without any obvious decrease in its catalytic activity.
We have applied those catalytic activities of EmimOAc to synthesis of Banana ester materials. The Banana fibers are consisted from 40% cellulose, 12% hemicellulose and 6% lignin. The Banana pseudo-stems are kindly donated from One Planet Café. It was found that the polysaccharide derivative from the Banana fibers, which constituted a mixture of cellulose and hemicellulose propionate, exhibited comparably better mechanical properties and a superior thermal processability for injection molding than those obtained from similar cellulose ester originating from wood pulps.

Biography

Kenji Takahashi was born in Hokkaido in 1961. He received his PhD in 1994 from Hokkaido University under the supervision of Prof. Kazuo Endo. As a researcher belonging to the Ministry of Education, Culture, Sports, Science, and Technology in Japan, he joined the Radiation Chemistry Group of Dr. Charles Jonah at Argonne National Laboratory in USA, where he worked from 1995 to 1996. He was then appointed assistant professor at Kanazawa University in 2003 and professor in 2012. His research group is currently working on the use of ionic liquids in reaction and material engineering for biomass refineries. He is now Project Leader, Open innovation Platform for industry academia co-creation by JST&MEXT.

Title: Synthesis Mesoporous Materials as Catalyst Support by Non-hydrolytic sol-gel

Dr. Johan G. Alauzun
Associate Professor
University Montpellier
France

Abstract

Non-hydrolytic sol-gel involves the reaction in non-aqueous media of precursors with organic oxygen donors instead of water[1]. The reaction of chloride precursors with an ether or an alkoxide at 80-150 °C provides useful alternatives to conventional sol-gel routes for the design of mesoporous oxide and mixed oxide materials, which have been successfully used as heterogeneous catalyst[2]. In this presentation I will focus on recent results concerning other materials such as metal oxide-carbon nanocomposites[3] (Figure 1), and other non-hydrolytic routes involving for instance ester elimination[4] or original phosphonate-based organic-inorganic hybrid materials[5].

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Biography

Johan Alauzun completed is PhD in 2005 on the functionalization of hybrid mesoporous silica. He has done three postdoctoral positions, one between the Universities of Lyon and Montpellier (France) on the synthesis of mesoporous supports for catalytic applications. He then joined the Michael A. Brook group in McMaster University (Canada) to elaborate antibacterial biomaterials and finally on porous non-oxide ceramics in the University of Lyon.
Johan Alauzun is now Associate Professor of the University of Montpellier since 2010. His work is focused on mesoporous hybrids and oxides elaborated by non-hydrolytic sol-gel. He is author of 65 publications and 4 patents.

Title: Self-assembly of Carbohydrate Block Copolymers: From Glyconanoparticles to tThin Films to Photonic Crystals

Dr. Redouane Borsali,
Professor
Director of PolyNat Carnot Institute, University Grenoble Alpes,
France

Abstract

To date, numerous studies have been focused on the self-assembly of petroleum-based BCPs for potential applications in multidisciplinary fields, such as nanoparticles for drug delivery, or nano-organized films for biosensors, or nanolithography, etc. Such materials are derived from fossil resources that are being rapidly depleted and have negative environmental impacts. In contrast, carbohydrates are abundant, renewable and constitute a sustainable source of materials. This is currently attracting much interest in various sectors and their industrial applications at the nanoscale level will have to expand quickly in response to the transition to a bio-based economy. The self-assembly of carbohydrate BCP systems1-4 at the nanoscale level via the bottom-up approach, has allowed the conception of nanostructured thin films and nanoparticles (micelles, vesicles,…) whose external shell is made from carbohydrates. We will present recent results on the self-assemblies of carbohydrate-based block copolymer leading to nanoparticles presenting different shapes (spherical, cubic, …), highly nanostructured thin films for nanobioelectronic applications and more recently brush-like glycopolymers exhibiting photonic crystals behavior leading to colored materials

Biography

Redouane Borsali is a CNRS research Professor and Director of the PolyNat Carnot Institute of the University of Grenoble Alpes University. He is also a member of the European Academy of Science - Before his actual position, he served as the Executive Director for International Relations Grenoble Alpes Univ. (from 2016-2019), Director of CERMAV (2007-2015) –(A CNRS Laboratory of Glycosciences, UGA, Grenoble), Group Leader (2000-2006) – (LCPO), Bordeaux University, France
He was a visiting Professor (2 years), Chem. Department, Stanford University, CA, USA and a visiting Scientist (1 year) IBM, Almaden, San Jose, CA, USA R. Borsali spent 2-year Post-doc (1989-1990) at Max-Planck-Institute for Polymer Research, Mainz, Germany –He earned his Master and PhD in polymer sciences at Louis Pasteur University at Strasbourg, France. He has more 300 papers, 4 books and 5 patents. Prof R. Borsali's expertise has been focused the last decade on the Self-assemblies of Carbohydrate-based block copolymers (BCP) systems.

IWCC 02:

Video Forum

Title: Pesticide: Analytic, Residue

Dr. Lydia Bondareva*, Dr. Nataliia Fedorova
Leader Researcher
Federal Scientific Centre named after F.F. Erisman
Russia

Abstract

On the global scale the damage of agricultural crops is caused by approximately 50 000 species of plant pathogens, 9 000 species of insects and mites and 8 000 species of pest plants. To minimize the risk for human health caused by the residual amounts of pesticides in agricultural products it is necessary to have vast and reliable information about the level of pollution which could allow one to develop measures to guarantee food safety for the population. The aim of the present study is to developed universal method for determination of pesticides of different classes in the agricultural plants and food products in order to reveal residue of organic substances.

Forty active substances in pesticides were selected for the research (including a number of metabolites), with the substances belonging to different chemical groups (neonicotinoids, tryasols, imidazoles, pyrethroids, organophosphorus compounds, strobilurins etc.). The identification was performed taking into account the retention time, presence of characteristic ions in the mass spectra (GC-MS method) and product ions (LC-MS/MS) and area ratio of the chromatographic peaks which are related to the characteristic ions. The application of the sample preparation method for QuEChERS excluded a number of active substances from the analysis; these substances, according to their structure, physical and chemical properties and ability for metabolic degradation with the formation of numerous metabolites, cannot be analyzed by the given technique.

The developed methods of multi-residual determination of pesticides were also tested in estimating the contamination of grain crops by residual amounts of pesticides. The attention was focused on wheat, maize and rice, the grain crops which amount to 88% of the world grain production; these methods were also successfully applied to determine pesticides in a number of tropical and dried fruit.

Different classes of pesticides lead to a suppression of nitrogen metabolism by increasing or decreasing the activity of certain enzymes. In addition, the pigmentation of the leaves may change, and grains may stop developing. The validation of the method for multi-residual determination of pesticides belonging to different classes in terms of the chemical structure and properties, and having different types of effects, makes it possible to simultaneously detect the presence of certain substances in the environments of different types

Biography

Lydia Bondareva, PhD of Analytical Chemistry, Full Professor of Ecology. Leader research in Analytical laboratory. Education: Lomonosov's Moscow State University, Analytical chemistry. Field: analytical chemistry, radioecology, chemistry of pesticides, aquatic plants I have more than 200 scientific articles in top-rated scientific journals and am the author and co-author of monographs.

Title: Enhancing the Photoluminescence of Monolayer MoS2 through Gap-Assisted Synthesis

Dr. Sheng-Kuei Chiu,* Lu-Chih Chen, Tzu-heng Yen, Bo-Hong Chen
Director
Feng Chia University
Taiwan

Abstract

The 2D nanomaterials have attracted the attention of many researchers for advanced electronic and optoelectronic devices. Transition metal dichalcogenides (TMDs), such as MoS2, have been studied actively due to their unique chemical and physical properties as a new generation of electronic devices1. However, the mechanism for self-limited monolayer growth of a 2D TMDs material is still poorly understood. This work fabricated about 490 cm2 area of monolayer MoS2 via face-to-face stacking chemical vapor deposition (CVD) synthesis. As the growth space changes, either nucleation or grain growth can be promoted. The 200 µm gap between the metal oxide film and the Si wafer substrate gives the best stacking setup for high-quality, high-uniformity, and 7 times photoluminescence intensity-enhanced (compared to the reactant powder CVD MoS2 growth method) monolayer MoS2 nanomaterial fabrication. Our results provide an innovative CVD process for the mass production-scale synthesis of monolayer MoS2 and other 2D TMDs materials for optoelectronic applications in the semiconductor manufacturing field2.

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Biography

Dr. Sheng-Kuei Chiu, is now an Assistant Professor at the Department of Materials Science and Engineering, Director of the Foresight Industry Alliance and Development Center (FIADC) at Feng Chia University. He got his B Sc in Chemical Engineering, M Sc in Chemistry, and Ph.D. in Inorganic Chemistry from Portland State University, and was the Principal Process Engineer at TSMC, Taiwan. Dr. Sheng-Kuei Chiu got the Deputy Director Award in 2016 for improving the 7nm production capacity at TSMC. Dr. Sheng-Kuei Chiu's research is focused on the synthesis of novel 2D TMXenes for next-generation optoelectronics at the atomic scale, development of two-dimensional materials for graphene and transition metal chalcogenides, from two-dimensional material synthesis to semiconductor components and devices applications, he also obtains the three years research funding from MOST (Taiwan, 110-2112-M-035-001-MY3)

World Congress of Physics Frontier 2023
(WCPF-2023)

WCPF 01:

Video Forum

Title: Quantum Foundation as Seen by a Statistician

Dr. Inge S. Helland
Professor Emeritus
University of Oslo
Norway

Abstract

In the literature, quantum mechanics is founded by a very abstract set of postulates. For several reasons I propose that this set should be replaced by straightforward postulates based on the notion of conceptual variables, a notion generalizing the statisticians' parameters: In his mind, any observer/ actor in each given situation may have several conceptual variables. Some of these are accessible, can in some future be given numerical values by measurements or experiments. The notion of a maximally accessible conceptual variable is crucial. This can be motivated by an assumption to the effect that all physical variables in the actor's context have parallels in his mind. Examples are given. Under weak technical conditions, basic postulates of quantum mechanics can be shown to be implied by a postulate assuming that the actor in his mind has two related maximally accessible variables. Some specific symmetry conditions are needed. The notion of being related has a precise definition. A parallel development can be based on conceptual variables shared by a group of communicating observers. The Born formula, giving probabilities, follows from some explicit additional assumptions. The technical details around all this are given in a published book and in some recent articles.

Biography

Dr. Inge Helland is a retired Professor in mathematical statistics from the University of Oslo. He has also been a professor of statistics at The Agricultural University of Norway, now The Norwegian University of Life Science. He has a very varied scientific production, ranging from pure applied articles to basic theoretical ones, including some review articles. He has in been particularly concerned with communication between different scientific communities, taking his background as a statistician as a point of departure. In the last 10-15 years he has worked with the foundations of quantum theory from this point of view. This has resulted in two books and in a number of recent articles in good physics journals, some rather technical, but with a simple model of an observer's mind as a core.

Title: Holographic Beta Function in de Sitter Space

Dr. Yoshihisa Kitazawa
Professor Emeritus,
KEK Theory Center
Japan

Abstract

We perform the resummation of the infrared logarithms in the inflationary universe. Applying the renormalization group, we derive the Fokker-Planck and Langevin equations as the effective theory at the horizon scale. We focus on the conformal zero mode to respect local Lorentz symmetry. It exhibits the identical scaling behavior with curvature perturbation as they coincide. Fokker Planck equation can be solved exactly under Gaussian approximation. We have found the UV complete and inflationary spacetime with power potentials. This fact offers a strong evidence for de Sitter duality as the identical equation follows from the classical thermodynamics in the inflation theory. Its solution with the ultraviolet fixed point indicates that the Universe begun with the de Sitter expansion near the Planck scale with epsilon=0. We argue the inflationary universe subsequently dominates to maximize the entropy. The pre-inflation eramay be necessary to prepare launching inflation era

Biography

Dr. Yoshihisa Kitazawa has completed his Ph.D. at the age of 25 years from Princeton University and postdoctoral studies from Enrico Fermi Institute, University of Chicago. He has served the director of KEK Theory group, now Theory Center, a premier High Energy Physics research organization for a decade. He has published more than 75 papers in reputed journals. He got his B.Sc. in Department Physics, University Tokyo. Ph.D. degree at Princeton University under David Gross. Yoshihisa has worked on string theory, matrix models and quantum gravity. Recently he works on the effective theory at the Hubble scale as the exciting new discoveries such as dark energy and CMB fluctuations indicate. In Einstein's theory of gravity, metric of spacetime plays an important role. He points out the importance of the overall scale of the metric (conformal mode). At the horizon, it performs the Brownian motion. He proposes that the stochastic equation of the conformal mode determines the evolution of spacetime.

Title: Allosteric Pathway Identification Through Network Analysis: From Molecular Dynamics Simulations to Interactive 2D/ 3D Graphs and Beyond

Dr. Luba Tchertanov
Research Director, CNRS, France;
Coordinator, Centre Borelli, ENS Paris-Saclay, France

Abstract

Allostery is a universal phenomenon that couples information induced by a local perturbation (effector) in a protein to spatially distant sites. Such highly regulated events can be described in terms of large-scale cooperative transmissions of information (communications) through a dynamic coupling between structurally rigid (minimally frustrated) and plastic (locally frustrated) clusters of residues.

To elaborate rational description of allosteric coupling, we have proposed an original and rational approach - MOdular NETwork Analysis (MONETA) - based on the analysis of inter-residue dynamical correlations to localise the propagation of both structural and dynamical effects of a perturbation throughout a protein structure [1]. MONETA uses dynamical correlations computed from molecular dynamics (MD) simulations and topological descriptors of a protein to build a modular network representation composed of clusters of residues (*dynamic segments*) linked together by chains of residues (*communication pathways*). MONETA provides direct and simple visualisation of protein communications. A Gephi module implemented in the MONETA package allows to generate 2D graphs of the communication network. An interactive PyMol module allows a 3D representation of the communication pathways between chosen protein fragments or residues.

MONETA is a powerful tool for the on-the-fly generation of communication networks in proteins. We applied MONETA to analyse communication pathways between the main regulatory fragments of receptors tyrosine kinase KIT and CSF-1R [2-4] in native and mutated states. The description of the physical support for allosteric coupling with MONETA allowed a definition (i) of the KIT constitutive activation mechanism induced by oncogenic mutation and (ii) of the modulation of KIT allosteric mechanism by an *in silico*-designed mutagenesis. Our theoretical prediction based on results obtained with MONETA was validated by *in vitro* experiments [5]. MONETA is a polyvalent analytical and visualisation tool entirely devoted to understanding the function/malfunctions of allosteric regulation in proteins, a crucial basis to guide the discovery of next-generation allosteric drugs. In particular, the pockets adjacent to the channel for communication pathways across a protein may constitute valid targets to develop inhibitors able to modulate the function-related communication properties of signalling proteins [6].

Developing inhibitors generally use conventional docking algorithms. To introduce new technologies, we developed original tools, the Haptic Modelling Workspace (HMW), a platform that proved helpful in human-assisted modelling for academia and industry [7]. It is an immersive visualisation environment coupled with force feedback devices (haptic arms) for the interactive manipulation and intuitive exploration of complex biological models (protein-ligand and protein-protein complexes). This superimposition of real and virtual elements (sounds, 2D/3D images, videos, etc.) allows the manipulation of digital biomolecules using visualisation software, tangible and sensory interaction devices, or yet to reproduce their dynamics in real-time by engine-simulators, creating augmented reality.

Given the first results obtained with modelling by HMW (molecular complexes of VKORC1 and NMDAR), it is evident that the application of HMW is advantageous to study dynamic objects with high conformational plasticity. Indeed, many target conformations of a flexible and bulky protein, and the multiple conformations of a ligand (inhibitor) adaptable to these conformations, create a vast space of solutions (putative molecular complexes). The HMW space allows a pre-selection of the most relevant solutions and their study in real-time by MD simulations integrated into the environment. The instantaneous calculation of the binding free energy of the complexes makes it possible to reduce the number of solutions significantly. This immersive and multimodal application, in which visual, audio and haptic renderings are combined to transmit the necessary information between the multiple partners of different profiles, is part of the future generation of simulators which must be applied to the development of new drug molecules.

