NANOMXCN
México-China Workshop on NANO
Materials / Science / Technology

Mexico-China Workshop on Renewable Energy and Environment Remediation

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UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO
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香港城市大學
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NANOMXCN

4 - 6 December 2016

HONG KONG

Major topics for discussion:

- Control of the nano- and micro- structure and composition of materials
- Optimization of the physical and chemical properties of nanomateriales and their response to environmental conditions
- Novel strategies to harness the benefits of enhanced surface-to-volume ratio
- Particle/quasi-particle confinement
- Use of nanostructured system design for enhanced device performance

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CONACYT project "I000/798/2016 FONCICYT/60/2016"

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Welcome to NANOMXCN-2016!

Central to our efforts is our hope to build collaboration relationships and long lasting friendship between our work places. Our sincere thanks to our hosts in Hong Kong and China for providing ideal venues for these activities. We also express our deepest gratitude to the many people in China, Hong Kong, and Mexico that made this event possible. Thank you for lending your time and join our efforts to revert the negative research collaboration growth between Mexico and China & Hong Kong. We believe there is much that all parties can offer and gain; we appreciate your time to explore all possibilities.

There are many people and institutions supporting NANOMXCN and unfortunately we can only name a few in this letter, our apologies. We start with the generous support of all our sponsors; especially our global sponsor CONACYT (project I000/798/2016 FONCICYT/60/2016), as well as our platinum sponsors, K. C. Wong Education Foundation and Red Global-MX of The Institute of Mexicans Abroad.

We thank the support of Amb Julian Ventura, the Mexican Embassy in China, and in particular Rodrigo Meléndrez that offered superb advice and suggestions. We also thank the Consulate General of Mexico in Hong Kong and Macau and Consul General, Damian Martinez Tagüeña. Together, their support in PR China and HK gives us the opportunity to reach beyond our daily opportunities; we are confident all the participants will take this at heart to make the most of it. Special thanks to Amb Alicia Buenrostro-Massieu and Consul Aureny Aguirre that encouraged this project from its origins: many many thanks!

In Hong Kong we witness an initial success in our goals to form a collaborative network. This, in the form of the inspiring participation from friends we met in Mexico at the first NANOMXCN event last August. Notably from the Research Center for Eco-Environmental Sciences, CAS, and Shanghai Jiao Tong University. Many thanks to Prof. Guibin Jiang for his energetic encouragement to the Sino-Mexico collaboration cause! Our appreciation also goes to Prof. Chen Jiesheng that unfortunately had to miss this Hong Kong Workshop at the last minute. Important and decisive actions also came from new good friends some that couldn't join but that provided means and new channels that enabled the participation of Prof. Lionel Vayssieres, IRCRE-Xi'an Jiaotong University and Prof. Jorge Gardea-Torresdey, UTEP. We thank them as we thank all participants that decided to include us in their busy schedules.

It is indeed the combined expertize of all our speakers and participants that gives sense to this effort. We very much appreciate the time and trust you place in attending the Workshop and hope you enjoy the technical programme as much as the social one. In this lines please join me in thanking A Mai Tran for her generous time commitment that made the social activities possible.

One last word should be shared to mention the tremendous change in S&T funding outlook in Mexico. We could not have anticipate such change when 15 months ago we intended to include student exchange as part of NANOMXCN's efforts. The landscape has changed and so has our attitude; the increased difficulties to achieve our goals will meet our resolution and conviction on the importance of achieving our goals. Your participation encourages us and we hope you enjoy a memorable meeting.

NANOMXCN organizing committee

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NANOMXCN Workshop, 4-6 Dec 2106
City University Of Hong Kong

Mexico-China workshop on Nanomaterials, Nanoscience and Nanotechnology: renewable energy and environment remediation

Dates: 4 – 6 December 2016.

Securing efficient and cost-effective solutions to provide green energy and environment remediation are shared critical priorities of many countries: adequate solutions provide invaluable benefits for society whereas, if left unattended, have the potential to spiral into severe problems or regional crisis. NANOMXCN-2016 will provide an international forum for prominent scientist interested in the development of joint collaborations and scientific exchanges to address these issues. The scientific discussions will focus on advanced strategies enabled by nanomaterials, nanoscience, and nanotechnology, for the optimization of the physical, chemical, and functional properties of the materials used in the development of next generation solutions to these pressing issues.

Major topics for discussion:

- Control of the nano- and micro- structure and composition of materials
- Optimization of the physical and chemical properties of nanomateriales and their response to environmental conditions
- Novel strategies to harness the benefits of enhanced surface-to-volume ratio and particle/quasiparticle confinement
- Use of nanostructured system design for enhanced device performance

NANOMXCN provides a specialised forum for prominent scientist of China, including Hong Kong SAR, and Mexico interested in the development of joint collaborations and scientific exchange to address these issues.

The scientific discussions will focus on the use of nanostructured system design for enhanced device performance by control of the nano- and micro- structure and composition of the materials involved in order to optimize their physical and chemical properties as well as their response to their working environments. This will include, for example, development of new synthesis and surface engineering methods - including in-situ characterization and control - for tailored self-assembled nanostructured materials with desired properties, computer modeling for optimization of nano- and micro- structure and composition, the resulting interfaces, and the device performance, and novel strategies to harness the advantages of nanotechnology approaches including enhanced surface-to-volume ratio, electronic, photonic, and plasmonic confinement.

Fundamental of NANOMXCNs proposal is the renewed interest between Mexico and China to establish increased cooperation links in many fields including science and technology. It is expected that this workshop could become the first of a series of

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scientific workshops and meetings hosted alternatively by both countries that will result in a long term sustained effort to increase the scientific cooperation in nanomaterials, nanoscience and nanotechnology for critical applications of common interests to Mexico and China.

To emphasize the urgent need to increase the collaboration between Mexico and China one can cite that a literature search (SCIE) gives only 50 papers with the topic "nano" that have been co-authored by Mexico and China for all years of the database; this figure is 92 papers for the topic "water".

The workshop focuses on the use of nanostructured materials for the development of environmentally friendly technologies for renewable energy and water remediation; this includes for example:

- Development of new synthesis and surface engineering methods for the fabrication of tailored self-assembled nanostructured materials.
- In-situ characterization and control of the structure and composition of self-assembled nanomaterials with distinctive (non-homogeneous) nano- and micro- characteristics.
- Hierarchical nanostructures
- Nanomaterials for energy harvesting and storage
- Hard nanostructured surfaces for optical/optoelectronic applications.
- Corrosion resistant nanostructured surfaces with enhanced catalytic properties.
- Nanoporous surfaces and membranes
- Plasmonic effects for ultrasensitive detection of pollutants and photo-catalysis.
- Nanotechnologies for water desalination

International Advisory Committee and KeyNote Speakers

- Yip-Wha Chung, Northwestern University, USA
- Jiang Guibin, Research Center for Eco-Environmental Sciences, CAS, China
- Zhong Lin Wang, Georgia Institute of Technology, USA
- Isaac Hernández-Calderón, CINVESTAV Zacatenco, Mexico
- Chao-Jun Li, McGill University, Canada
- S. Y. Tong, South University of Science and Technology of China (SUSTC), China
- Pedro Alvarez, Rice University, USA
- Ching-Ping Wong, The Chinese University of Hong Kong, HK SAR
- Jiesheng Chen, Shanghai Jiao Tong University

KeyNote Speakers

- Jiesheng Chen, School of Chemistry and Chemical Engineering, Shanghai Jiao Tong University.
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- Jian Lu, Department of Mechanical and Biomedical Engineering Centre for Advanced Structural Materials, City University of Hong Kong Kowloon, Hong Kong, China

Invited Speakers

- Gerko Oskam, Centro de Investigacion y de Estudios Avanzados del IPN, Mexico
- Xiangdong Li, The Hong Kong Polytechnic University, Hong Kong SAR, China.
- Kin Man Yu, Department of Physics and Materials Science City University of Hong Kong Kowloon, Hong Kong
- Steven Sai-Wing Tsang, Department of Physics and Materials Science, City University of Hong Kong, Hong Kong
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- Chunyi Zhi, Department of Physics & Materials Science, City University of Hong Kong 83 Tat Chee Avenue Kowloon, Hong Kong SAR, China
- Erjun Zhou, National Center for Nanoscience and Technology, No. 11, Beiyitiao, Zhonggguancun, Beijing, China
- Bing Yan, Shandong University, Jinan, China 250100
- Hector Cabrera, Cardiovascular & Metabolic Diseases, Duke-NUS Medical School Singapore. Institute for Biochemistry, Medical Faculty Justus-Liebig-University Giessen Germany
- Refugio Rodríguez Vázquez, Biotechnology and Bioengineering Department/Cinvestav IPN/Xenobioticos, Cinvestav Mexico City/Mexico.
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Prof. Guibin Jiang received his Ph.D. from the Research Center for Eco- Environmental Sciences of the Chinese Academy of Sciences in 1991. He is now the director of the institute and director of the State Key Laboratory of Environmental Chemistry and Ecotoxicology. From January 2006, he was formally appointed the Associate Editor of Environmental Science and Technology (ES&T). He was elected as an academician of the Chinese Academy of Sciences in 2009, fellow of the Third World Academy of Sciences (TWAS) in 2012, and fellow of the Royal Society of Chemistry (FRSC) in 2014. Prof. Jiang's research is mainly focused on environmental analytical chemistry and toxicology, including analytical development, environmental characterization and toxicity of persistent organic pollutants (POPs), organometallic compounds and nano- materials. He has contributed more than 600 papers in peer-reviewed scientific journals. He also contributed to the implementation of the Stockholm Convention on Persistent Organic Pollutants in China and identified some new POPs in the Chinese environment. In recognition of his research on the analytical methodology, distribution, accumulation and toxicity of POPs, he was honored with International Exchange Award of Japan Society on Water Environment in 2003, the prestigious Chang Jiang Scholars Achievement Award of China‟s Ministry of Education in 2007, National Award of Natural Science of State Council of PRC in 2003 and 2011, Agilent Thought Leader Award in 2013, and Outstanding Science and Technology Achievement Prize of Chinese Academy of Sciences in 2013.

Five selected publications:

[1] Lu, D. W.; Liu, Q.; Zhang, T. Y.; Cai, Y.; Yin, Y. G.; Jiang, G. B., Stable silver isotope fractionation in the natural transformation process of silver nanoparticles. *Nat Nanotechnol*, *11*, (8), 682-686. (2016)

[2] Yongguang Yin, Yanbin Li, Chao Tai, Yong Cai, Guibin Jiang. Fumigant methyl iodide can methylate inorganic mercury species in natural waters. Nature Communications, 5, 4633. (2014).