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Biography

Dr. Luba Tchertanov is a Research Director at the CNRS (France) and Coordinator of BiMoDyM at the Borelli Center of ENS Paris-Saclay (France). She has multidisciplinary skills (M2 in Physics, Ph.D. in Crystallography, HDR in Life Sciences) and extensive experience in structural computational biology. Specifically, she focuses on exploring the structure-dynamics-function relationships to study the allosteric regulation and intrinsic disorder in crucial cancer and other therapeutic targets. She also contributes to the methodological development of new methods and tools that enable the delivery of advanced information for new therapeutic targets. This interdisciplinary research at the interface of biology, mathematics, computer science and physics targeted the extraction of biophysical/biochemical parameters inaccessible by practical techniques.

Title: Efficient Energy Cumulants for Pure and Dilute Baxter-Wu Model

Dr. Ioannis N. Velonakis
Post Doctoral Researcher
University of Athens
Greece

Abstract

In this work, using both analytic methods and Monte Carlo simulations with our triangle cluster algorithm, we illustrate the scaling behavior of two possible 4th-order energy cumulants across the well-known second and first-order phase transitions of the Baxter-Wu model under zero external magnetic field. It is found that 4th-order connected energy cumulant introduced by Janke provides a very good theoretical and tool for finding and distinguishing phase transitions, especially in case the order parameter of a particular model is hardly known. Also, the physical importance of the cumulants' local minima and maxima is investigated, showing that they are finite-size scaling effects, as well as their behavior in case of Binder-like sublattices. Furthermore, we extend our results to the dilute Baxter-Wu model, showing that they may be easily applied to other spin models.

Biography

Dr. Ioannis N. Velonakis is a Post Doctoral Researcher of the Physics' Department (Solid State Physics Section) of the National and Kapodistrian University of Athens. He was born in Athens in 1980 and he has got a Degree in Physics (2002), an Msc in Material's Physics (2005) and a Ph.D. in Solid State Physics (2013) in the National and Kapodistrian University of Athens. His research interests are about Theoretical and Computational Solid State Physics, especially with Monte Carlo Algorithms, Phase Transitions and Critical Phenomena. He has published about twelve (12) original research papers on scientific journals with referees (he usually works with former Deputy Prof. Drs. Sotirios S. Martinos and Ioannis A. Hadjiagapiou) and he has also made four (4) announcements in international scientific conferences. He also works as Physics' teacher (since 2006) at secondary Greek schools.

Title: Effect of Structure Transformations on Generation of Optical Centers in KV and KU Quartz Glasses Exposed to Neutron-Gamma Fluxes

Dr. Elvira M Ibragimova*, Aygul Sapaeva, Nurmukhamad Iskandarov, Malika Mussaeva, and Khamdam T Nazarov
Principal Researcher
Institute of Nuclear Physics
Uzbekistan

Abstract

Color centers in transparent dielectrics are believed to be the main radiation effect due to ionization and atom displacements. Optical spectra are interpreted as electron transitions in point defects. However exposure of optical materials to mixed fluxes of neutrons, charged particles and gamma-quanta in the nuclear reactor initiates results also to 1-2-3 dimensional defects, which are studied with X-ray diffraction, scanning and probe electron microscopy and also element analysis. XRD –structure-phase and SEM-EDS analyses were implemented for studying pure SiO_2 glasses with low and high concentration of hydrogen as OH-groups [Dianov E.V. 2000] irradiated with neutrons, protons and gamma-quanta of > MeV energy. KV type SiO_2 glass –reference sample 66 vol% of cristobalite-II $(2\theta)21.8^o$ and 34% tridymite, having displacements +0.984 and +0.950, respectively, due to interface contacts, the sizes are estimated <5 nm. At low angles there are two diffusion bands of the same intensity at $\sim6^o$ and 21^o, corresponding to three-gonal and hexagonal cages of the glass network. 60Co gamma-irradiation to dose 50 MR causes significant decrease in the band at 6^o. Similar effect comes from the mixed neutron+gamma-irradiation in the nuclear reactor core to the integral neutron fluency 10^{19} cm^{-2}. Local element analysis at SEM-EDS found significant decrease in the ratio Si/O as compared to the stoichiometric one because of nuclear reactions of branching and transmutation types. In the case of KU-2 type there are 60% tridymite and 40% H3SiOSiH3 phases. After intensivegamma-irradiation to the heavy dose of 6×10^9R there appeared the radiation induced SiH3F phase at the expense of destroying the existing phases. Possible contribution from phase transformations and stable products of the nuclear reactions into the optical response of glass units in the optical signal losses of the registration system of ITER should be taken into account. Light scattering from nanoparticles and optical absorption by electron transitions in the total response of optical detection system should be separated.

Biography

Prof. Elvira Ibragimova, Doctor of physics-mathematics sciences (Dr.Sci.), now is a Principal researcher and professor of physics of condensed matter, works at the Laboratory of physics of nanostructure and superconducting materials at the Institute of nuclear physics (INP) Academy of sciences of Uzbekistan, Chairman for Board of physics at Supreme Attestation Committee of Uzbekistan, a member of MRS and ACS. She got her M.Sc. Diploma "with excellence" in optics from Samarkand State University, after 3 year Ph.D. scholarship on "Radiation induced defects in yttrium aluminum garnet and yttrium aluminate with impurities" at the INP she got Ph.D. diploma and began working for this Institute first as a junior researcher then as a senior researcher in the field of radiation physics of solids and radiation technologies. Soon after the famous discovery of high temperature superconductors (HTSC) she got down to study radiation effects in YBCO in collaboration with Institute for metal physics (Russia), Argonne National Laboratory (USA), University of Oxford (UK) and in 14 years she completed the researches and got her Doctor of Sciences Diploma. Then she turned towards a new direction: assembling of nanoparticles and forming of nanostructures in simple compounds (LiF, ZnSe, SiO2, graphite) under exposure to nuclear particles in the research atom reactor and cyclotron, electron beams and gamma-quanta radiation. She was and is a super-wiser for M.Sc., Ph.D. and Dr.Sci. researches. Currently Prof. Elvira Ibragimova' researches are focused on the structure phase transformation and chemical element transmutations in multilayer compounds under intensive irradiation with nuclear particle beams and picosecond laser pulses.

The 9th World Energy Congress 2023 (WEC-2023）

WEC 01:

Latest Perspectives on Global Energy Policies and Utilization

Chair

Dr. Georgi Dimitrov Todorov, Professor, Head of CoE "Mechatronics and Clean Technologies", Dean of the Faculty of Industrial Technology, Technical University of Sofia, Bulgaria

Co-chair

Dr. Janet Xuanli Liao, Associate Professor, The University of Dundee, Scotland, UK

Time: 09:00-12:20, May 18, 2023 (Thursday)
Place: Kibune, 5F, Hyatt Regency Osaka

Title: China's Carbon Neutrality Targets vs the Use of Coal

Dr. Janet Xuanli Liao
Associate Professor
The University of Dundee
UK

Abstract

After over 30 years of opening and reform, the Chinese economy surpassed that of Japan in 2010 to be the No 2 economy, second only to the United States. But the cost of such an achievement was equally huge: China became the world's largest carbon emitter in 2007 due to its heavy reliance on coal in the energy mix. The announcement by Chinese President Xi Jinping in Sept 2020, that China would "aim to peak CO2 emissions by 2030 and achieve carbon neutrality before 2060", did send an encouraging signal to the world in the fighting against climate change. However, China has not made sufficient policy changes to ensure the smooth implementation of the 30-60 pledges. The question to be asked was that can China achieve its carbon neutrality without phasing out of coal in its energy mix?

The presentation aims to answer the question from three perspectives: China's energy mix, the concept of energy trilemma, and the political struggles between different interest groups. Indeed, China is the world's largest coal producer and consumer, and the heavy reliance on coal in its energy mix is a historical legacy and cannot be changed easily given China's economic scale. Meanwhile, when a country is facing the energy trilemma – sustainability, security, and affordability – a government would normally choose the latter two to meet the immediate concerns, and that is also true in China's case. Finally, the making of energy and climate policy in China does not always follow the rational choice model. While the central government want to move away from coal sooner, the coal industry and relevant actors have tried to fight back to protect their own interest. One of the excuses is that coal has a key role for "peak shaving" for the renewables, and thus should not be removed in the foreseeable future. It is essential for China to fulfill its carbon neutral pledge but it also requires both political determination and the advancement of technology to help China phasing coal out of its energy mix as soon as possible.

Biography

Janet Xuanli Liao is Associate Professor of International Relations, at the Centre for Energy, Petroleum and Mineral Law and Policy (CEPMLP), within the Division of Energy, Environment and Society, School of Humanity, Social Sciences and Law of the University of Dundee. Dr Liao obtained her PhD in International Relations from the University of Hong Kong. She held B.A. and M.A. in History from Peking University, China, and worked as Lecturer at the Institute of International Relations at PKU briefly, before studying a second M.A. in International Relations at the International University of Japan. Dr Liao's current research interests include China's energy diplomacy and the "Road and Belt Initiative" (towards Central Asia-Russia, Middle East, Africa, etc.), the relationship between Chinese National Oil Companies and the government, Sino-Japanese political/energy relations (including the East China Sea dispute), China and Japan's climate change policy, and climate change governance. She has published three monographs and a few dozens of articles/commentaries on the above subjects. Dr Liao was appointed as Honorary Professor at the China Institute of Boundary Studies of Wuhan University between 2008-2012, and was Visiting Professor to the International Univ of Japan (2011) and to the Xi'an Jiaotong University (2017). She has been invited to deliver a talk at various workshops globally and served as Visiting Fellow at the International Institute for Strategic Studies (London), the Institute of Energy Economics, Japan (Tokyo), and the Institute for Security & Development Policy (Sweden).

Title: Development of New Energy Vehicle Transmission System Under the Dual Carbon Target

Dr. Yong Chen
Professor
Guangxi University
China

Abstract

This paper comprehensively analyzes the technological development status of hybrid vehicles and pure electric vehicle transmission systems at home and abroad, and focuses on the latest technological development and pre-research products of the European automobile industry and China's own brand industry in recent years. Finally, the simulation application research of Professor Chen Yong's team in the key technologies of new energy vehicle transmission system of the New Energy Vehicle Research Center was introduced. The main chapter of the report: analysis of carbon emission development scenario in domestic and foreign automobile markets. Current status of hybrid and pure electric vehicle powertrain technology. Simulation and application practice of key technologies of new energy vehicle transmission.

Biography

Chen Yong, the professor and doctoral supervisor of the School of Mechanical Engineering of Guangxi University, an overseas high-level talent expert, a member of the Chinese Society of Automotive Engineering, a vice president of the Tianjin Society of Automotive Engineering, and a director of the Tianjin Society of Mechanical Engineering.
Doctor of Engineering, National Saga University, Japan. During 18 years of work in JATCO, Japan, as a senior technical expert and section chief, he was responsible for more than 10 R&D projects of automatic transmission and CVT transmission system for 4-speed, 5-speed, 6-speed and 7-speed cars. After returning to China, he successively served as the vice president of Geely Automotive Research Institute, vice president of Geely Powertrain Research Institute, and senior chief engineer. He was in charge of the research and development of Geely passenger vehicle transmission and the CAE and trial production of the whole vehicle. He was successfully responsible for the development of mass production of 6-speed manual transmission, 7-speed double-clutch automatic transmission and hybrid 7-speed automatic transmission.
He has successively presided over one national 863 project, one science and technology support project during the 12th Five-Year Plan, four key special tasks of the national key research and development plan "new energy vehicles", one key international strategic cooperation project of the Ministry of Science and Technology, and many provincial and ministerial projects. More than 120 articles have been published in international and domestic technical journals, including more than 40 SCi/Ei. 167 authorized invention patents, more than 230 utility model patents, published three academic monographs in English and Chinese by the first author.

Title: Full Speed into the Electric future: What Can We Expect of Lithium-ion Technology in Vehicles?

Dr. Daniela Werlich
CTO
CUSTOMCELLS® Group
Germany

Abstract

Range anxiety and long waiting times at charging stations are ubiquitous topics when talking about electric vehicles. The first generation of vehicles could not completely refute this. How can these two topics be combined in one cell generation and what does the future of lithium-ion technology hold in store? In our overview of the development, the latest trends and next generations of storage technologies, we not only want to go into the technology but also consider the entire value chain from raw materials to second life and recycling. In doing so, we will always keep an eye on the currently important issues of security of supply and technological sovereignty. Furthermore, in the context of the development of lithium-ion battery cells, it is particularly important that the development of the electrochemistry and the production processes run in parallel. The production processes have a significant influence on cell performance, and care must be taken in the early phases of development to ensure that processes are scalable and do not become a bottleneck in the entire cell production. This is where the Mircofactory advantage comes into play. Small, flexible production systems that already map the processes that are used in a scaling are the perfect development environment. The talk will go into these aspects in detail and point out challenges and solutions.

Biography

After getting the degree in chemistry in 2012 Dr. Daniela Werlich joined Dispatch Energy/Liacon as a project and technology manager. The company produces battery systems for home solar and industrial applications based on lithium-ion cell with LTO anodes. In 2016 Dr. Daniela Werlich joint CUSTOMCELLS® as a Senior Project Manager and holds the position of CTO since 2019. CUSTOMCELLS® is one of the world's leading companies in the development of special lithium-ion battery cells. At its sites in Itzehoe (Schleswig-Holstein - Germany) and Tübingen (Baden-Württemberg - Germany), CUSTOMCELLS® develops and produces application-specific battery cells from prototypes to small and medium series. Since 2017 she is active in various committees that support research and development in the field of lithium-ion technology in order to connect science and industry.

Title: Module Approach and Puzzle of Innovations for Breakthrough in the Batteries Improvement in Benefit of Electric Vehicles Development, Within and Beyond of the European Helios H2020 Project

Dr. Yavor Sofronov*, DSc. Georgi Todorov, DSc. Ivan Kralov, and Dr. Ivan Ivanov
Associate Professor
Faculty of Industrial Technology
Technical University of Sofia
Bulgaria

Abstract

In the conditions of more and more increasing global climate change last decades, the development of adequate road transport has a leading role in mitigating the impact on the environment in a global, regional and national scale, especially in large cities and around major transport corridors, for instance in Europe. The transition to a fully electric mobility scenario is one of the main challenges to be overcome. Batteries play a key role in the success of this transition and in increasing the efficiency of electric vehicles (EVs). The HELIOS project (2021-2024) of the European H2020 Programme aims at developing and integrating innovative technical solutions, materials, designs, technologies and processes to create a new concept of smart, modular and scalable battery pack for a wide range of EVs used in urban electromobility services, from mid-size full-electric vehicles to electric buses, with improved performance, energy density, safety and reasonable Levelized Cost of Storage (LCoS). The main objective of the HELIOS* project is to pave and accelerate the path of EVs by enhancing and demonstrating innovative, modular, lighter and eco-friendly hybrid Li-Ion-based battery packs through a holistic development of the whole required technologies and designs.

The main innovations woven into the battery design begins by evaluating strength and weakness of battery-to-pack, battery-to-chassis and module-to-chassis technology. Then solving the complex puzzle between user requirements functional elements and system interfaces by using hybrid top-down and bottom-up approach. The result is novel modular system with scalable structure where completely interchangeable modules with unified outside dimensions use different type of battery cells and could compose battery packs from mid-size EV up to E-bus. This development accomplish the task for different driving scenarios where the goal could be mainly urban driving and fast charging, were high power is needed, or only long range journey, were high energy is needed, or different ratio between them and this could be changed according to user needs during the operational life of the EV and even the drive style could be adjusted. Therefore the design and manufacturing process of the battery module is simplified. The cost and weight of the battery pack is reduced by eliminating redundant components and connections. The performance and safety of the battery pack is improved by optimizing the cooling and thermal management system. The design was developed with vision to the second life of battery packs as energy storage. Methods for “Design for recyclability” were developed in combination with “Design for Manufacturing” and “Design for Assembly” in entire design loop.

This abstract is related with a project HELIOS that has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 963646.