[3] Chang Wang, Thanh Wang, Wei Liu, Ting Ruan, Qunfang Zhou, Jiyan Liu, Aiqian Zhang, Bin Zhao, Guibin Jiang. The in Vitro Estrogenic Activities of Polyfluorinated Iodine Alkanes. Environmental Health Perspectives, 120, 119-125. (2012)

[4] Liu Qian, Shi Jianbo, Sun Jianteng, Thanh Wang, Zeng Lixi, Jiang Guibin. Graphene and Graphene Oxide Sheets Supported on Silica as Versatile and High-Performance Adsorbents for Solid-Phase Extraction. Angewandte Chemie-International Edition, 50, 5913-5917. (2013)

[5] Guangbo Qu, Jianbo Shi, Thanh Wang, Jianjie Fu, Zhuona Li, Pu Wang, Ting Ruan, and Guibin Jiang. Identification of Tetrabromobisphenol A Diallyl Ether as an Emerging Neurotoxicant in Environmental Samples by Bioassay-Directed Fractionation and HPLC-APCI-MS/MS. Environmental Science & Technology, 45, 5009-5016. (2011)

Antibiotics and Antibiotic Resistance Genes (ARGs) in Water Environments of China

Professor Xiangdong Li
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Professor Xiang-dong Li is Chair Professor of Environmental Science and Technology at Department of Civil & Environmental Engineering, Associate Dean (Research) of Faculty of Construction and Environment, The Hong Kong Polytechnic University. He obtained his BSc in Earth Sciences and his MSc in Geochemistry from Nanjing University, and his PhD in Environmental Technology from Imperial College London.

Prof. Li's major research interests include regional environmental pollution, urban environmental studies, and phytoremediation of contaminated soils. He has published more than 170 papers in leading international journals, and is one of the highly cited researchers in Environment/Ecology of the ISI database.

Professor Li is the past president (2011-2013) of the International Society of Environmental Geochemistry and Health (SEGH). He is currently an Associate Editor for Environmental Science and Technology (ES&T), a leading environmental research journal published by American Chemical Society (ACS). Prof. Li is also an associate editor and editorial board member for several other international journals in related research fields.

Five selected publications:

[1]Xu, W.H., Zhang, G., Wai, O.W.H., Zou, S.C., Li, X.D.* *Transport and adsorption of antibiotics by marine sediments in a dynamic environment. Journal of Soil and Sediment*, **9**, 364-373, (2009)

[2] Chen B.W., Liang X.M., Xu, W.H., Huang, X.P., Li, X.D.* *The changes in trace metal contamination over the last decade in surface sediments of the Pearl River Estuary, south China. Science of the Total Environment*, **439**, 141-149 (2012).

[3] Chen B.W., Liang X.M., Huang, X.P., Zhang, T., Li, X.D.* *Differentiating anthropogenic impacts on ARGs in the Pearl River Estuary by using suitable gene indicators. Water Research*, 47, 2811-2820 (2013).

[4] Liang X.M., Chen B.W., Nie, X.P., Shi, Z., Huang, X.P., Li, X.D.* *The distribution and partitioning of common antibiotics in water and sediment of the Pearl River Estuary, South China. Chemosphere*, 92, 1410-1416 (2013).

5. Chen B.W., Yang, Y., Liang X.M., Yu, K., Zhang, T., Li, X.D.* *Metagenomic profiles of antibiotic resistance genes (ARGs) between human impacted estuary and deep ocean sediments. Environmental Science and Technology*, 47, 12753-12760 (2013).

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Synthesis, Characterization, Photocatalytic and Toxicological Evaluation of M-TiO_2 (M = Ag, Cu^{2+}) materials

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Iliana E. Medina-Ramírez got a PhD in chemistry (organometallic and materials chemistry) from Tulane University (2005). She has nearly 10 years of research experience in the field of nano-structured materials (metallic, metal oxides and metal-chalcogenides), with particular interest in photocatalytic materials for environmental remediation. She has published about 30 papers in internationally peer review journals, 4 book chapters and co-edited a book. She has also participated in several international conferences. She has supervised 30 BSc students, 10 MSc students and 4 doctorate students. She was awarded the best junior researcher prize (2007) and advanced researcher award (2nd place, 2011) at her current academic institution. She is a member of the System of National Researchers (Mexico).

Selected Publications

1. "Photocatalytic Semiconductors. Synthesis, Characterization and Environmental Applications" Aracely Hernández-Ramírez and Iliana Medina-Ramirez (Eds.) Springer, 2015 (ISBN 978-3-319-10999-2).

2. I Medina-Ramírez, JL Liu, A Hernández-Ramírez, C Romo-Bernal. Synthesis, characterization, photocatalytic evaluation, and toxicity studies of TiO2–Fe3+ nanocatalyst (2014). Journal of Materials Science 49 (15), 5309-5323.

3. I Medina-Ramirez, Z Luo, S Bashir, R Mernaugh, JL Liu. Facile design and nanostructural evaluation of silver-modified titania used as disinfectant (2011). Dalton Transactions 40 (5), 1047- 1054.

4. X Pan, I Medina-Ramirez, R Mernaugh, J Liu. Nanocharacterization and bactericidal performance of silver modified titania photocatalyst (2010). Colloids and Surfaces B: Biointerfaces 77 (1), 82- 89.