Biography

Dr. Yavor Sofronov, Associate professor at dept. Theory of mechanisms and machines in the Faculty of Industrial Technology, Technical University of Sofia (TUS), received his Bachelor’s degree in “Computer aided design and technology of mechanical engineering” and Master degree in “Technology of mechanical engineering” in Technical University of Sofia. Since 2007 he begins his research career in laboratory “CAD/CAM/CAE in industry” (3Clab), where he specialized in the field of virtual engineering, and continues to work there. Mr. Sofronov was appointed Assistant Professor in 2013 and began his research in the field of rapid manufacturing technologies. At 2015 he obtained his PhD and became a Senior Assistant Professor. Since 2021 he became Associate Professor at dept. Theory of mechanisms and machines in the Faculty of Industrial Technology. Until now Yavor Sofronov is a Senior Researcher in national projects funding, in partnership with industrial companies and have more than 30 successfully completed international industrial projects. Dr. Sofronov is a winner of national awards: The Award “YOUNG ENGINEER OF THE YEAR FOR 2014-2015” of Federation of Science-Technical Unions in Bulgaria and the "BEST YOUNG MECHANIC" of the National Committee for Theoretical and Applied Mechanics.

Title: Decarbonization: The Journey to Carbon-free Systems

Gene Hinkle
Managing Director
GE Energy Consulting
USA

Abstract

Around the world, new mandates are continuously emerging promoting deeper and deeper levels of decarbonization. These goals appear in many shapes and sizes: carbon vs. renewable outcomes, different entity types, different decarbonization levels. But one theme is common: Many of these goals are being set before planners have determined out how to practically implement them.
While policy makers are focused on the high-level carbon goal, system operators, see three additional transformations:
1. An operations transformation: Operators are used to generators with fuel sources that are almost always available when needed. Variable resources are uncertain and vary their availability with the weather. Thus, a system with high percentage of its energy coming from variable resources means that operators will need to adopt new practices to accommodate energy coming from a variable and uncertain fuel source.
2. An economics transformation: Energy prices have typically been based on the cost of fossil fuel sources like natural gas and coal. Given that variable resources are zero variable cost, a market with a high percentage of its energy coming from variable resources will lead to energy markets with lower energy prices.
3. A physics challenge: For the last 100 years of our electric system, frequency and voltage has been maintained by synchronous machines: rotating steam or gas turbines that mechanically drive an electrical generator to create electricity. Wind turbines, solar panels, and batteries all drive power electronic, inverter-based electrical generators which maintain frequency and voltage in a fundamentally different manner. A high percentage variable resource system is a fundamentally new inverter-based system.
All three of these transformations are now happening simultaneously. However, do the departments responsible for planning each of these three transformations collaborate? Are their planning tools integrated? Herein lies the real decarbonization challenge. Not only are government policies preceding implementation plans, but the entities responsible for implementation often work on their own part of the system with historically siloed planning practices. We have found that in many cases, these departments are not even allowed to meet and share information even if they wanted to.

Biography

Gene Hinkle is the Managing Director of GE Energy Consulting in Schenectady, NY.
He has 23 years of experience in analysis of power system economics.
He has been a key member in power system studies to evaluate the impacts of high penetrations of wind power on the operation, reliability, and economics of power grid of the Hawaiian Islands and Independent System Operator of New England (ISO-NE). He co-led the PJM Renewable Integration Study
He has conducted studies for clients in areas such as the formation of Regional Transmission Organizations, developing methodology for modeling bidding behavior of power generators in the Northeastern United States, effect of new generation plants on the deregulated environment, energy and capacity price forecasts, and valuing over 2000 generator assets throughout the U.S. He has also been involved in simulating the UK, Irish, Australian, & Canadian power markets.
Prior to joining GE, Gene was as a Senior Consultant for Navigant Consultant INC.
He holds a Bachelor of Science in Electrical Engineering from Rensselaer Polytechnic Institute.

Title: Trends and Emerging Technologies for the Development of Electric Vehicles

Dr. Tiande Mo*, Dr. Chi-kin Poon
Head of Green and Smart Mobility,
Hong Kong Productivity Council,
Hong Kong SAR
China

Abstract

In response to the dire climate and energy crisis, increased global attention has been directed towards the electrification of transportation systems for the development of electric vehicles (EVs). Currently, there are still a large number of conventional internal combustion engine (ICE) vehicles in operation around the world, and they consume considerable amounts of fossil fuels. Therefore, the acceleration of the electrification of vehicles is imminent. Following several years of development, EVs in some developed countries have demonstrated significant technological progress and market success. However, most of the developing countries are still in the early stages of technological development and marketing of EVs. Traveler range anxiety, insufficient charging infrastructures, and challenging charging time management are the largest obstacles hindering the development of EVs. Emerging technologies in electric vehicles provide new solutions to the persistent problems that plague the development and popularization of electric vehicles, and also bring good opportunities for the rapid development of new EV markets.

Representative emerging EV technologies including wireless charging, smart power distribution, vehicle-to-home (V2H) and vehicle-to-grid (V2G), connected vehicles (CVs), and autonomous driving greatly benefit EV stakeholders and further promote EV adoption. Wireless charging and autonomous driving make the use of electric vehicles more convenient and intelligent, and can also greatly increase the range of electric vehicles without increasing the weight of the battery. The popularity of wireless charging, smart grid and V2G also provides solutions to alleviate the shortage of charging facilities and rational charging time management. Smart power distribution and V2G can reduce the pressure on the grid during peak charging of EVs, and combine V2H to use electricity more rationally. Besides, CVs and autonomous driving will greatly improve the driving experience of people's travel, and bring new impetus to the promotion of EVs in addition to environmental and energy concerns.

The purpose of this lecture is to reveal new trends and emerging technologies in the development of EVs, and to discuss in detail the new opportunities and challenges brought by wireless charging, smart power distribution, V2G and V2H systems, CVs and autonomous driving. Our work also focuses on the commercialization development cases of EVs in major countries around the world and provides representative examples of emerging technology products. This research serves as a reference and guide for future technological development and commercialization of EVs and provides perspectives and recommendations on the future smart transportation.

Biography

Dr. Tiande Mo is the Head of Green and Smart Mobility at the Smart City Division of Hong Kong Productivity Council (HKPC) and he is also the Head of Business Development Unit at Automotive Platforms & Application Systems R&D Centre (APAS). He received his Ph.D. in Engineering from Swinburne University of Technology, M.Sc. in Energy and Environment from City University of Hong Kong, and B.S. in Automotive Engineering from Hefei University of Technology. He has strong track records in a number of Hong Kong Innovation and Technology Fund (ITF) projects in terms of project management and R&D. His current research is mainly focused on new energy vehicles and intelligent systems for smart city.

Title: A Novel Metallic Nuclear Fuel Design for High Burn-up Applications in Fast Neutron Reactors

Dr. Di Yun*, Qian Zhengyu, Linna Feng, Yuwen Xu, Jie Qiu
Professor
Xi'an Jiaotong University
China

Abstract

In order to improve the economics of fast reactors and their associated fuel cycles, achieving ultra-high fuel burn-up and ultra-long fuel life has been a topic of significant interests. One example of such reactor design concept is the Travelling Wave Reactor (TWR). However, the very high fast neutron irradiation dose on the fuel cladding materials has posed a major challenge to such reactor conceptual designs. The initial fuel cladding fast neutron irradiation dose design parameter for the TWR was set to be more than 600 dpa, which greatly exceeds the current limit on this design parameter obtained from past reactor operation experience (200 dpa). A lot of work have been conducted to attempt to improve the fast neutron irradiation dose limit on fast reactor fuel cladding materials. In this work, a new angle is taken to help achieve ultra-high fuel burn-up. That is, to rely on the low swelling property of the spinodal decomposed U-50Zr metallic fuel under irradiation environments for steady-state operation (below the phase change temperature of U-50Zr fuel to transit to the gamma phase) and then vent fission gas at certain fuel burn-up intervals, once fission gas has accumulated in the fuel matrix, by manually creating a transient scenario and raising fuel temperature for a relatively short time span. Such operation serves two purposes: on one hand, it drives a complete release of fission gas, on the other hand, it will help anneal defects accumulated in the cladding material during fast neutron irradiation. In addition, an interesting phenomenon has been discovered on irradiated MX-ODS steel which led us to believe that there may be a materials technology that will help sustain long term corrosion by lead or lead-bismuth eutectic. This materials technology will be discussed in this paper as well.
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Biography

Professor Di Yun focuses on developing advanced nuclear fuel materials. On the theoretical front, he explored a novel approach, multi-atom nucleation, to describe gas bubble nucleation process in metallic nuclear fuel materials, and developed a novel high burn-up metallic fuel concept for fast neutron reactors; he also investigated in fundamental aspects of nuclear fuel performance modeling and applied multi-scale simulation methods to address fuel performance issues. On the experimental front, he is developing nitride coatings for advanced nuclear fuel systems for light water reactors and has received technological awards in this area; he is currently pushing for development of such materials into real engineering application scenarios.

Title: Canada's Approach to Small Modular Reactor Regulation and International Collaboration

Sarah Eaton
Director, Advanced Reactor Licensing
Canadian Nuclear Safety Commission
Canada

Abstract

In Canada, there is great interest in advanced and Small Modular Reactors (SMRs). The Canadian Nuclear Safety Commission (CNSC) Canada's nuclear regulator is currently reviewing an application to construct a SMR. Ontario Power Generation (OPG) applied in later 2022 for a licence to construct the GE Hitachi BWRX-300 SMR at the Darlington site in Clarington, Ontario. In addition, Global First Power (GFP) has applied to prepare site for the USNC Micro Modular Reactor at the Chalk River site in Ontario. Future applications are also expected in the next few years in other provinces. The CNSC has been preparing for over 10 years to be ready to regulate and licence SMRs and innovative technologies and has used this to launch the SMR Readiness Project with the goal of effective and efficient regulation of innovative technologies. This 5 year, $50 million dollar project is built upon 4 pillars: regulatory predictability, policy and shared responsibilities, capacity and capability and international collaboration.
The importance of collaboration with other mature regulators is a key to effective and efficient regulation. The CNSC has increased collaboration with the United States Nuclear Regulatory Commission (USNRC) and the United Kingdom Office of Nuclear Regulation (UK ONR) under memoranda of cooperation (MOC). In 2019, the CNSC and the USNRC signed a MOC with a mutual goal of safety and agility in regulating SMRs. The MOC focuses collaborative efforts on SMR technologies and regulatory approaches emerging in the US and Canada and contributes to SMR readiness priorities. In 2022, CNSC and USNRC furthered cooperation on licensing reviews of the GE Hitachi BWRX-300 proposed by both Ontario Power Generation (OPG) and Tennessee Valley Authority (TVA). This collaboration is expected to benefit safety and agility while demonstrating leadership in expanding international regulatory collaboration. Collaboration and readiness activities help ensure the CNSC is agile and innovative in regulation while ensuring safety is the top priority.

Biography

Sarah Eaton is the Director of the Advanced Reactor Licensing Division at the Canadian Nuclear Safety Commission (CNSC). She began her CNSC career in 2009, spending over 8 years conducting inspection of uranium mines and mills. In 2017, Sarah joined the Nuclear Processing and Facilities Division, where she was a Senior Project Officer conducting inspections of fuel cycle facilities and spearheaded a number of improvement initiatives. In April 2021, Sarah was appointed the Director of Advanced Reactor Licensing in the Directorate of Advanced Reactor Technologies (DART). Sarah and the Advanced Reactor Licensing team is responsible for licensing small modular reactors (SMRs) and Advanced Reactors. DART is also the SMR readiness hub for the CNSC, ensuring a coordinated matrix approach to organizational readiness for regulating SMRs and new advanced technologies. Sarah is a proud Newfoundlander, with a Master's of Science in Earth Science from Memorial University of Newfoundland and is currently registered as a Professional Geologist (P. Geo) with Professional Geologists of Ontario.

Title: Case Onkalo - Finland Is the Global Leader in Final Disposal

Juha Poikola
Manager
Public Relations, TeollisuudenVoma Oyj
Finland

Abstract

Finland is one of the most successful countries in utilising nuclear energy. In the 21st century, Finland's four nuclear power plant units have been among the world leaders every year in terms of plant load factors. Finland is also the first country in the world where the challenge of spent nuclear fuel disposal has been solved. Spent fuel will be disposed of in the bedrock at a depth of approximately 430 metres.
This presentation describes how one of the key issues related to sustainable nuclear energy has been solved in Finland. The road to the solution was not straightforward, easy or quick. Many technical, political and social challenges had to be overcome. It has all been about people. Nuclear power produces soon 40 % of the Finnish electricity demand. Finns consider nuclear power to be a reliable and environmentally sustainable energy source.

Biography

Mr Juha Poikola' title is Manager, Public Relations. He also works as a TVO's expert in energy and climate policy. Currently Juha is also responsible for Olkiluoto 3 communication. Mr Poikola has actively participated into lobbying for positive political decisions for Olkiluoto 3 and Olkiluoto 4. Finnish parliament made these decisions in years 2002 and 2010. Mr Poikola has worked at energy sector for 21 years. Before that he worked for forest industry.
Education M.Sc. Forestry, Helsinki University 1987
MBA, Helsinki School of Economics (currently Aalto University) 1994

WEC 02:

Novel Technologies on Green Energy and Energy Storage

Chair

Dr. Jana Vejpravova, Professor, Charles University, Czech Republic

Co-chair

Ir. Tjerk Reijenga, Architect principal, BEAR-iD Sustainable Urban planners and architects, The Netherlands

Time: 09:00-12:15, May 19, 2023 (Friday)

Place: Kibune, 5F, Hyatt Regency Osaka

Title: Advances in Computational Materials Design for Energy Conversion

Dr. Hideaki Kasai,[1,2] Ryan Lacdao Arevalo,[1] Susan Menez Aspera[1]
[1]National Institute of Technology, Akashi College, Japan
[2]Osaka University, Japan

Abstract

The modern-day society has faced an unprecedented technological development that necessitated a tremendous amount of energy consumption. Because the global primary energy is derived mainly from a scarce supply of fossil fuels, much research effort is aimed towards the development of alternative energy systems that are the cheap, reliable, efficient, and environmentally friendly. Through the years, our group has been engaged in the field of computational materials design (CMD®) that contributed to the development and realization of materials for alternative energy technologies. In CMD, the fundamental properties of materials are accurately calculated through first-principles (ab-initio) calculations; that is, the properties of materials are determined from fundamental equations of quantum theory without empirical parameters. Its impact on industrial research and development has become very significant in the past years and is expected to grow in the coming years with the explosion of the number of granted patents purely based on CMD.

One particular topic of interest is the conversion of ortho-Hydrogen (o-H_2) to para-Hydrogen (p-H_2). At room temperature, there is a 3:1 ratio between o-H_2 and p-H_2. However, at thermal equilibrium conditions in the liquid phase of hydrogen, p-H_2 is more stable and dominant. The conversion of o-H_2 to p-H_2 entails giving off heat, hence the possibility of boil-off. In our research, we considered the H_2 quantum dynamics using density functional theory (DFT)-based calculation and perturbative calculations to enhance the conversion of o-H_2 to p-H_2 through surface interaction. The method we proposed is essential to avoid H_2 boil-off scenario by filling storage tanks with an equilibrium composition of 100% p-H_2.

Apart from this, we were also engaged with the development of electrode and electrolyte materials for fuel cells, particularly the proton exchange membrane fuel cell (PEMFC). We worked on finding alternative catalyst to the expensive Pt-based electrode. With our efforts, we tapped non-precious metal catalysts like the nature inspired hydrogenase for the hydrogen oxidation reaction (HOR) at the anode side and porphyrin and pyrrole-based material for the oxygen reduction reaction (ORR) at the cathode side. This will greatly reduce the cost of practical implementations of PEMFCs and would significantly contribute to the development of renewable energy sources. Aside from this, we have also investigated the alkaline fuel cells (AFC) that can work efficiently without the need for precious metals that are required for acidic environment. Among the reactions of interests are the conversion of fuels such as borohydride, hydrazine, carbohydrazide, and methanol.

Another important investigation related to catalysis on surfaces is the quantum tunneling effects in O_2 dissociative adsorption on metal surfaces. Here, we proposed the importance of the dynamics of reactions, which are analyzed by the motion of the nuclei based on quantum mechanics, and not only of electrons. Consequently, it was found that quantum tunneling effects for O_2 reaction plays an important role for the dissociative adsorption on the solid surfaces, e.g., Pt, which is now widely used as a cathode catalyst for the PEMFC. With this, the necessity of taking quantum effects into account for the analysis of corresponding reactions was realized. For the purpose of investigating quantum effects, we developed our own computation codes, NANIWA series, NANIWA Dynamics and NANIWA Statics.