5. I Medina-Ramirez, S Bashir, Z Luo, JL Liu. Green synthesis and characterization of polymer-stabilized silver nanoparticles (2009). Colloids and Surfaces B: Biointerfaces 73 (2), 185-191.

6. I Medina-Ramírez, M González-García, JL Liu. Nanostructure characterization of polymer-stabilized gold nanoparticles and nanofilms derived from green synthesis (2009). Journal of materials science 44 (23), 6325-6332.

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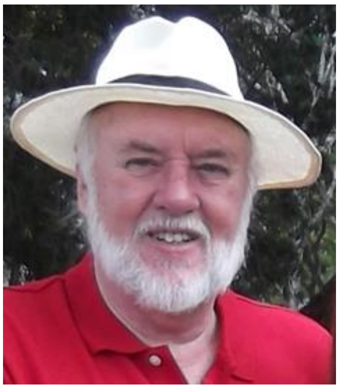

Dr. Stephen MUHL

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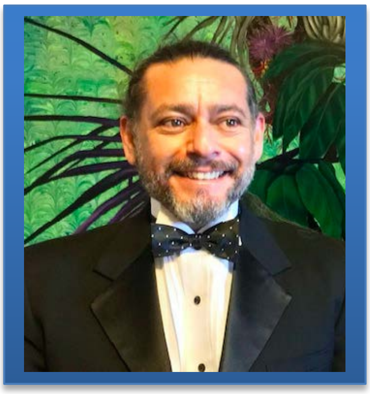
Stephen Muhl was born in Lincolnshire, England a few miles from Boston (the original one) in 1953. He studied his first degree, Master of Arts and PhD in the University of Lancaster. Although about half the work was carried out in the Atomic Energy Research Establishment of Harwell. Following this he worked in the Facultad de Estudios Superiores, Cuautitlan, Mexico of the Universidad Nacional Autónoma de México (UNAM). Here he gave various courses on experimental physics and directed the studies of a couple of very talented undergraduate students, one of which concluded in the successful application of Mexican and British patents, his principal aim was learning about and enjoying the life of Mexico. Early in the 1980´s he transferred to the Instituto de Investigaciones en Materiales (IIM) of the UNAM in Mexico City and started to do research on the preparation and characterization of hydrogenated amorphous silicon based thin films using PECVD: this work also led to the a Mexican patent, as well as various publications and the formation of about 4 postgraduate students. In 1987, just after the 8.2 Richter scale Mexico City earthquake seriously damaged his apartment, he went to work with Dr. Arun Madan at Glasstech Solar, Denver, USA. Here he learned much more about a-Si:H and particularly how to make highly efficient solar modules of up to 120 x 40 cm. After three years Dr. Muhl decided to return to his position in the IIM-UNAM where his has continued to work until today. In 2003 Dr. Sandra Rodil and Stephen started the PlasNaMat (Plasmas and Nano-Materials) group, and in 2014 Dr. Muhl promoted the formation of the Department of Materiales de Baja Dimensionalidad en el IIM. The earlier studies on a-Si:H where quickly extend to include cubic boron nitride and amorphous carbon and diamond films, and somewhat later carbon nitride. From 2000 to today Dr. Muhl's research interests have focussed on studies of transition metal nitride and oxide hard coatings by magnetron sputtering, the use of plasma assisted processes to produce a-C coated metal and oxide nanoparticles, the growth of MWCNTs and the development of novel plasma sources. Dr. Muhl has published more than 90 articles with about 1000 citations, one book on silicon based solar cells, a couple of book chapters on carbon based materials, he has 7 patents (more are in process), has organized about 10 international conferences and symposia, and has had the great privileged to work with and guide the studies of more than 30 excellent students.

Five selected publications:

[1] S. Muhl, A. Pérez, The use of hollow cathodes in deposition processes: A Critical Review, Thin Solid Films, 579 174 (2015).
[2] A Perez, A T Luna, S Muhl, Characteristics of a toroidal planar hollow cathode and its use for the preparation of Bi nanoparticles, J. Phys. D: Appl. Phys. 46, 505303. (2013).
[3] C Garcia-Segundo, M Villagran-Muniz, S Muhl And J-P Connerade, Initial considerations on the relationship between the optical absorption and the thermal conductivity in dielectrics, N J. Phys. D: Appl. Phys. 43, 255403 (2010).
[4] F. Maya, S. Muhl, O. Peña, M. Miki-Yoshida, Synthesis and characterization of silver–carbon nanoparticles produced by high-current pulsed arc, Thin Solid Films 518, (5) 1484, (2009).
[5] A review of the preparation of carbon nitride films, Muhl S. & Mendez J.M., Diamond and Related Materials, 8, 1809, (1999).