All these works are just a few of our efforts dedicated to unraveling the many mysteries of material science with the purpose of significantly contributing to the preservation of the environment through developing novel materials for the realization of renewable energy sources.

Biography

Presenter: Prof. Hideaki Kasai is a professor emeritus at Osaka University in Osaka, Japan and the former president of the National Institute of Technology, Akashi College in Hyogo, Japan. In his long and multi-awarded career, he has published about 500 peer-reviewed works in reputable scientific journals and been granted about 32 patents. Among his most notable contributions to science are his pioneering works on ultra-fast quantum processes, elementary processes in excitations and reactions at surfaces and interfaces, quantum first-principles-based design of nano-material devices, hydrogen storage and fuel cell catalysts, nanospintronics, and properties of strongly correlated systems. He has held several key positions in the government and scientific organizations. He was a scientific adviser to the Supreme Court of Japan; advisory board member of the Institute of Solid State Physics Supercomputer; board member of The Vacuum Society of Japan, member of the editorial board and deputy editor of the Journal of Physics: Condensed Matter by the Institute of Physics; council adviser of the Physical Society of Japan; board adviser of the Physics Department at De La Salle University, academic adviser for the development of Bandung Institute of Technology, and member of the editorial board of the Computational Materials Science.

Title: Green Optoelectronics Based on Graphene and Van Der Waals Materials

Dr. Jana Vejpravova*
Professor
Charles University
Czech Republic

Abstract

Van der Waals (vdW) materials have been intensively explored for applications in energy storage, harvesting, and conversion, as well as for information storage and processing devices. Thanks to their unique optical and electronic properties, they have revealed a great potential for the creation of ultrathin nanoelectronic devices capable of electrical, magnetic, and optical control. In my talk, I will recap recent progress in the design of low-energy consumption architectures and hybrid nanomaterials based on graphene and other prominent 2D materials. Next, I will present several examples recently developed in our group, including their rational design, fabrication, and performance under chiral light and magnetic field down to helium temperatures. First, superradiant emitters (SREs) based on TMDs will be presented [1]. These ultrathin single photon emitters represent a new generation of light sources in which an ensemble of identical emitters produces a standing wave of electric dipoles that stimulate the emission from the system via collective light-matter interactions under a common pumping source. Thus, SRE based on solid-state emitters can dramatically improve the lighting devices' spectral purity and energy consumption. Next, a mixed-dimensional hybrid architecture based on TMD monolayer and single-molecule magnets will be discussed as a unique source of strong chiral light emission [2]. Finally, I will summarize new avenues for the design and fabrication of green optoelectronic devices based on the vdW materials, employing proximity effects and interfacial symmetry breaking.

Biography

Jana Vejpravova (https://vejpravova.eu), a Full Professor of Condensed Matter Physics, Charles University, earned her M.Sc. (with honors) in "Chemistry" in 2003 and graduated with Ph.D. in "Condensed Matter Physics and Materials Research" from Charles University in 2007. After her postdoctoral stays in 2010 (Hasselt University and National Institute for Materials Research, Tsukuba), she worked as a senior scientist & head of the department at the Institute of Physics, Czech Academy of Sciences; in 2015, she defended habilitation and became an Assoc. Professor at Charles University. In 2017, she returned to Charles University and established a research group thanks to the prestigious ERC Starting grant TSuNAMI (2016). Her current research interests cover the experimental physics of two-dimensional materials, nanocarbons, and magnetic nanoparticles. She published ~ 180 publications in peer-reviewed journals and three book chapters and co-edited one book. Her work was already supported by > 15 national and international projects as PI. She has received various awards, including B. Bolzano Foundation Annual Award in Physics (2007), the Award of the Minister of Education, Youth, and Sports for results of Major Significance (2008), the Scopus/Elsevier Award (2010), Otto Wichterle Award (2014), and F. Běhounek Award by Minister of Education, Youth, and Sports for propagation and popularization of Czech Science in European Research Area (2019).

Title: Devices Based on Graphene Heterostructures

Dr. Martin Kalbac
Professor
J. Heyrovsky institute
Czech Republic

Abstract

Functionalization of graphene dramatically enhance potential for application of this material. However, so far realized strategies do not typically allow to control the functionalization process in terms of localization of the functional groups and mutual interactions with the graphene. We show here that mastering of these processes will pave the way to precisely control electronic structure of graphene and thus enable more advanced applications. I will review some strategies, which enable controlling and tailoring the functionalization process. Also I will show how tailored functionalization can be exploited to optimize function of graphene /PANI composite for energy storage applications.

Biography

Martin Kalbac graduated in inorganic chemistry from Charles University, Prague, Czech Republic, (1998), where he also received his Ph.D. degree in 2002 and has been habilitated in the field of inorganic chemistry (2019). Since 2001 he has worked at the J. Heyrovsky Institute of Physical Chemistry of the Academy of Sciences of the Czech Republic. Currently, he is a vice-director of the institute and the head of the Department of Low dimensional Systems. His research interests include carbon nanotubes, 2D materials, Raman spectroscopy and spectroelectrochemistry, isotope engineering of carbon nanostructures and sensorics.

Title: How BIPV Will Change the Built Environment

Ir. Tjerk Reijenga
Architect principal
BEAR-iD Sustainable Urban planners and architects
The Netherlands

Abstract

When I was introduced to PhotoVoltaic systems for the first time, it was 1993. Some researchers were looking for the application of PV systems attached to buildings. We joined a consortium in the Netherlands with Ecofys and the Dutch ministry of Economic Affairs to develop and to demonstrate PV systems for buildings.
In 1994 we started our first demonstration project for BIPV roofs. This project was shortly followed by another series of projects about BIPV. Within IEA PVPS task 7 about building integration, we started to disseminate the advantage and the challenges and pitfalls as well.
Now, 30 years later, BIPV is ready to apply everywhere, the costs, the exact orientation, the appearance and the colour are no barriers anymore. Regulation is sometimes lacking but this is also a matter of time.
The application of BIPV will be less obvious, almost unnoticed in buildings. BIPV cladding systems can have the same high-end appearance as natural stone or glazed facades.
My presentation will focus on the big changes and give the arguments why BIPV can be used in future development.

Biography

Tjerk Reijenga did his masters (with honour) at the Delft University of Technology. Soon after, he founded BEAR-iD (Dutch name: BEAR Architecten) in the Netherlands. In 2009 he opened a second office in Shanghai.
The work of BEAR-iD focus on sustainable urban planning and design. Many projects have been built in the Netherlands and in China.
Besides the design work, time was also spend on EU funded research and co-operation within IEA PVPS (task 7 and task 15). Several projects for UNDP with the focus on solar systems are also carried out.

Title: Utilization of Wave Energy by Hybrid System

Dr. Rositsa Velichkova**, Martin Pushkarov, Iskra Simova and Detelin Markov
Associate Professor
Technical University of Sofia
Bulgaria

Abstract

The oceans are a great source of renewable energy, which is stored in the form of heat, kinetic energy, chemical energy, and biological energy. Similar to hydro energy, wind, and solar energy, ocean dynamics is an ideal energy resource. The aim of our study is to present the design of a new integrated system for harvesting the energy of the tides. The integrated system consists of an air turbine and a water turbine with oscillating blades. The paper also discusses the strength of the tides and the efficiency of the sea and ocean waves' energy transformation in mechanical energy. It is also given some experiment results of the main parameters of turbines.

Biography

Assoc.prof. Rositsa Velichkova PhD (2011) in Fluid Mechanics by the TUS. She has a Master Degree by the TUS (2003) in Heat, ventilation and air conditioner systems. Her main activity has been focused on research and innovation on the topics of fluid mechanics, heat comfort, CO2 utilization and risk assessment, Indoor and outdoor environment assessment and renewable energy system. She has participated in a huge number of national and international projects together with a vast number of research and education institutions. She has lead an international conference EFEA 2021 and internal conference for faculty of Power Engineering and Power machines.
http://orcid.org/0000-0003-3757-8685

Title: CO_2 Utilization in Advanced Power Generator and Olympic Ice Rink

Dr. Hua Tian*, Ligeng Li, and Jingyu Wang
Professor,
Tianjin University,
PR China

Abstract

The power cycle and refrigeration cycle using natural CO_2 as the working fluid, are the effective technologies to reduce the CO_2 emission. Focusing on the principle of efficient CO_2 cycle in power generation and refrigeration systems, we have achieved innovative results in terms of key components, cycle configuration, system integration, and application. For the application of power cycle, a small-scale supercritical CO_2 turbo-generator was developed and tested in a CO_2 transcritical power cycle test bench. The maximum electric power reached 11.5 kW with a total efficiency being higher than 58%. The maximum cycle efficiency reached 6.5%. For the application of refrigeration cycle, integrated CO_2 ice rink technology was applied in the Beijing 2022 Winter Olympics to help to reach the goal of the first carbon-neutral Olympics. An improvement of 103.4% in energy efficiency was achieved compared with the traditional R507A ice rink technology by comprehensive utilizing both cooling and heating energy. The ice was more uniform, with a temperature difference within 0.3°C (1.3°C for traditional ice), conducive to breaking seven new records.

Biography

Hua Tian, Professor/Doctoral Supervisor of Tianjin University, chief National Key R&D Program scientist. Deputy Director of State key lab of engines, Tianjin University. Supported by National Natural Science Funds for Excellent Young Scholar. He has long been engaged in the basic theory and key technology research on internal combustion engine waste heat recovery, supercritical CO2 power/cooling cycle, and intelligent control of energy systems. In recent years, with "direct utilization of carbon dioxide to achieve carbon emission reduction" as the main research line, he has established the theory and technology system of the power cycle and refrigeration cycle with carbon dioxide as the working medium, which is applied in the field of internal combustion engine waste heat recovery and artificial ice production. He first proposed the waste heat recovery CO2 trans-critical power cycle technology for internal combustion engines, which has been technically transformed in many enterprises such as Weichai Power Engine, Yuchai Group, and Sinotruk Jinan Truck. As the chief scientist, he presided over the National Key R&D Program - Science and Technology for Winter Olympics Special Program and developed the CO2 trans-critical ice-making technology, which was first applied and demonstrated in five ice rinks including the short track speed skating and figure skating competition venues of the Beijing Winter Olympics. He has published 100 SCI papers (11 highly cited) as the first/corresponding author, 23 authorized patents for inventions, and 4 monographs. He received the second prize in the National Natural Science Award of China and the first prize in the Tianjin Natural Science Award.

Title: Preparation and Adsorption Properties of Amine Functionalized Mesoporous Humidity Control Material from Light-emitting Diode Waste Quartz Sand and Granite Sludge

Dr. Kae-Long Lin[1,*], Ya-Wen Lin[2], Wei-Hao Lee[2], Bo-Yi Kuo[1] and Yen-Chun Liu[1]
Director
[1] Department of Environmental Engineering, National Ilan University, Yilan city
[2] Institute of Mineral Resources Engineering, National Taipei University of Technology
Taiwan, R.O.C.

Abstract

In this study, we synthesized an amine functionalized mesoporous humidity control material (AF/MHCM) using SiO_2 from light-emitting diode waste silica sand (LEDWQS) and Al_2O_3 from granite sludge (GS). The crystalline phase and surface composition of AF/MHCM were consistent with those of typical MCM-41. The specific surface area of AF/MHCM with 2.5 vol.% amine functional groups was 26.21 m^2/g. The grafting of amine functional groups on pore surfaces and the nitrogen adsorption-desorption isotherm of AF/MHCM confirmed a change from type IV to type II. The AF/MHCM with 2.5 vol.% amine functional groups presented excellent humidity control performance, with moisture adsorption–desorption performance reaching 63.36 g/m^2, thereby meeting the Japanese Industrial Standards for humidity control building materials (i.e., > 29 g/m^2). AF/MHCM synthesized using recycled waste from the manufacture of electronics could be used as an interior humidity control material in a variety of applications.

Biography

Ya-Wen Lin Ph. D. student
OBJECTIVE: To pursue a research career in Eco-Zeolite/ Waste Treatment/Management/ recycle/ E-waste recycle/humidity control materials.
ACADEMIC RECORD
Ph.D. candidate: Institute of Mineral Resources Engineering, National Taipei University of Technology, Taipei 10608 Taiwan (2019-)
Thesis Title: Research on the Recycling and Reuse of Waste from the Optoelectronics Industry to Synthesize Eco-Zeolite
Master of Science: National Ilan University, Yilan, Taiwan, 260007 (2016-2018)
Thesis Title: Preparation of Nanoscale Catalyst Using Supercritical Fluids Applied in Thermal-Photocatalytic Gaseous Pollutant
University: Dayeh University, Changhua, Taiwan 515006, R. O. C. (2012-2016)

WEC 03:

Video Forum

Title: Pumped hydro, Solution or Pariah. The case of Snowy 2.0.

Dr. Glen Currie
Lecturer
University of Melbourne
Australia

Abstract

Until recently, hydro dams have been seen to impact the local environment in such as way to make their energy and water management less than worthwhile. The World Bank stopped funding them, and local governments have turned away most development proposals in the past decade.

The path to renewables has shown that storage is central to balancing electricity supply. The storage that has seen most media is lithium battery storage, which can respond in a fraction of a second and balance electricity grids but can only take the total load for minutes. The other type of storage fills the holes in generation during times of lesser wind, and less sun, meaning those two dominant renewable generators have low output. This can mean enormous volumes of electricity are needed for scales of a week or more.

Therefore hydro dams with two dams, one low and one high can absorb renewable electricity during high output to pump water from the bottom dam to the top dam, and release the energy by dropping the water again when the solar and wind electricity supply has dropped. These are known as pumped hydro, and an assessment of Australia found 28,000 potential sites (Stocks etal., 2021).

The next question will be to select sites with less environmental and social impact, so the first step is to analyse examples of environmental impact of pumped hydro in Australia. In this presentation, I will discuss Snowy 2.0 which is currently being built in NSW.

Stocks, M., et al. (2021). "Global atlas of closed-loop pumped hydro energy storage." **5**(1): 270-284.

Biography

Victorian based business manager with experience in 44 countries. A Fellow of the Australian Institute of Energy and active in the energy industry from electricity generation to retail including commercialization of innovative technologies.

Over 20 years' experience strategically planning and leading transformations of companies. At Caterpillar, Glen was a Senior Consultant in the Service Department technology program for dealers in Europe, Asia and Australia. Led business for CSIRO Energy and became passionate about the energy transition. Next, started up solar and energy technology businesses and now submitted PhD thesis in Consumer Roles in the Future Electricity System.

Glen leads complex problem solving, quickly marshalling teams to respond to changing circumstances. His mandates in previous roles included helping to "fix" the commercial process and associated systems within CSIRO Energy.

Title: The Vanadium Redox Flow Battery Operating with Overloaded Electrolytes in order to Enhance the Stored Energy Density

Dr. Théo Tzedakis
University of Toulouse III-Paul Sabatier
Toulouse-France

Abstract

Vanadium redox flow batteries (VRFB) are one of the most promising technologies for large scale energy conversion and storage [1]. Since it uses the same element in its four oxidation states ($\oplus$: $V^{(V)}/V^{(IV)}$ and $\ominus$: $V^{(III)}/V^{(II)}$), its major advantage is the non-contamination of the electrolytes because the ionic transfer towards the electrolytic compartments (cross-over), a classical problem observed in most other RFBs. The crossover exists of course, however its effect in this case is only a certain loss on the faradaic yield, and its advantage is that it suppresses the needs of costly separative operations of the electrolytes. The means that the electrolyte has an infinite regenerative capacity [2], makes this type of battery extremely rewarding on the economical point of view as well as on the environmental point of view (there is none rejection of electrolyte). However, the commercialization of the VRFB is hindered, among other reasons, by:
i) the limited quantity of stored energy *(~ 40 kWh/m³*) due to the various solubilities of the vanadium salts *(< 2 M*); the last are strongly influenced by the sulfuric acid concentration, generally used as supporting electrolyte (*higher [H_2SO_4] stabilize the $V^{(V)}$ species but decrease the solubility of the other salts $V^{(II)}$, $V^{(III)}$ and $V^{(IV)}$*).
ii) operating temperature which affects the solubility of vanadium salts, inducing thereby an opposite behavior for the $V^{(V)}$ compared to the other valences.
Therefore, the precipitation of vanadium species is considered to be an important problem for which a number of solutions has been proposed such as the use of a mixed H_2SO_4/HCl supporting electrolyte [3] and precipitation inhibitors [4].
The proposed talk presents results obtained during the study of solid/liquid suspensions of the vanadium salts, expecting to propose the building of a battery with intensified stored energy. Typically, talk will begin with the presentation of syntheses and characterization of all the involved solids salts, as well as the kinetic laws of the precipitation of their oversaturated solutions. Then the talk will pursue by developing a complete thermochemical treatment of the graphite felt electrode in order to improve its electrocatalytic properties. Finally the mains results of the electrochemical behavior of the elaborated solid/liquid vanadium suspensions during cycling (charge/discharge of the battery) will be presented to conclude on the performance of the battery.

Biography

*Permanent position, full Professor at the University of Toulouse III-Paul Sabatier, France; affected at 'The Chemical Engineering Laboratory,
https://lgc.cnrs.fr/annuaire/tzedakis-theo/', Electrochemical Processes Department :, Head of the Team 'ELECTRE':
'Electrochemical Engineering' - Conception-designing and optimization tools and processes for Energy and electrosynthesis».
*theodore.tzedakis@univ-tlse3.fr; Tel.+33561558302; mobile : +33631186656; ORCID number: Orcid.org/0000-0002-9222-4487.
Assistant professor 1987, Associated professor 1991, and full professor 2001 to this day at the same university.
*PhD of U.P.S. 1989 at 'The chemical engineering Laboratory', University Paul Sabatier of Toulouse, Specialty: chemical
engineering. "Study of indirect electrooxidation processes of aromatic compounds using metallic cations"
*HDR 'Habilitation to manage researches' (2000), at 'The chemical engineering Laboratory', University Paul Sabatier of Toulouse, Specialty: chemical engineering. "The electrochemistry for the understanding, the design and the optimization of clean processes".
Research field: Conception, design, building, optimization and modelling of tools and processes in the field of electrochemical engineering, at both the micro and macro scale, applied on energy and electrosynthesis of organic compounds. In the carried studies, both physical and chemical analyses of all the phenomena occurring (kinetics,

mass and electron transfers, fluid mechanics,…) were performed and followed by experimental and theoretical optimization. Electrochemical reactors and microreactors have been developed for chiral syntheses, or semi solid flow cells,

Collaborations with industry (Airbus, Snecma, Totalenergies, CEA, Areva, Renault,…) and also with several academic labs. Some examples of leaded projects: *Coordinator of the ANR project Vanadium Solid-Liquide redox flow batteries, *Partner of HY-UREA ANR project 2020-2023

*Electrolyte transfer modelling in Lithium batteries (Project with Renault).

*About sixty 'full papers' and around 100 communications in the field of chemical and electrochemical engineering. Supervisor of 20 PhD and several (>50) Masters internships

*Head of research team: ELECTRE-Electrochemical Engineering, Conception-designing and optimization of molecules, tools and processes at micro and macro scale, for synthesis-pollution abatement and Energy».

* Coordinator of the Organizing Committee of the 7th European Symposium on Electrochemical Engineering, 2005 Toulouse, France. 8th European Summer school on Electrochemical Engineering 2018 Toulouse, France.

13th European Symposium on Electrochemical Engineering, 2023 Toulouse, France.

*Co-organizer of the symposium 8 of the Electrochemical Process Engineering and Technology, 5th division of the ISE, 2010, Nice.

*Coordinator of the scientific committee of the Faculty 'Sciences and Engineering' at the Paul Sabatier University (~2000 scientists): 2014-.

*Member of the scientific board of 'European Symposium on Electrochemical Engineering': 9thEEE, 2011, Chania, Greece 10thEEE, 2014, Sardinia, Italy

Title: Stability Oriented Optimal Energy Management of Multi- microgrid Integration with Powergrid and its Impacts

Saritha K S,
Associate Professor
Sree Narayana Gurukulam College of Engineering (SNGCE), Kerala
India

Abstract

Electricity that is reliable, affordable, and of high quality serves as a basic requirement for any consumer or sector that promotes national advancement. Deregulation of the electrical market, open access in the power industry, and technological advancements in distributed generation have given the distribution network a new dimension. Microgrids consequently became an essential component of the current electrical power infrastructure. Integration of microgrid with the utility grid helps to increase the stability, import/export electric power from/to the main grid. Also, power quality, flexibility and reliability increase the overall social performance of the micro grid system. Customers benefit economically and environmentally from the integrated microgrid strategy, which also makes the system more adaptable and trustworthy. This presentation will cover the advantages of microgrids, an integrated microgrid scenario, and how multi-micro grid integration can increase the usage of renewable energy sources without violating system constraints and grid stability. It will also cover the benefits of microgrid integration for the end user and performance of the power system.

Biography

Saritha K S, is an Associate Professor in Electrical and Electronics Engineering Department, Sree Narayana Gurukulam College of Engineering (SNGCE) under Kerala Technological University, Kerala, INDIA. She was born and raised in Kerala, where she also earned her undergraduate degree from Mahatma Gandhi University, Kerala. She started working in the Industrial sector (Kerala State Electricity Board) as an apprentice after receiving her bachelor's degree, and she continued there as a Skilled Assistant for almost ten years. After that she enrolled in SNGCE as Assistant Professor in Electrical and Electronics Department and continuing there as Associate Professor from 2017 forward. She graduated with a master's degree in Power Electronics and Power Systems from Mahatma Gandhi University, Kerala. She is currently almost done with her Ph.D. Programme in Electrical Engineering Department at Cochin University of Science and Technology (CUSAT), Kerala, India, under the guidance of Dr. Sasidharan Sreedharan, University of Technology and Applied Sciences, Sultanate of Oman and Dr. Usha Nair (Retired Professor) Electrical Department, School of Engineering, CUSAT. Her research interests include the integration of renewable energy sources into the grid, microgrid integration, optimal power system operation, and grid stability.

Title: Thermophilic digestion of solid Biomass (wheat husk)

Dr. Nirmal Halder
Assistant Professor
Sandip University, Nashik, Maharashtra
India

Abstract

In present investigation, for efficient biogas production from wheat waste like wheat husk, an analysis was performed on thermophilic digestion. For current study, thermophilic biogas digester was utilized to decrease the digestion period. Thermophilic digestion was kept by heating the water placed at outer jacket of digester. J Type thermocouples were located at various position inside the digester. A Data Accusation System was used to display the temperature of thermocouples. Thermophilic digestion analysis was done with contour of velocity, pressure, temperature, density, turbulent kinetic energy. Also velocity vector, velocity streamline, mass fraction for wood volume, carbon di oxide and oxygen has been studied to discuss the thermophilic digestion analysis.

Biography

Nirmal Halder, Distinguished Assistant Professor of Aerospace Engineering, Sandip University, grew up in India and received his Bachelor's degree (B.Tech) in the Jalpaiguri GOVT Engineering college of West Bengal in 2006. After that he completed Master Degree (M.Tech) from Indian Institute of Technology Guwahati (IIT Guwahati) of Assam in 2008. He obtained his Ph.D. degree from Indian Institute of Technology Kanpur (IIT Kanpur) of Uttar Pradesh in 2021.

After completion of B.Tech, he joined ‘United conveyor corporation India PVT LTD’ as project Engineer in 2006. There he worked for 1 year and 6 month. Then he joined IIT Guwahati to complete Master Degree in Technology by cracking world’s on of the most toughest exam ‘Gate’. After completing of M.Tech degree, he worked for ‘Maharishi Markendeshwar University’ in 2010-2012 as ‘Lecturer’. He worked as research associate at IIT Kanpur in 2021-2022. He joined As Assistant Profess or at Sandip University in 2022 to till date after accomplishment of Ph.D degree.

His area of research are Thermodynamics, Heat transfer analysis, Fluid Mechanics, Thermal Engineering, Fluid machinery, Computational Fluid Dynamics & Heat Transfer, Numerical simulation & modeling of Turbulent Flow, Convective Heat & Mass Transfer, Experimental methods in Thermal Sciences, Thermal Hydraulics in Power Generation Technology (Two Phase Flow), Flow past over an airfoil, wetting of droplet, biogas digester, Renewable energy. He has published 7 journals and 5 international conference.

Title: Energy Storage in Poland: Legal Status, Market Development Potential

Ms. Katarzyna Wypychewicz
Board Advisor
Polish Energy Storage Association
Poland

Abstract

Energy storage is an essential component of the transition towards a more sustainable energy system. In Poland, although the legal framework for energy storage is still in its early stages of development, the introduction of a new law on July 3rd, 2021 has given the green light for the development of energy storage systems. The market for energy storage is growing, driven by the increasing demand for renewable energy and the need for energy security. The potential for market development is high, with ambitious plans for deployment by DSOs and TSO announcement of at least 800 MW by 2030. The presentation will analyse the current regulations and policies related to energy storage, identify the main barriers to market growth, and explore the opportunities for investment in the energy storage sector. It will provide insights into the challenges and opportunities for energy storage in Poland, and provide recommendations how policymakers and investors on how to accelerate the development of this critical technology.

Biography

Reports:
PTPiREE, Power industry, distribution and transmission (“Energetyka dystrybucja i przesył”), 2021
Polish Energy Storage Association, Impact of the expansion of energy storage infrastructure on economic development in Poland - forecast until 2040 (“Wpływ rozbudowy infrastruktury magazynów energii na rozwój gospodarczy w Polsce – prognoza do 2040 r.”), 2022
Websites:
European Commission website on energy (https://energy.ec.europa.eu/index_en)
Ministry of Climate and Environment in Poland (Ministerstwo Klimatu i Środowiska)
National Fund for Environmental Protection and Water Management (Narodowy Fundusz Ochrony Środowiska i Gospodarki Wodnej)
Polish Energy Group (Polska Grupa Energetyczna, PGE)

Posters & Papers

Title: Application of Nanomaterials in (Bio) Sensors

Dr. Elzbieta Malinowska
Professor
Faculty of Chemistry
Warsaw University of Technology
Poland

Abstract

Chemical sensors are an alternative to typical instrumental analytical methods, offering a low unit cost of analysis, the possibility of miniaturization and a much shorter analysis time. Nanomaterials became recently important components in bioanalytical devices since they clearly enhance the performances in terms of sensitivity and detection limits. The specific properties of such nano - objects are beneficial in comparison to classical transduction methods. Nanomaterials, after proper functionalization, can be used as active components of sensor structure. Their catalytic activity, biocompatibility and the ability to amplify the analytical signal are of particular importance from the point of view of (bio)sensors development and application. The combination of the unique features of nanomaterials with the recognition ability and selectivity offered by receptors of biological origin (e.g., based on DNA/DNA or antibody/antigen interactions) enables the development of sensors with unique working parameters that are of high importance concerning medical diagnostics, biotechnology, food industry, agriculture and environmental research.
In this lecture the latest achievements in the field of (bio) sensors, including the application of nanomaterials in a construction of transducers and receptor layers will be discussed.

Biography

Prof. E. Malinowska is currently a Full Professor of Chemical Sciences at Warsaw University of Technology (WUT) and V-Ce Director of the Centre for Advanced Materials and Technologies (CEZAMAT) in Warsaw, Poland. She completed her doctorate (1984), habilitation (2002) in analytical chemistry at WUT, and performed postdoctoral trainings in the group of Prof. W. Simon at ETH Zurich (1984-85) and in the group of Prof. M. Meyerhoff at University of Michigan (1993-95). She received the title of professor in 2007. Her current research is focused on the development of bio- and nano materials and their application in chemical sensors and biosensors as well as medical devices.

Title: Nucleic Acids Based Approach in Electrochemical Detection of Metal Ions

Elżbieta Malinowska*, Marcin Olszewski, Anna Szymczyk, Marta Jarczewska, Joanna Zajda, and Robert Ziółkowski
Chair of Medical Biotechnology
Faculty of Chemistry
Warsaw University of Technology
Poland

Abstract

Recently nucleic acids gained considerable attention as selective receptors of metal ions. This is because of the possibility of adjusting their sequences in new aptamers selection, as well as the convenience of elaborating new detection mechanisms. Such a flexibility allows for easy utilization of newly emerging nanomaterials for the development of detection devices. This, in turn, can significantly increase analytical signal intensity and the same can allow for obtaining exceptionally low detection limits and fast biosensor responses. All these properties, together with low power consumption, make nucleic acids biosensors perfect candidates as detection elements of portable analytical devices. Presented study is dedicated to investigations on the development of easy in use electrochemical biosensors toward chosen metal ions. Research was focused on one hand on the receptor layer design including DNA/RNA sequences, its lengths or further labelling with electrochemical redox marker. The other part was dedicated to the detection conditions adjustment, both pH, buffer composition electrochemical markers used. Also the feasibility of the obtained biosensors miniaturization was shown, making the developed assays potentially applicable in real life measurements conducted directly in the sampling place.

Biography

Head of the research group "Nanomaterials, Biosensors and Medical Diagnostics" at the Department of Medical Biotechnology at the Faculty of Chemistry of the Warsaw University of Technology. She is a world-renowned specialist in the construction of chemical sensors and biosensors. Her research interests include production and characterization of nanomaterials for bioanalytical applications and the development of modern biosensors involving DNA, aptamers and antibodies. Author of >155 papers, including: over 115 in journals from the JCR list (according to Scopus: h-index 31, 2818 citations, IF> 350) and 5 monographs and 4 patents. She realized 16 research projects. Functions: Deputy Director of the Center for Advanced Materials and Technologies CEZAMAT PW.

Title: Chemical Changes of Oak Wood Polysaccharides During Thermal Degradation

Dr. František Kačík*, Dr. Danica Kačíková, and Dr. Ivan Kubovský
Professor
Technical University in Zvolen
Slovakia

Abstract

Wood has been widely used to produce construction materials, flooring, furniture, and interior finishing materials because of its various useful properties. However, the outdoor utilization of wood is highly limited by its strong hygroscopicity and low durability. Thermal modification is an environmentally friendly method to improve the dimensional stability and decay resistance of wood. Samples of European oak (*Quercus robur*, L.) were thermally modified at atmospheric pressure using three temperatures (160, 180, and 210 °C) according to Thermowood process and compared to untreated one. Chemical changes of oak wood polysaccharides were evaluated by infrared spectroscopy (FTIR) and size-exclusion chromatography (SEC). FTIR spectra were recorded on a Nicolet iS10 FT-IR spectrometer using an attenuated total reflectance (ATR) sampling accessory attached to a diamond crystal. Samples of cellulose and holocellulose were derivatized using phenyl isocyanate to obtain tricarbanilates. SEC analyses were performed at 35 °C with tetrahydrofuran at a flow rate of 1 ml min^{-1} on a two PLgel, 10 µm, 7.5 × 300 mm, MIXED B columns. From obtained results is evident that polysaccharides undergo various changes at elevated temperatures. From FTIR spectra can be observed the cleavage of acetyl groups, especially in hemicelluloses, the most thermally labile wood polymer. SEC analyses show depolymerization of cellulose at the temperature above 180 °C and crosslinking of polysaccharide chains at the temperature of 210 °C. This work was supported by the Slovak Research and Development Agency under the contracts No. APVV-17-0005 (25 %) and No. APVV-16-0326 (25%), and by the VEGA Agency of Ministry of Education, Science, Research and Sport of the Slovak Republic No. 1/0493/18 (25 %) and No. 1/0387/18 (25%).

Biography

Frantisek Kacik is a full-time professor at the Technical University in Zvolen, Slovakia. He earned his M.Sc. (1982) in chemistry from the Pavol Jozef Safarik University in Kosice, Slovakia, and his Ph.D. (1989) degree at the Technical University in Zvolen. His research and teaching interests include wood chemistry, biomass treatment, and analytical methods in wood chemistry. His recent research activities include wood thermal modification, biomass pretreatment and wood flame retardants. He has consulted to several biomass processing plants (Mondi SCP, Energochemica) on pulp production, and biomass pretreatment for cellulosic ethanol production. He is a member of American Chemical Society (ACS).