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Antonio was born in Morelia the capital of the Michoacán state in México. He is currently Associate Professor at City University of Hong Kong where he teaches undergraduate and doctoral courses in general physics, optics and nano-photonics among others. He studied Physics at the National Autonomous University of Mexico (UNAM). After a short research exchange in the UK he started his doctoral studies at The Pennsylvania State University (Penn State, USA) receiving his PhD degree in December 2000 for his work in the Optical Characterization of the Nucleation and Growth of Wide Bandgap Materials under the Co-Supervision of Prof. Russell Messier and Prof. Robert Collins. He lives in Hong Kong since 2002 and his current research interests include optical characterization of nanostructures for plasmonic and photonic applications, energy generation and storage, light emission, and optical sensors. He has co-authored three book chapters and ~ 120 publications indexed in SCI who have received more than 3900 citations with *h*-index 33 (Google Scholar 4,900 citations, *h*-index 36). He has participated as invited speaker in more than 25 international conferences and is involved as organizer of several workshops and scientific conferences in Mexico, the United States and Hong Kong. Antonio is the main organizer of ***NANOMXCN**: Mexico-China Workshop on Nano Materials / Science / Technology* (www.nanomxcn.com) a series of workshops with the main objective of promoting scientific and technological collaboration between Mexico and China, including Hong Kong.

Five selected publications:

[1] T. Wood, K. T. Cheung, Y. Foo, Y. K. Liu & J. A. Zapien "Resonance modulated amplified emission from CdSSe nanoribbons" Scientific Reports **5** (2015) 15071. DOI: 10.1038/srep15071 (online October 2015).
[2] CH To, A Ng, Q Dong, AB Djurišić, JA Zapien, Wai Kin Chan, C Surya, "Effect of PTB7 Properties on the Performance of PTB7:PC71BM Solar Cells" *ACS Appl. Mater. Interfaces* **7** (2015), 13198−13207.
[3] K. T. Cheung, Y. Foo, C. H. To, **J**. A. Zapien, "Towards FDTD modeling of spectroscopic ellipsometry data at large angles of incidence" *Appl. Surf. Sci.* 281 (2013) 2– 7.
[4] A. Ng, X. Liu, C.H. To, A. B. Djurisic, J. A. Zapien, W. K. Chan, "Annealing of P3HT:PCBM Blend Film-The Effect on Its Optical Properties" *ACS Appl. Mat. Int.* 5 (2013) 4247-4259.
[5] S. Jha, J.-C. Qian, O. Kutsay, J. Kovac Jr, C.-Y. Luan, J. A. Zapien, W. Zhang, S.T. Lee and I. Bello "Violet-blue LEDs based on p-GaN/n-ZnO nanorods and their stability" *Nanotechnol* **22**, 245202 (2011), doi:10.1088/0957-4484/22/24/245202.

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Jiesheng Chen received his BSc and MSc degrees from Sun Yat-sen University in Guangzhou in 1983 and 1986, respectively. In 1989 he obtained his PhD degree at Jilin University and from 1990 he worked as a postdoctoral fellow in the Royal Institution of Great Britain, the United Kingdom, until 1994 when he joined the faculty of the Department of Chemistry, Jilin University as a professor. Since 2008, he has been a professor in the School of Chemistry and Chemical Engineering, Shanghai Jiao Tong University. His research interest is the synthesis of solid compounds and composite materials with new structures and functions. He is a fellow of the Royal Society of Chemistry.

Five selected publications:

1. F. H. Du, B. Li, W. Fu, Y. J. Xiong, K. X. Wang, J. S. Chen. Surface Binding of Polypyrrole on Porous Silicon Hollow Nanospheres for Li-Ion Battery Anodes with High Structure Stability. *Adv. Mater.*, 2014, **26**, 6145-6150.
2. T. N. Ye, L. B. Lv, X. H. Li, M. Xu, J. S. Chen. Strongly-veined Carbon "Nanoleaves" as Highly Efficient Metal-free Electrocatalyst. *Angew. Chem. Int. Ed.*, 2014, **53**, 6905-6909.
3. Y.Y. Cai, X. H. Li, Y. N. Zhang, X. Wei, K. X. Wang, J. S. Chen. Highly Efficient Dehydrogenation of Formic Acid over a Palladium-nanoparticle-based Mott–Schottky Photocatalyst. *Angew. Chem. Int. Ed.*, 2013, **52**, 12038-12041.
4. L. Li, G. D. Li, C. Yan, X. Y. Mu, X. L. Pan, X. X. Zou, K. X. Wang, J. S. Chen. Synergistic Effect on Photoactivation of Methane C-H Bond over Ga3+-Modified ETS-10. *Angew. Chem. Int. Ed.*, 2012, **51**, 4702-4706.
5. L. Li, G. D. Li, C. Yan, X. Y. Mu, X. L. Pan, X. X. Zou, K. X. Wang, J. S. Chen. Efficient Sunlight-Driven Dehydrogenative Coupling of Methane to Ethane over a Zn+-Modified Zeolite. *Angew. Chem. Int. Ed.*, 2011, **50**, 8299-8303.

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Professor Lau is a National Thousand Talents Awardee in China, and currently leads the Center for Green Innovation, University of Science & Technology Beijing as its founding director. He has worked on R&D relevant to nanomaterials and nanotechnology, surface science and engineering, and green energy/chemistry. Professor Lau is particularly keen on advocating practical applications of research results. In this aspect, he is currently developing projects on fundamental studies of energy-conversion mechanisms, green chemistry driven by reactant's kinematics, photovoltaic module manufacturing, distributed PV engineering, and green-town planning in China. Professor Lau was born in China and grew up in Hong Kong. He developed his career in Canada and then returned to Hong Kong where he served the Chinese University of Hong Kong as Chair Professor of Materials Science, Head of Physics Department, and Dean of Science Faculty. In 2005, he returned to Canada again to direct Surface Science Western, a research center excelling in university-industry collaboration. In 2010, he moved back to China, with his main focus on novel and practical green energy and manufacturing technologies, and on training highly qualified personnel in these fields. Professor Lau has published some 400 articles, invented some 60 patented or patent-pending technologies, and founded 5 high-tech startups.