Title: Metal-Tag Labeling Coupled with Inductively Coupled Plasma Mass Spectrometry for Quantitation of Graphene Oxide in Biological Tissues

Dr. Yu-Cing Li, Yuh-Chang Sun, and Tsung-Ting Shih
Department of Biomedical Engineering and Environmental Sciences
National Tsing Hua University
Taiwan

Abstract

Graphene oxide (GO) is colloidal-sized particles with diameters ranging from 50 to 200 nm. As a result of the unique properties of GO nanosheets, such as ultrahigh specific surface area and good biocompatibility, GO has attracted much attention as a promising nanomaterial in the development of drug-carrier in which drugs may be encapsulated and adsorbed. Because the endothelial fenestration of tumor is up to 780 nm, the permeability of blood vessel to GO in the tumor region is considered much higher than that of the normal tissues, by way of EPR effect. However, up to now, the lack of proper analytical methods of GO quantitation in biological tissue still hamper the sound understanding of pharmacokinetic behavior of GO during the drug-carrier development. To achieve the goal of further understanding the pharmacokinetic behavior of GO as a drug-carrier, this analytical method can reveal the distribution phenomenon of GO after its exposure. Herein, we established a sample and efficient analytical method for the quantitation of GO in biological tissues. We choose the ultra-trace metal element thorium (Th^{4+}) in living organism as an tag of GO by means of the appropriate interaction between Th^{4+} ion and those moieties of the surface of GO sheet. Additionally, combined with a sophisticated sample digestion, filtration sample collection procedures, and the subtle employment of masking agent, we have successful minimized the influences of matrix effects resulted from biological tissue. Under the optimized conditions, the analytical performance of the method was demonstrated in a wide concentration range, from 1 pg L-1 to 1000 pg L-1, with a detection limit of 4.49 pg L-1.

Biography

Yu-Cing LI received his B.Sc. degree from the Department of Medical Laboratory Science and Biotechnology of Fooyin University (FY) in 2017. In FY, she was engaged in the research involving effects of Taiwan fried chicken on lipid peroxidation and antioxidative enzymes in young people under the supervision of Prof. Wei-Chang Tseng. Thereafter, she joined the research group directed by Prof. Yuh-Chang Sun and pursued her M.Sc. degree in the Department of Biomedical Engineering and Environmental Sciences, National Tsing Hua University (NTHU). In NTHU, she focused on the development of inductively coupled plasma mass spectrometry (ICP-MS)-based hyphenation techniques for quantitation of graphene oxide in biological tissues. Meanwhile, she was a certified clinical laboratory technologist in Taiwan (R.O.C.). The interests of her research are the development of sample pretreatment techniques and microfabrication techniques and polymer- and paper-based microdevices used for the determination of trace elements in biological specimens.

Title: Use of Fluorescence Spectroscopy as Analytical Methodology to Determine Gramicidin in Corn Steep Water

K. Lvova[1], X. Vecino[1]*, J.M. Cruz[1], A.B. Moldes[1], and B. Pérez-Cid[2]

1 Chemical Engineering Department, School of Industrial Engineering – CINTECX, University of Vigo, Campus As Lagoas-Marcosende, 36310 Vigo, Spain

2 Analytical and Food Chemistry Department, Faculty of Chemistry – CINTECX, University of Vigo, Campus As Lagoas-Marcosende, 36310 Vigo, Spain

Abstract

Corn steep water (CSW) is a residual stream of wet corn milling industry where it was demonstrated the presence of Aneurinibacillus Aneurinilyticus. This microorganism is characterized by the ability of producing Gramicidin (GR), a polypeptide with antibiotic properties, under the framework of the project ref. PID2021-122221OB-I00. In the production of GR, they can be involved different cluster of gens and consequently various types of GR can be produced. Hence, GR-S is a cyclic peptide, whereas GR-D is a mixture of lineal molecules with slightly differences in the aminoacidic chain, and they are known as GR-A, GR-B and GR-C. Lineal GR possess a higher molecular weight than GR-S and all of them contains fluorescent amino acids. Thus GR-S is characterized by the presence of phenylalanine (Phe); whereas GR-D is characterized by the presence of phenylalanine (Phe), tyrosine (Tyr) or tryptophan (Trp). Therefore, based on this A. Aneurinilyticus, microbial extracts from CSW or synthetic media were analyzed by fluorescence spectroscopy to determine the presence of Gramicidin. Commercial GR-S and GR-D were used to prepare the stock solutions.

Biography

Xanel Vecino is a Ramón y Cajal postdoc researcher in the Chemical Engineering department of the University of Vigo (Spain). Her long-term goal of research is the development of cost-effective and sustainable revalorization of secondary raw materials to produce value-added products (e.g., biosurfactants and bioadsorbents) by following the concept of circular economy and industrial symbiosis. Indeed, she is a PI of a JIN-type I+D+i project, from the call «Proyectos Retos Investigación 2019», based on the recovery of biosurfactants from corn steep waters by membrane technology, in the University of Vigo (Spain) in collaboration with the Universitat Politècnica de Catalunya (UPC, Spain).

Title: Single Crystal X-ray Diffraction Studies on Alkali Metal Thallides

Dr. Stefanie Gartner*, Susanne Tiefenthaler, and Vanessa Schwinghammer
Head of Department X-ray Structure Analysis
Faculty of Chemistry and Pharmacy
University of Regensburg
Germany

Abstract

In the 1980s and 1990s, binary materials of alkali metal and thallium have been characterized but crystal structures always suffered from severe absorption effects due to very large absorption coefficients for these kinds of materials. Nowadays, brighter X-ray sources in combination with new detector techniques allow deeper insights into this class of compounds. We here show, that well-resolved data can be obtained in these days even for very strong absorbers, like alkali metal thallides, and this allows a new and deeper understanding for inorganic solid state materials, far beyond the experimental limits in the 1980s and 1990s. On our poster, we present three different examples, where we demonstrate how far structure determination can go for strong absorbers (μ>60 mm-1). The first structural family we focused on belongs to the A8Tl11 structure type.[1]
Additionally, we were interested in the sodium rich binary material "Na6Tl", which was characterized in 1972 by Samson and Hansen who reported evidence for a not fully occupied or even empty point set and comparatively high temperature factors for one sodium position.[2]
The third class of compounds we focus on our poster belongs to the A15Tl27 structure family, of which up to now only Rb15Tl27, Cs15Tl27 and Rb14CsTl27 are known. We show that for new mixed alkali metal compounds, preferences for the alkali metal positions can be resolved.
[1] S. Gärtner, S. Tiefenthaler, N. Korber, S. Stempfhuber, B. Hischa, Crystals 2018, 8(8), 319
[2] S. Samson, D.A. Hansen, Acta Cryst. B, 1972, 28, 930-935.

Biography

Dr. Stefanie Gärtner is Head of the department X-ray Structure Analysis (part of the central analytical services of the Faculty of Chemistry and Pharmacy, University of Regensburg). She obtained her Ph.D. at the University of Regensburg in the group of Prof. Korber (inorganic chemistry), where she studied very temperature labile crystals of main group elements grown in liquid ammonia. She is giving lectures in X-Ray Structure Analysis and inorganic chemistry for undergraduate and graduate students of chemistry. Currently, her research focuses on strongly absorbing crystalline materials, especially alkali metal thallides, which are obtained by classical solid state techniques. Susanne Tiefenthaler and Vanessa Schwinghammer work on thallides in context of their Ph.D. and teachers approval work, respectively.

Title: Strongly Absorbing Materials: How Far Can Structure Determination by X-rays Go?

Dr. Stefanie Gartner
Head of Department X-ray Structure Analysis
Faculty of Chemistry and Pharmacy
University of Regensburg
Germany

Abstract

Compounds including the element thallium in formal negative oxidation states are known since Eduard Zintl stated the existence of NaTl in the 1930s. Zintl himself prepared 1:1 binary alkali metal thallides by reducing thallium (I) salts by alkali metal in liquid ammonia solutions. The resulting, very air and moisture sensitive microcrystalline powders were characterized using X-ray powder diffraction methods.[1] Based on his powder diffraction data he rightly concluded a cubic unit cell (Fd-3m) where the structure only revealed one crystallographically independent Na-Tl distance. We repeated Zintl's experiments and observed a tetragonal splitting of the cubic reflections in Zintl's NaTl. The subsequent structure solution and refinement resulted in tetragonal NaTl-tI8 (I41/amd)[2] which undergoes a reversible first order phase transition upon heating to cubic NaTl-cF16. Additionally, DSC and 23Na MAS NMR investigations have been performed. Theoretical calculations suggest that the reason for the tetragonal distortion is due to the splitting of one Na-Tl distance in the cubic form into two different distances in the tetragonally distorted structure. As a consequence, the Na-Tl interactions are optimized.[3]
Besides X-Ray powder diffraction studies, also single crystal X-Ray structure analyses of thallides reveal interesting results, which we present on our related poster.
[1] Zintl, E.; Goubeau, J.; Dullenkopf, W. Salzartige Verbindungen und intermetallische Phasen des Natriums in flüssigem Ammoniak. Z. Phys. Chem. 1931, 154, 1–46.
[2] Tiefenthaler, S.; Korber, N.; Gärtner, S. Synthesis of the Tetragonal Phase of Zintl's NaTl and Its Structure Determination from Powder Diffraction Data. Materials 2019, 12, 1356.
[3] Tiefenthaler, S.; Schlosser, M.; Pielnhofer F.; Shenderovich, I.; Pfitzner, A.; Gärtner, S. Investigations on tetragonally distorted NaTl-tI8; Z. Anorg. Allg. Chem. 2020, accepted.

Biography

Dr. Stefanie Gärtner is head of the department X-ray Structure Analysis (part of the central analytical services of the Faculty of Chemistry and Pharmacy, University of Regensburg). She obtained her Ph.D. at the University of Regensburg in the group of Prof. Korber (inorganic chemistry), where she studied very temperature labile crystals of main group elements grown in liquid ammonia. She is giving lectures in X-ray Structure Analysis and inorganic chemistry for undergraduate and graduate students of chemistry. Currently, her research focuses on strongly absorbing crystalline materials, especially alkali metal thallides, which are obtained by classical solid state techniques.

Title: New Modified Carbon-Graphite Electrode and Their Application for Voltammetric Determination of Biologically Active Substances

Dmitry Markielovich Aronbaev*, Sergey Aronbaev, and Gavkhar Narmaeva
Associate Professor
Samarkand State University
Uzbekistan

Abstract

A new ergonomic design of a carbon-graphite electrode for voltammetric measurements is proposed.
The design of the electrode includes a housing made of a graphite rod of spectral purity, coated with insulation, at the end of which there is a cavity filled with electroactive carbon-containing material. A characteristic feature of the proposed electrode is that the insulating shell of the housing is made of a heat-shrink tube, and the surface of the cavity is electrolytically coated with a conductive metal film. A positive effect is achieved by simplifying the design of the electrode, increasing mechanical strength, extending the service life, the possibility of volumetric and surface modifications with the economical use of modifying reagents.
Examples of surface modification of carbon-graphite electrodes with a film of mercury and bismuth and bulk modification by manganese dioxide and silver nanoparticles and microparticles are given. In this case, the modification of the carbon-containing paste by manganese dioxide nanoparticles was carried out by the hydrothermal synthesis method using the redox reaction between Mn (VII) and Mn (II) ions in a neutral medium.
The preparation of silver nanoparticles and the modification of graphite powder were carried out using the Tollens reagent (silver mirror). Examples of the analytical use of the developed electrodes for the determination of heavy metal ions, hydrogen peroxide, riboflavin (vitamin B2), ascorbic acid, dopamine, etc. using various types of voltammetry are given.

Biography

Dmitry Markielovich Aronbaev is Candidate of Chemistry, Associate Professor of the Department of Chemistry of Samarkand State University, Professor of the Russian Academy of Natural Sciences.
The main scientific direction: the creation of methods and analytical platforms for the indication of clinically significant markers; chemo and biosensor systems.
He has published more than 300 scientific and educational works, including 2 books, more than 100 journal articles, and 7 copyright certificates of the USSR and patents of the Republic of Uzbekistan in the field of analytical chemistry, analytical instrumentation, food industry, 10 teaching aids.

Title: Determination of Numerical Values of Wave Parameters of the Gravitational Field

Dr. Valentyn Nastasenko
Professor
Kherson State Maritime Academy
Ukraine

Abstract

A large number of scientific papers are devoted to the study of the gravitational field. However, its wave characteristics are only indirectly associated with the Lorentz-Maxwell equations, which does not allow determining their numerical values on a rigorous scientific basis. This drawback is inherent in all modern works in this field of scientific knowledge (Einstein's works on the theory of gravity are no exception as well). The waves of the gravitational field were discovered as a result of complex experimental studies using the unique expensive equipment of severally laboratories (Nobel Prize in Physics of 2017). However, they only recorded their presence, without revealing their numerical parameters. The complexity of these experiments allows drawing up a conclusion about the expected complexity of new experiments to determine these numerical parameters, which requires a search for new ways to study them. Such a new way was proposed by V. Nastasenko on the basis of his scientific discovery in 2005 – the possibility of the gravitational constant (G) and other fundamental physical constants (c,h) obtaining, within their dimension, through Planck's parameters: of length, time and mass. This allowed him in 2013 and in further work, on a strict physical basis, determines the numerical values: of the frequency of oscillations of the gravitational field wave ν_G=7.4·10^{42} *Hz* (Nastasenko constant) and wave length λ_G = c/ν_G = =4.051249|432|·10^{-35} *m*.
Thus, the numerical parameters found put scientific research in the domain of gravity and the foundations of the material world to a fundamentally new level of development.
Key words: gravitational constant, oscillations and wavelength gravitational field.

Biography

Valentyn Nastasenko, Doctor of Technical Sciences, is Professor of Department of Transport Technologies of Kherson State Maritime Academy, Kherson, Ukraine. The scope of scientific interests includes quantum physics, gravitation theory, and the foundations of the material world and the birth of the Universe – the author of more than 50 scientific papers in these fields.

Title: Fiber-Optic Raman Spectrum Sensor for Fast Diagnosis of Esophageal Cancer

Dr. Jianhua DAI*, Xiu HE, Zhuoyue LI, Kang LI, Tingting YANG, Zengling RAN, Lijian YIN, Yao CHEN, Dianchun FANG, and Guiyong PENG
Institute of Digestive Disease
Southwest Hospital
Army Medical University
China

Abstract

A fiber-optic Raman spectrum sensor system is used for fast diagnosis of esophageal cancer during clinical endoscopic examination. The system contains a 785nm exciting laser, a Raman fiber-optic probe with 7 large core fiber and a focus lens, and a highly sensitive spectrum meter. Raman spectrum of the tissue could be obtained within 1 second by using such a system. Signal baseline removal and denoising technology was used to improve signal quality. A novel signal feature extraction method for differentiating the normal and esophageal cancer tissues is proposed, based on the differences in half-height width (HHW) at 1200cm-1 to 1400 cm-1 frequency band and the ratios of the spectral integral energy between 1600 to 1700 cm-1 and 1500 to 1600 cm-1 band. It shows a high specificity and effectivity for diagnosis of esophageal cancer.

Biography

Dr. Jianhua Dai, Medicine Doctor. She is a member of Professor Guiyong Peng's team. They mainly engaged in the endoscopic diagnosis and treatment of early gastrointestinal cancer, and the diagnosis and research of Raman spectrum in gastrointestinal cancer.