Examples of research outputs by Professor Lau and his coworkers:

"Cross-linking the surface of cured polydimethylsiloxane via hyperthemal hydrogen projectile bombardment", **ACS Appl. Mater. Interf.** 7, 8515-8524(2015)
"Electrodeposited CZTS solar cells from Reline electrolyte", **Green Chem.** 16, 841-3845(2014)
"Cleaving C-H bonds with hyperthermal H_2: facile chemistry to cross-link organic molecules under low chemical-and energy-loads", **Green Chem.** 16, 1316-1325 (2014)
"Shewanella oneidensis MR-1 bacterial nanowires exhibit p-type, tunable electronic behavior ", **Nano Lett**. 13, 2407-2411(2013)
"Grafting of polyelectrolytes onto hydrocarbon surfaces by high-energy hydrogen induced cross-linking for making metallized polymer films", **Chem. Comm.** 49, 4658-4660 {2013)
"Resolving surface chemical states in XPS analysis of first row transition metals, oxides and hydroxides: Cr, Mn, Fe, Co and Ni", **Appl. Surf. Sci.** 257, 2717-2730(2011) {cited some 600 times}
"Electrical transport along bacterial nanowires from Shewanella Oneidensis MR-1", **Proc. Nat. Acad. Sci.** 107, 18127-18131(2010)

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Professor Wong received his BS degree from Purdue University, and his MS and PhD degree from the Pennsylvania State University. After his doctoral study, he was awarded a postdoctoral fellowship under Nobel laureate Prof. Henry Taube at Stanford University. Prior to joining Georgia Tech, he was with AT&T Bell Laboratories for many years and became an AT&T Bell Laboratories Fellow(the highest technical award bestowed by AT&T Bell Labs) in 1992.

Professor Wong has published widely with over 1,000 technical papers, authored and edited 12 books. He has yielded fruitful research results and holds over 65 US patents. Professor Wong has made significant contributions to the industry by pioneering new materials, which fundamentally changed the semiconductor packaging technology.

Professor Wong has successfully motivated and nurtured numerous inquisitive young minds over the years. As a distinguished scholar, Professor Wong was awarded numerous international honors, such as the IEEE CPMT Society Outstanding Sustained Technical Contributions Award in 1995, the IEEE Third Millennium Medal in 2000, the IEEE EAB Education Award in 2001, the IEEE CPMT Society Exceptional Technical Contributions Award in 2002, the Georgia Tech Class 1934 Distinguished Professor Award(the highest award by GT to its faculty) in 2004, named holder of the Charles Smithgall Institute-Endowed Chair(one of the two GT Institute-endowed Chairs) in 2005, the IEEE Components, Packaging and Manufacturing Technology Field Award(hailed as Father of the Modern Semiconductor Packaging) in 2006, the Sigma Xi's Monie Ferst Award in 2007, the Society of Manufacturing Engineers' Total Excellence in Electronic Manufacturing Award in 2008, the IEEE CPMT David Feldman Award in 2009. He has also received the 2012 International Dresden Barkhausen Award (Germany).

Professor Wong is a member of the US National Academy of Engineering (elected in 2000), and a foreign academician member of the Chinese Academy of Engineering(elected in 2013).

Five selected publications:

[1] Jizhang Chen, Junling Xu, Shuang Zhou, Ni Zhao, Ching Ping Wong, *Nano Energy* **15**, 719 (2015).
[2] Shuang Zhou, Junling Xu, Yubin Xiao, Ni Zhao, Ching Ping Wong, *Nano Energy* **13**, 458 (2015).
[3] Jizhang Chen, Junling Xu, Shuang Zhou, Ni Zhao, Ching Ping Wong, *J. Mater. Chem. A* **3**, 17385 (2015).
[4] Jizhang Chen, Junling Xu, Shuang Zhou, Ni Zhao, Ching Ping Wong**,** *Nano Energy* **21**, 145 (2016).
[5] Jizhang Chen, Junling Xu, Shuang Zhou, Ni Zhao, Ching Ping Wong**,** *Nano Energy* **25**, 193 (2016).

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B. of Sc. UNAM (1982) Ph. D. UNAM (1989). Posdoc CWRU (1990-1992), UC Berkeley (1994). Sabbatical Research UC Berkeley (2005), Harvard (2007, 2010, 2013). I am a Theoretical Physical Chemist with experience in the study of metallic alloys and organic molecules. I have employed and studied different quantum chemical techniques, for example, Quantum Monte Carlo and Density Functional Theory.

Our present interest is in the use of modern techniques of Theoretical Chemistry to the prediction of properties of materials in applications to renewable energies. I participate in the Harvard Clean Energy Project, which has ranked over three million small organic molecules as potential candidates for improving efficiency of Organic PhotoVoltaics (OPVs). Currently, I lead a multidisciplinary Mexican project (with funding from the Ministry of Energy) to synthesize these molecules and assamble and test the corresponding OPV devices. Also, we are interested in energy storage, particularly based on organic flow batteries. Our goals focus, on the one hand, on the combination of high throughput quantum chemistry prediction of promising materials with machine learning techniques, molecular mechanics studies of mesoscopic geometries and quantum models on the computational side, and on the other hand, on the collaboration with experimentalists on the synthesis of predicted chemicals and the ellaboration of the corresponding devices for renewables.