Title: Variable Temperature, Pressure Operando MAS NMR for Catalysis and Energy Storage Sciences

Dr. Jianzhi Hu*, Nicholas R. Jaegers, Mary Hu, Oliver Y. Gutierrez Tinoco, Donald M. Camaioni, Yong Wang, and Johannes A. Lercher
Senior Scientist
Pacific Northwest National Laboratory
USA

Abstract

High resolution magic angle spinning (MAS) NMR is a powerful technique for studying structure and dynamics in a heterogeneous system containing a mixture of e.g., solid, semi-solid, liquid, and gaseous phases. Due to its intrinsic advantage of probing local structure at molecular level, MAS NMR is an attractive tool for in situ (operando) investigations of reaction mechanisms, including but not limited to the identification of active centers, intermediates, and the reaction dynamics associated with material synthesis, chemical reactions using solid catalysts, the adsorption and desorption of molecules on surfaces of porous materials. However, the commercially available reusable-MAS rotors are rarely capable of achieving 100% seal under harsh experimental conditions of, e.g., significantly elevated temperature and pressure, or significantly cold temperature with high pressure. To address these challenges and advance the application of MAS NMR under harsh experimental conditions, we have developed a perfectly sealed, powerful, in situ MAS NMR rotor that is capable of sealing a heterogeneous sample under extreme experimental conditions of combined high pressure and high temperature. The same technology is equally applicable to low temperature and high pressure operations. The in situ MAS rotor is constructed using an integrated high mechanical strength zirconia rod except an O-ring and a spin tip. Herein, we will first report the latest advancements associated with high field and fast sample spinning where in situ MAS rotor with outside diameters of 4 and 3.2 mm have been successfully developed. To illustrate the power of in situ MAS NMR, examples of application will be given in the fields of material science, catalytic reactions, and energy storage systems such as beyond Li-ion batteries.

Biography

Dr. Jian Zhi Hu, Ph.D., is a Senior Staff Scientist, Principle Investigator and Key Investigator of multiple NIH, DOE-BES grants with more than 210 peer reviewed publications, h-index of 42, 11 US patents and two R&D 100 awards. He got his Ph.D. in Applied Physics from a joint training program in 1994 by Wuhan Institute of Physics, the Chinese Academy of Sciences and University of Utah, USA. Currently his researches focus on NMR technology development and application.

Title: Physical Theory of Useful Strength of Metallic Crystals

Dr. Vladimir G. Tkachenko
Head of Department
Frantsevich Institute for Problem of Materials Science
Ukraine

Abstract

A new first-order physical theory of long-term strength based on a dislocation model and analytical rate-equations has been evolved for describing dynamical (time-dependent) microyield/creep resistance responsible for a potentially useful measure of the uniform plastic strain. Such an approach enables the rate-controlling dragging dislocation mechanisms to be identified for stressed crystals in terms of thermoactivation (numerical) analysis. In this context, a more accurate (dislocation) criterion is formulated for the quantitative assessment of the undesirable transition from a structurally uniform crystal lattice sliding to a localized shear strain. According to the affirmation, a threshold dragging stress which prevents a premature fracturing is sure to connect with elastic stability of a dislocated crystalline lattice, velocity, density of sliding dislocations, and line tension (excess energy) in the dislocation stress field. A newly developed diagnostic approach and analytical rate-equations derived are found to be very appropriate for the description of the findings being intrinsic in different types of stressed crystals with hcp and fcc lattice structure. The long-term strength design has been directly applied to magnesium alloys and solid solutions enriched by excess vacancies which might be used in biophysics and biomechanics due to their better bio-compatibility.

Biography

Dr. Vladimir Tkachenko, specializes in Solid-State Physics, now is UAS Full Member (Academician). Head of the Physical Metallurgy Department, Director of the International Center for Electronic Materials Science and Applied Problems of Airspace Technology (ICEMS), Member of the Fems Society, EU. Recipient Ukraine State Prize Laureat and Ntl. Acad. Sci. Prize Winner. He got his M.Sc. in physics at Institute of metallophysics, ScD at Frantsevich Institute, Ntl. Acad. Sci. Currently he is engaged in solving a number of fundamental research problems of improving the quantum efficiency of the nanocluster-forming metal alloys in high-current electronics.

Title: Arithmetic Progression Way in Calibration STD Curve

Hisham Hassan Ahmed Mohammedkhair
Faculty of Medical Laboratory Sciences
University of Khartoum
Sudan

Abstract

At present, most of the clinical chemistry laboratory and analytical chemistry of the pharmacy worldwide use the equation of dilution in the preparation of calibration STD curve constructed from several numbers of points run in arithmetic progression manner. The equation of dilution “v2=m1.v2 /m1 “ has problems concerning shortage of stock STD and increasing error possibilities because from its own idea of explanation depends on dilution one step number of mole before and after the step of dilution is constant; so I introduce an alternative method (Arithmetic progression way in the calibration STD curve) which from its own idea depends on the available volume (Av) {Av =∑stdv IAP= n÷2(n-1)d} the equation ; which solve the problems of equation of dilution; furthermore can be used to modify sensitive device automatic pipette to suck solution in arithmetic progression manner depending on difference and available volume; (A.P.W automatic pipette).
Key words: calibration STD graphs -equation of dilution- equation of prime arithmetic-dilution equation - APW automatic pipette.

Biography

Hisham Mohammedkhair has completed his Bachelor degree at University of Khartoum in Sudan and graduate study of qualifying year at the institute of the endemic Disease - University of Khartoum at age of 25 years –He is a laboratory manager of Almujlad Hospital attending several workshops in medical laboratory; with experience of seven years. Member of Sudanese inventors Union.

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Title: Dietary Exposure Assessment of the Spanish Population to Cyclo-di-BADGE through the Consumption of Canned Fish

Antía Lestido Cardama[1,2], Patricia Vázquez Loureiro[1], Raquel Sendón[1], Juana Bustos[3], Ana Rodríguez Bernaldo de Quirós[1], Perfecto Paseiro Losada[1], Letricia Barbosa Pereira[1]*
[1]Department of Analytical Chemistry, Nutrition and Food Science, Faculty of Pharmacy, University of Santiago de Compostela, Santiago de Compostela, Spain
[2]INL - International Iberian Nanotechnology Laboratory, Braga, Portugal
[3]National Food Centre, Spanish Agency for Food Safety and Nutrition, Majadahonda, Spain
*Associate Researcher Ramón y Cajal
University of Santiago de Compostela

Abstract

Polymeric coatings applied to the inner surfaces of cans into contact with foods represent an important source of contamination through the migration of chemicals into food and its subsequent ingestion. Cyclo-di-BADGE (CdB) is one of the main compounds detected in epoxy-based coatings.
In this study, the dietary exposure to CdB by canned fish consumption was assessed by in vitro bioaccessibility studies. After evaluating the content of CdB in can material and canned foods, the samples were subjected to an in vitro gastrointestinal digestion, following the standardized INFOGEST [1] protocol, to determine accurately the amount of CdB available to be absorbed at the intestinal level. Moreover, the experiments were performed at different gastric pHs (between 1 and 4) according to the human population variations. The quantification of CdB was achieved by liquid chromatography coupled with the tandem mass spectrometry technique. The exposure to this contaminant was assessed for different age groups of the Spanish adult population, including pregnant women, considering the amounts of CdB bioaccessible, together with national surveys regarding the canned food products consumption. After digestion, canned foods with a high-fat content (25-35 %) and covered with olive and sunflower oils showed the highest percentages of CdB bioaccessibility and exceeded the tolerable daily intake of 1.5 µg/kg bw/day recommended for chemical compounds classified as chemical compounds with high toxicological risk (Cramer class III).
Acknowledgments: BACFood4Expo project (PID2020-114569RJ-I00) funded by Spanish Ministry of Science and Innovation under the competitive State R&D Program Oriented to the Challenges of the Society, "R&D Projects 2020".
References
[1] Brodkorb, A., et al. (2019). Nature protocols, 14(4), 991-1014.

Biography

Graduated in Pharmaceutical Sciences (University of Porto, Portugal) and a Ph.D. in Analytical Chemistry, Nutrition, and Food Science from the University of Santiago de Compostela (USC, Spain), Letricia Barbosa-Pereira is currently an Associate Researcher at the Faculty of Pharmacy of USC. Her research has been supported by several competitive grants from different European and national agencies: Marie Curie grant (EU), MIUR (IT), JdC, JIN, and RyC (ES). She participated in 24 national (ES and IT) and 4 European research projects, author, and co-author of more than 50 scientific publications; 3 patents; presented more than 60 works at international scientific conferences and is a guest editor of the open-access journal Foods (2 SI).

Title: A Phosphorus-nitrogen-functionalized Graphene Oxide for Improving the Fire Safety of Epoxy Resin

Dr. Zhengping Fang*, Shiye Ran, and Fang Fang
Professor
Ningbotech University
China

Abstract

As one of the most important thermosetting polymers, epoxy resin (EP) is used extensively in vehicles, construction, electric appliance, and aircrafts fields owing to its excellent properties. However, EP suffers intrinsic flammability, extremely limiting its practical applications. In this paper, a phosphorus-nitrogen functionalized GO (PPGO) via self-assembled supermolecular aggregate of piperazine (PiP) and phytic acid (PA) onto GO has been fabricated. The loading of 3 wt% PPGO to EP reduced the pHRR (peak heat release rate) and pCOP (peak CO production) by 42% and 44%, respectively, showing excellent flame retardant and smoke suppression effects. Apart from the excellent fire-retardant performance, the loading of PPGO also lead to the increase in both storage modulus in rubbery state and glass transition temperatures. The improved flame-retardant performance of EP nanocomposites was assigned to a tripartite cooperative effect from the key components (piperizine, phytic acid, GO).
Acknowledgments: The authors acknowledge financial support from the National Natural Science Foundation of China (51991355)

Biography

Prof. Zhengping Fang, graduated from the Institute of Materials Science, Fudan University and got his Master degree in 1986. He joined the Institute of Polymer Composites in 1998 when Zhejiang University was merged with Hangzhou University and other two universities. Prior to that he was a professor at the Department of Chemistry of Hangzhou University. Presently he is the dean of the School of Materials Science and Engineering, NingboTech University (formerly Zhejiang University Ningbo Institute of Technology). His research interest is in the structure-properties relationship of multi-component polymer systems and the modification of polymeric materials via blending, filling, and compounding. He is a permanent member of Chinese Chemical Society, member of American Nano Society and American Chemical Society. He has published more than 370 papers (including more than 260 articles cited in the web of science with an H-index of 52), and 8 books or book chapters by the end of 2022.

Title: Natural Nanoporous Zeolites as Advanced Functional Materials

Dr. Venčeslav Kaučič*, Nataša Zabukovec Logar
Professor
National Institute of Chemistry
Slovenia

Abstract

Natural microporous aluminosilicates - zeolites - have long been recognised as cost-effective, nontoxic, and highly selective sorbents for heavy metal pollution control, especially in industrial and agricultural wastewater management. On the other hand, metal-loaded zeolites are known as efficient catalysts for oxidation reactions. In the present study, we combined both applications and demonstrated the potential of waste metal-loaded zeolite, produced during wastewater treatment, as an effective VOC catalyst for air purification. In a first step, we evaluated the sorption performance of natural zeolite clinoptilolite (HEU type) for the simultaneous removal of metal ions (copper, manganese, iron) from aqueous solution and determined the optimal sorption conditions and maximum metal concentrations in wastewater that can be disposed into rivers or municipal plants after treatment. The metal-loaded zeolites thus obtained were thermally treated at 540 °C before the second step, where we evaluated their catalytic performance in the removal of VOC and demonstrated their good catalytic performance in the total oxidation of toluene as a model VOC and their excellent cycling stability.

Biography

Venčeslav Kaučič, PhD in Chemistry, University of Ljubljana, Slovenia in 1977; since 1992 Full Professor of Inorg. Chem. at Univ. of Ljubljana. From 1981 to 1983 post-doc at Univ. of Leicester, UK; 1992 to 2014 frequent visitor to several UK institutions; 1988 to 1990 Director of Research Fund of Slovenia and 1990 to 1991 Under-Secretary, Ministry of Science. 1992 to 2012 Head of Inorg. Dept. at National Inst. of Chemistry; 2017 to 2019 Secretary General at the Slovenian Academy of Engineering.
In 1997 National Award in Science; since 2014 Professor Emeritus; 1996 to 2017 President of the Slovenian Chem. Soc., since 2017 Honorary President), IUPAC ChemRAWN C'tte (titular member); Slovenian Science Foundation (President of Science Council (1994 - 2014)); ENMIX, European Nanoporous Materials Institute of Excellence (2012 to 2016 vice-CEO).
Research: Inorg. Chem.: Synth. & char. of trans.-metal fluorides. Synth. &char. of porous materials, including zeolite and AlPO mol. sieves. **Crystallography**: Determination of crystal structures of coordination compounds using single-crystal and powder diffraction. Appl. of synchrotron radiation to several cryst. problems with AlPOs (small single crystals, utilisation of anomalous dispersion to trace metal atoms in the AlPO's and SAPO's framework sites). Over 175 scientific papers in SCI journals (over 3700 citations), 10 chapters in scientific monographs and over 300 lectures.

Title: Annealing-free Hole Transport Layers for Highly-Efficient and Stable Organic Solar Cells

Nurul Kusuma Wardani*, Muhammad Jahandar, Yong Hyun Kim, Soyeon Kim, and Dong Chan Lim
Surface Technology Division
Korea Institute of Materials and Science (KIMS)
Republic of Korea
Department of Smart Green Technology Engineering
Pukyong National University
Republic of Korea

Abstract

Organic solar cells (OSCs) are becoming widely attractive in energy harvesting due to their advantageous characteristics such as low cost, tuneable absorption, adjustable energy levels, and large-area printable capability. The efficiency of organic solar cells is directly influenced by the interfacial layers employed as electron transport layers or hole transport layers (HTLs). PEDOT:PSS is one of the well-known HTLs in OSCs owing to its solution processability, effective electron blocking, and high work function that results in the formation of good Ohmic contact with a range of organic donor material. However, due to its acidic nature, PEDOT:PSS still possesses hygroscopic properties that might have an impact on the device's performance and stability. Herein, a solution-processable method and annealing-free of the ultrathin phosphotungstic acid (TWA) was presented as hole transport layers. As the result, the power conversion efficiency (PCE) of 17.28% has been achieved with PM6:Y6:PCBM as the active layer, which was higher than the 15.88% with PEDOT:PSS. The increased performance of the TWA-based devices is mainly due to the contribution of lower parasitic absorption, increased carrier mobility, and reduced charge recombination, hence, can facilitate the efficient charge collection of photogenerated carriers in OSCs. This study provides a facile, low-cost method and the potential of TWA as HTL in OSCs which is favorable for improving the device performance and stability.

Keywords: annealing-free, hole-transport layer, phosphotungstic acid

Title: The Use of Bamboo as a Sustainable Alternative in Interior and Furniture Design

Ms. Taina Nicolau de Campos
Interior Designer
Brazil

Abstract

This research aims to introduce the replacement of materials traditionally used in construction and its slopes , such as wood and non biodegradable materials , by bamboo, which has superior physical and mechanical characteristics . An analysis could be performed from glued bamboo laminates and verified their properties , such as tensile strength , compression and shear , as well as the analysis of their flexural strength in its natural form , obtaining satisfactory results after a comparison between species. This material has the advantage of being a renewable and environmentally friendly resource due to high stem and biomass generation , nutrient cycling and a permanent crop . In addition , it has a light and versatile structure , which allows good aesthetics and comfort for indoor and outdoor spaces , and the development of these products makes it well regarded among consumers , which is one of the reasons why bamboo is not so used today . The role of the designer is necessary not only in the elaboration of projects , but also in the transformation of the materials industry , since this professional is aware of the ecological issues and solutions willing to accompany the rapid changes in the area.

Biography

Ms. Taina Nicolau de Campos is a twenty three year old, newly graduated interior designer who is finishing her postgraduate studies, specializing in technology and sustainability applied to architecture and design, where she is developing her course completion work focused on Bamboo applications in design. Due to her interest in this area, she participated in a scientific initiation at the university, which led her to publish an authorial scientific article in the renowned sustainability journal Springer Nature Switzerland, entitled Building Lifecycle and Sustainable Development, published in Encyclopedia of Sustainability in Higher Education. Currently, she works with bio architecture projects, where she makes use of recyclable materials and more efficient techniques, makes use of life cycle analysis and opts for local materials when possible, aiming to apply her theoretical knowledge in her professional life.