Five selected publications:

[1] Further insights in DFT calculations of redox potential for iron complexes: the ferricinium/ferrocene system. Martha M. Flores-Leonar, Rafael Moreno-Esparza, Víctor M. Ugalde-Saldívar, Carlos Amador-Bedolla Submitted for publication to Computational and Theoretical Chemistry, COMPTC-D-15-01073 (2016)

[2] Sistemas de Energía. Carlos Amador Bedolla y Ramón Muñoz Ledo. Reporte Mexicano de Cambio Climático: Grupo III Emisiones y mitigación de gases de efecto invernadero. UNAM Programa de Investigación en Cambio Climático (2015). ISBN 978-607-027523-4

[3] Accelerated computational discovery of high-performance materials for organic photovoltaics by means of cheminformatics. Roberto Olivares-Amaya, Carlos Amador-Bedolla, Johannes Hachmann, Sule Atahan-Evrenk, Roel S. Sánchez-Carrera, Leslie Vogt and Alán Aspuru-Guzik. Energy & Environmental Science 4, 4849-4861 (2011) doi: 10.1039/C1EE02056K

[4] The Harvard Clean Energy Project: Large-Scale Computational Screening and Design of Organic Photovoltaics on the World Community Grid. J. Hachmann, R. Olivares-Amaya, S. Atahan-Evrenk, C. Amador-Bedolla, R.S. Sánchez-Carrera, A. Gold-Parker, L. Vogt, A. M. Brockway, and A. Aspuru-Guzik J. Phys. Chem. Lett. **2**, 2241-2251 (2011) doi: 10.1021/jz200866s

[5] Site occupancy of ternary additions to B2 alloys. G. Bozzolo, R. D. Noebe and C. Amador. Intermetallics 10, 149-159 (2002)

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Dr. An received her PhD in Civil and Environmental Engineering at the Hong Kong University of Science and Technology (HKUST). Her dissertation on sludge minimization mechanism in Oxic-Settling-Anaerobic process in wastewater treatment system was well received and cited. Since 2009, Dr. An has extended her research and education career with Sustainability concept at the University of Tokyo, Japan. She has conducted several research projects and field work focused on sustainable water management and urban development.

Research Interests:
Dr. An's research focus is on developing sustainable water resource including desalination, membrane distillation and rainwater harvest.

- Emerging membrane processes: membrane distillation (MD), forward osmosis (FO), and hybrid system for wastewater nutrient recovery and treatment
- Novel seawater desalination technologies using Membrane Technology: MD, FO and Adsorption desalination (AD)
- Optimization and improvement of pre-treatment for algae removal and biofouling control in seawater reverse osmosis systems
- Nanocomposite membrane for Emerging pollutant removal
- Membrane fabrication: organic, inorganic, magnetic and hybrid composite

Five selected publications:

[1] Alicia Kyoungjin An*, Jiaxin Guo, Eui-jong Lee, Sanghyun Jeong, Yanhua Zhao, Zuankai Wang, TorOve Leiknes. PDMS/PVDF hybrid electrospun membrane with superhydrophobic property and drop impact dynamics for dyeing wastewater treatment using membrane distillation. Journal of Membrane Science (2016). In press.
[2] Alicia K.J. An*, Guo, J., Jeong, S., Lee, E.-J., Tabatabai, S.A.A., Leiknes, T., 2016. High flux and antifouling properties of negatively charged membrane for dyeing wastewater treatment by membrane distillation. Water Res. 103, 362–371.
[3] E.-J. Lee, Alicia K.J. An *, T. He, Y.C. Woo, H.K. Shon, Electrospun nanofiber membranes incorporating fluorosilane-coated TiO2 nanocomposite for direct contact membrane distillation, J. Memb. Sci. 520 (2016) 145–154.
[4] Eui-Jong Lee , Alicia K.J. An*, Pejman HADI , Sangho Lee, Yun Chul Woo, and Ho Kyong Shon. Advanced multi-nozzle electrospun functionalized titanium dioxide/polyvinylidene fluoride-co-hexafluoropropylene (TiO2/PH) composite membranes for direct contact membrane distillation. Journal of Membrane Science (2016). In press.
[5] Lee, E., Alicia K.J. An.*, Hadi, P., Yan, D.Y.S., (2015). Characterizing flat sheet membrane resistance fraction of chemically enhanced backflush. Chem. Eng. J. doi:10.1016/j.cej.2015.08.136

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Dr. Elder de la Rosa earned his Bachelor's Degree in Science (Physics and Mathematics) from the Higher School of Physics and Mathematics of the National Polytechnic Institute in Mexico in 1988, his Master's Degree in 1990, and his PhD Degree in 1998, these last two from the Center for Research in Optics ("Centro de Investigaciones en Optica", CIO), also in Mexico. In 1999, he did a post-doctoral research stay at UNAM's Center of Applied Physics and Advanced Technology, and as of 2000, he has been a head researcher at CIO.

He has published over 100 papers in international journals with strict refereeing, and has received over 1300 type A citations. He is the founder of CIO's research group on Nanophotonics and Advanced Materials (NAFOMA), which includes three CIO researchers.