Title: Preliminary Testing of Polymer Dispersed Liquid Crystals of 50% Polymer and 50% Liquid Crystals Content as Slab Waveguide Cladding Material

Dr. Ghada Nabil Hassanein
Assistant Professor
Physics Department, Faculty of Science, Taibah University
Saudi Arabia

Abstract

Polymer Dispersed Liquid Crystals (PDLC) combines both the advantages of polymers and LC. In this study it is used as cladding material in polymer planar waveguide. Slab polymer planar waveguide is fabricated in this study for testing. PDLC of polymer (P) content of 50wt%, and nematic liquid crystals (LC) content of 50wt% ; (LC/P : E7/NOA65: 50/50wt%) is used as upper cladding material.and Benzocyclobutene - Cyclotene 3022-35 (BCB) is used as waveguide core material. On applying amplitude modulated (AM) electric driving signal; the threshold field strength at which the mode power starts to decrease is 1.48V/m, 1.07V/m, and 0.97 V/m for TM-mode at modulating signal frequencies 5Hz, 10Hz, and 20 Hz, respectively. The cut off field strength of the TM-mode is 4.2 V/m, 2.43 V/m, and 2.31 V/m at modulating signal frequencies 5Hz, 10Hz, and 20 Hz, respectively. The TE-mode was of lower power than TM-mode and was completely captured by the cladding at cut-off field strength 2.28 V/m, 1.43V/m, and 1.52 V/m at modulating signal frequencies 5Hz, 10Hz, and 20 Hz, respectively. The waveguide shows polarization independence and high stability within a wide temperature range; from room temperature up to ~60 oC, which is the LC transition temperature to the isotropic phase.

Biography

Dr. Ghada Nabil Hassanein is an Assistant Professor at Physics Department, Faculty of Science, Taibah University, Al Madinah, Saudi Arabia (since 2013 till now). She has got Ph.D. degree from Electronic Engineering department - Faculty of science and Engineering - City University of Hong Kong, 2012. Before 2007, she got M.Sc. degree in experimental physics from physics department - Faculty of Science - Cairo University, Egypt, 2003. She has got scientific research training at Applied Physics & Biophysics departments at Ulm University-Germany, summer 2001 and 2004, respectively, through bilateral agreements between Cairo University and Ulm University. In the period from 2000-2006 worked at Cairo University in Egypt, as research assistant and junior researcher through joint research projects between; Laser Spectroscopy and Liquid Crystal Laboratory-Physics Department-Faculty of Science - Cairo University, Egypt and Ferroelectric Material Research Center (FLCMRC) Colorado University, USA, 2001-2005. In the period; 2005-2007, she worked as Assistant Lecturer at Faculty of Engineering American University in Cairo (AUC) then at British University in Egypt (BUE) - Basic Science and Engineering Department (Physics). Then was Ph.D. Student-Electronic Engineering Department – City University of Hong Kong, 2007 - 2012. Her main research interest is in the field of Liquid Crystals and Polymer Dispersed Liquid Crystals electro-optics.

Title: Characterization and Cu^{2+} Adsorption of Ecological Hydroxyapatite Synthesized from Limestone Sludge

*Kae-Long Lin[1], *, Ya-Wen Lin[2], Wei-Hao Lee[2], Sheng-Yuan Peng[1], Yan-Yu Lin[1], Wei-Ching Chang[1] and Mei-Yu Lin[1]*

[1] Department of Environmental Engineering, National Ilan University, Ilan City, 260, Taiwan

[2]Institute of Mineral Resources Engineering, National Taipei University of Technology, Taipei City, 106, Taiwan, R.O. C.

Abstract

This study developed a novel approach to the hydrothermal synthesis of eco-hydroxyapatite (eco-HPA) from recycled limestone sludge for the removal of Cu^{2+} from aqueous solutions. The resulting eco-HPA was characterized using X-ray fluorescence, thermal field emission scanning electron microscope, X-ray powder diffraction analysis, and surface area measurements. Under a hydrothermal temperature of 120 °C and Ca/P molar ratio of 1, this study obtained the nitrogen adsorption isotherm and desorption curves indicative of hydroxyapatite. These are the type-IV adsorption isotherm curves of a mesoporous structure with an H3-type hysteresis loop. The same sample achieved adsorption capacity of 210 mg/g. The adsorption kinetics closely fit the pseudo-second order kinetic model (R^2= 0.9990-1.000). Adsorption isotherms presented the strongest correlation with the Langmuir model (R^2 =0.97-0.99). Taken together, these results demonstrate that the proposed eco-HAP is a viable low-cost environmentally friendly adsorbent with broad applicability for the removal of heavy metals from aqueous solutions.

Biography

Prof. Kae-Long Lin Ph. D.
OBJECTIVE: To pursue a research career in Pozzolanic reaction/ Eco-cement/ Waste Treatment/Management/ recycle/ E-waste recycle.
ACADEMIC RECORD
Ph.D.: Environmental Engineering, National Central University, Chungli, Taiwan 320, R.O.C.
Thesis Title: Feasibility of Pozzolanic activity using municipal solid waste incinerator (MSWI) ash slag in blended cement
Master of Science: Civil and Hydraulic Engineering (1989-1991)
University: Feng-Chia University, Taichung, Taiwan 40724, R. O. C.

Title: Hierarchical Porous Electrode Impedance Model based on Diffusion Dynamics and Electrode Morphology and Prediction of Electric Double Layer Structure

Dr. Yanfang Gao* and Zhen-kai Guo
Director
Inner Mongolia University of Technology
China

Abstract

The capacitance performance of hierarchical porous carbon (HPC) electrode mainly depends on the dipole storage capacity and the rate of electric double layer (EDL) reorganization. However, it is difficult to directly measure the effect of microscopic changes of porous and electrolytic characteristics on the internal ionic mechanism of EDL. Therefore, a model is proposed to easily and accurately describe both the diffusion and EDL dynamics of hierarchical porous carbon electrode. In general, diffusion in the mesoporous channel can be characterized in the middle-frequency region (5 Hz-500 Hz), and in the micropore in the low-frequency region (0.05 Hz-5 Hz). What's more, we have proved that the diffusion layer thickness is inversely proportional to the electrolytic concentration, and positively proportional to the mesoporous size, microporous depth and surface roughness. In particular, the thicker diffusion layer makes it easier for ions diffusing into micropore, and a better EDL recombination in mesoporous channel. But the thinner diffusion layer means a better EDL recombination in micropore. The low-frequency region (0.01 Hz-0.05 Hz) characterized the compact layer dynamics which shows the CPE behavior obviously, moreover, the compact layer thickness is inversely proportional to the surface heterogeneity, thus determining the dipole storage capacity. The model offers a general framework for impedance analysis and EDL prediction of HPC.

Biography

Dr. Yanfang Gao, Engineering Doctor (Ph.D.-engineering),now is is a professor and doctoral supervisor of Inner Mongolia University of Technology, and a member of the 10th Youth Federation of Inner Mongolia Autonomous Region.In 2010 was selected into the second level of "New Century 321 Talent Project"; In 2015 was selected into the first level of "New Century 321 Talent Project" and won the titles of "Grassland Talent" and "Young Science and Technology Talent" of Inner Mongolia Autonomous Region. Won the "10th Inner Mongolia Autonomous Region Youth Science and Technology Award" and the "10th 'Challenge Cup' Regional College Students Extracurricular Academic Science and Technology Works Competition of science and Technology invention production Class B" third prize, In 2014, the project of "High conductivity electrode materials in the construction of supercapacitors and the application of methanol electrocatalytic conversion" won the third prize of natural science of the Autonomous Region twice.

Title: Stable Mo/1T−MoS2 Monolith Catalyst with a Metallic Interface for Large Current Water Splitting

Dr. Zhiwei-Wang[1,2], Yan-Fang Gao[1,*]
Inner Mongolia University of Technology, China
Inner Mongolia University of Finance and Economics, China

Abstract

For supercapacitors, when carbon and metal oxide are used alone as electrode materials, certain shortcomings of the two electrode materials will be To achieve global carbon neutrality, realization of highly−active and stable catalysts is critical for water splitting to produce green hydrogen (H_2). MoS_2 is considered to be the most promising non−precious metal catalyst for H_2 evolution because of its excellent properties. Herein, we report a metal-phase MoS_2 (1T−MoS_2) synthesized using a simple hydrothermal method. Using a similar procedure, we synthesize a monolithic catalyst (MC) in which 1T−MoS_2 is vertically bonded to a metal molybdenum plate via strong covalent bonds. These properties endow the MC with an extremely low resistance interface and mechanical robustness, equipping it with outstanding durability and fast charge transfer. Results show that the MC can achieve stable water splitting at 350 mA cm^{-2} current density of with low 400 mV overpotential. The MC exhibits negligible performance decay after 60 h of operation at large a current density of 350 mA cm^{-2}. This study provides a novel possible MC with robust and metallic interfaces to achieve technical high current water splitting to produce green H_2.

Biography

Zhiwei Wang, is currently a Ph.D. Student in the School of Chemical Engineering at Inner Mongolia University of Technology. His research interests are in the field of electrocatalysis.He received his M.S. degree from Inner Mongolia University of Technology in 2013.He has been working at Inner Mongolia University of Finance and Economics since 2014.

Title: Rare Earth Metal-Triazine-Based Porous Organic Polymer Catalyzed Oxygen Reduction Reaction

Dr. Xiaoqi Zhao and Yanfang Gao*
Inner Mongolia University of Technology
China

Abstract

Oxygen reduction reaction (ORR) is a critical reaction in metal-air batteries and other fuel cells, which involves slow multi-electron kinetic processes and requires a large number of expensive Pt/C catalysts, resulting in high system cost. Therefore, the design and construction of high-performance and low-cost oxygen reduction reaction catalysts at the cathode have always been the focus of research in related fields. At present, non-precious metal-nitrogen-carbon (M-N-C) catalysts have attracted wide attention due to their simple preparation method, low synthesis cost and high catalytic activity. The covalent organic frameworks are porous crystal materials with periodic structures composed of C, N, O and other non-metallic elements. It has the advantages of conjugated skeleton, rich porosity and high N doping. The unique electronic structure and chemical properties of rare earth metal 4f subshell electrons provide an opportunity to design and construct efficient rare earth metal-based ORR electrocatalysts. Herein, under the condition that the melamine ligand molecules remain unchanged, the triazine-based covalent organic frameworks with different conjugated lengths were synthesized by hydrothermal method with phthalic anhydride, 1,4,5,8-naphthalenetetracarboxylic dianhydride and perylene-3,4,9,10-tetracarboxylic dianhydride, respectively. Rare earth metals were introduced as active sites of metal centers to synthesize rare earth metal-triazine covalent organic frameworks for catalyzing oxygen reduction reactions.

Biography

Dr. Xiaoqi Zhao obtained a master's degree in 2022. Now, she, majoring in the research of the catalysts of oxygen reduction and reaction, is studying at the School of Chemical Engineering, Inner Mongolia University of Technology. Professor Yanfang Gao is working in the Department of Chemical Engineering, Inner Mongolia University of Technology. She has published many papers in electrochemistry journals. She engaged in electrochemical energy storage devices (supercapacitors, lithium-ion batteries, zinc-ion batteries, etc.), fuel cells, electrochemical organic synthesis, and other fields of teaching and research work.

Title: In Situ Synthesis of VNQD@rGO/NC Composites for High-Performance Lithium-Ion Battery Anode Materials

Dong Wang, Zhiwei Wang, Zihan Guo, Yanfang Gao*
Inner Mongolia University of Technology,
China

Abstract

Vanadium nitride (VN) is an emerging class of anode materials that has attracted much attention due to its high theoretical capacity, good electrical conductivity and suitable working potential window. Unfortunately, its practical application in lithium-ion batteries is limited by the large volume deformation and slow lithium-ion diffusion kinetics during charging and discharging, resulting in rapid capacity decay and poor multiplicative performance. In this work, composites of vanadium nitride quantum dots anchored on layered graphene (denoted as VNQD@rGO/NC) were prepared using in situ redox reaction and heat treatment with urea as the nitrogen source. The VN quantum dots were uniformly dispersed on the graphene surface and incorporated into the NC backbone, preventing restacking of the layered graphene and providing more channels for the electrolyte to enter and exit and for ion absorption, thus providing more electrochemically active sites. VNQD@rGO/NC is used as an anode material for Li-ion batteries and can reach a capacity of 520 mAh/g after 1000 cycles at a current density of 2 A/g. This good electrochemical performance is due to the high capacity provided by vanadium nitride quantum dots, with graphene and nitrogen-referenced carbon acting as the conductive network and mechanical backbone.

Biography

Dr. Dong Wang is currently studying at the School of Chemical Engineering, Inner Mongolia University of Technology. Her main research direction is lithium-ion batteries. In 2008, he received a bachelor's degree in engineering from Dezhou University. In 2011, he received a master's degree in engineering from Inner Mongolia University of Technology.

Title: Preparation of Manganese Dioxide and ZIF-67 Derived Porous Carbon Composite Material and Its Application in Supercapacitors

Dr. Ju-Yin Liu, Yan-Fang Gao*
Inner Mongolia University of Technology
China

Abstract

For supercapacitors, when carbon and metal oxide are used alone as electrode materials, certain shortcomings of the two electrode materials will be exposed, which will then cause a series of problems. In this paper, ZIF-67 is prepared into nanoporous carbon by calcination, and then it is compounded with manganese dioxide to obtain a modified material. This can not only avoid the shortcomings of the two, but also maximize the advantages of both. Finally, the specific capacitance of manganese dioxide (MnO_2) and porous carbon at the best mass ratio is obtained. The electrochemical performance of the materials is compared by different testing methods, and the best electrode material is finally selected. The use of this composite material can not only effectively avoid the problems caused by the shortcomings, but also can further improve the electrical conductivity, specific volume and other characteristics of the composite electrode material, thereby enhancing its electrochemical performance. The ZIF-67@MnO_2 has the highest specific capacitance at a current density of 0.5 A/g, which can reach 257 F/g. Compared with pure MnO_2, the electrochemical performance of ZIF-67@MnO_2 is twice that of it. Under the three-electrode system, the potential window of ZIF-67@MnO_2 electrode material can reach 1.2 V.

Biography

Dr. Juyin Liu is currently studying at the School of Chemical Engineering, Inner Mongolia University of Technology. Her main research direction is supercapacitor. In 2019, she received a bachelor's degree in engineering from Inner Mongolia University of Technology. In the same year, she studied for a master's degree and a doctoral degree in 2021.

Title: Captan: Problems Associated with Its Identification in Environmental Objects and Food Products - Ways of Solution

Dr Lydia Bondareva*, Dr Nataliia Fedorova
Associated Professor
F.F. Erisman's Federal Scientific center of Hygiene
Russia

Abstract

Captan is mainly used in agriculture as a contact fungicide. Captan belongs to the class of phthalimides, e.g., folpet and captafol, which are used for treating garden trees, grapes, vegetables and decorative plants, as well as for treating packing boxes for food products. The study is devoted to identifying possible ways of the influence of captan on humans, including air and food. The objects of research were the following: the active substance - captan, air and a vegetable - sweet pepper. The equipment included a chromato-mass-spectrometer «Agilent 5977A» with a gas chromatograph «Agilent Technologies-7890B», a liquid chromatograph «Agilent 1260» with a diode array detector and a liquid chromato-mass-spectrometer ExionLCAD/Qtrap 6500+. The method of gas-liquid chromatography does not provide reproducible results due to unstable connection. Using the developed techniques for the identification of captan in air, as well as with the help of High-Performance Liquid Chromatography, captan was determined in real samples taken during agricultural work. The captan content was reliably measured in the air of the working zone (0,2 – 0,75 mg/m^3), wipe samples from the skin of the operators (0,2 – 0,4 mg/wipe). In determining captan in fruit and vegetable products, new methodological approaches were worked out in detail in order to minimize the matrix effect: the calibration curve was built based on the control matrix sample. The detection limit for captan was established to be 0,01 mg/kg. In the analysis of the real sweet pepper samples the captan content was found to be below the detection limit. Captan is spread as aerosols and it contaminates the open skin of employees, who, for example, use the chemical for treating plants in an apple orchard. Possible errors due to matrix effects were minimized, for example, color, presence of other impurities and contaminants including those not reported in fruit and vegetables.
Acknowledgements
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Biography

Bondareva Lydia, PhD of the Analytical Chemistry, Associated Professor of Chemistry, Leading Researcher. Skills: analytical chemistry, chemistry of pesticides, radioecology. Author of more than 200 scientific papers and monographs.

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BIT Congress Inc.
Address: 3F, Building 2, Dalian Life Science Innovation Center,
Dalian Hi-tech Industrial Zone LN 116025, P.R.China

Fax: 0086-411-84799629
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