Work:

Centro de Investigaciones en Óptica A.C., Head Researcher, "C" level since 2008; Head Researcher "B" level 2004-2008; Head Researcher "A" level 2000-2004. General Director since November 23th, 2012. Chief of the Photonics Division (31 researchers) from January, 2009 to November 22nd, 2012, and member of the Academic Committee since the same date. Leader of the Advanced Materials and Nanophotonics research group

Research lines:

Linear and non-linear properties of advanced materials for photonic applications. Synthesis and characterization of luminiscence in nanostructured materials (oxides, semiconductors, metals) for lighting systems, biomedical applications and solar cells. Preparation and characterization of luminiscence in soft glasses (P2O5, TeO2) doped with rare-earths for optic fiber amplifiers and lasers. Preparation and characterization of scintillating optic fibers.

Five selected publications:

1. Elisa Cepeda-Pérez, Tzarara López-Luke, Germán Plascencia-Villa, Leonardo Perez-Mayen, Andrea Ceja-Fdez, Arturo Ponce, Juan Vivero-Escoto and Elder de la Rosa; *SERS and integrative imaging upon internalization of quantum dots into human oral epithelial cells*; *J. Biophotonics*, **(2016) DOI 10.1002/jbio.201600034**
2. Zarazúa, D. Esparza, T. López-Luke, A. Ceja-Fdez, J. Reyes-Gomez, I. Mora-Seró, E. De la Rosa;

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Nanoparticle Drug Delivery Systems for Prevention of Cardiovascular Disease

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Hector Cabrera-Fuentes was born in El Espinal, Oaxaca, Mexico, and graduated with a BSc (Hons) in Microbiology and MSc (Hons) in Molecular Biology at the Kazan State University, Russia in 2009. As a microbiologist by trade, his interests over the last years have been not only targeted microbiology toxins, but also molecular and cardiovascular biology. He became a fellow of the International Training Group PROMISE Giessen-Barcelona and obtained a PhD degree (2014) under the supervision of Prof. Klaus T. Preissner at the Medical School, Justus-Liebig University Giessen in Germany. During this time he was the first to demonstrate the relevance of extracellular RNA-dependent triggering of TACE resulting in pro-inflammatory induction of macrophages (M1-polarization) that was accompanied by the release of a multitude of cytokines, particularly relevant for atherogenesis and myocardial infarction. The damaging functions of self-eRNA (mainly ribosomal RNA) are counteracted by vascular RNase1 (from endothelium), which thereby serves as anti-atherogenic and anti-inflammatory factor. He was the ***Winner of the SERVIER-International Society of Heart Research Award 2016.*** Moreover, he was Finalist at the Louis N. and Arnold M. Katz Basic Science Research for Young Investigators of the American Heart Association in 2014, winer of Young Investigator Award of the Russian Society of Cardiology (2014) and of the German Society of Atherosclerosis (2013). Likewise, he is member of the editorial board of the Journal Discoveries, and recently was the leading guest editor of the thematic issue: **Inflammation between defense and disease: impact on tissue repair and chronic sickness.**

Publication list

http://www.ncbi.nlm.nih.gov/pubmed/?term=Cabrera-Fuentes
https://www.ncbi.nlm.nih.gov/pubmed/?term=Carbrera-Fuentes

[1] Cabrera-Fuentes HA, et al. "Protecting the cardiovascular system from ischemia: between bench and bedside". ***Basic Res Cardiol*** 111(1):7 (2016).
[2] Cabrera-Fuentes HA, et al. "From basic mechanisms to clinical applications in heart protection, new players in cardiovascular diseases and cardiac theranostics". ***Basic Res Cardiol*** 111(6):69 (2016).
[3] Cabrera-Fuentes HA, et al. "Regulation of macrophage polarization by extracellular RNA". ***Tromb Haemost.*** 113(3):473-481 (2015).
[4] Cabrera-Fuentes HA, et al. "RNase1 prevents the damaging interplay between extracellular RNA and tumour necrosis factor-α in cardiac ischaemia/reperfusion injury". ***Tromb Haemost*** 112(6): 1110-1119 (2014).
[5] Simsekyilmaz S#, Cabrera-Fuentes HA#, et. al. "The Role of Extracellular RNA in Atherosclerotic Plaque Formation in Mice". ***Circulation*** 129:598-606. #Equal first authors. (2014).

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Wallace C. H. Choy received his PhD Degree in Electronic Engineering from the University of Surrey, UK in 1999. His work at Surrey was supported by the Croucher Foundation Scholarship. He then joined National Research Council of Canada as a member of research staff to work on optical device structures of polarization independent optical amplifiers and modulators. He joined Fujitsu at San Jose, US in 2001 to develop real-time wavelength tunable lasers and optical transmitter modules. He is now a professor of Department of Electrical and Electronic Engineering, the University of Hong Kong (HKU). His current research interests are concerned with organic/inorganic optoelectronic devices, plasmonic structures and nano-material devices, and optical and electrical properties of organics, metal nanomaterials and metal oxides. Prof. Choy has published over 160 internationally peer-reviewed journal papers, contributed to one book and seven book chapters, as well as US and China patents. Details of publication can be found in http://scholar.google.com.hk/citations?user=GEJf9dAAAAAJ. He was the recipient of the Sir Edward Youde Memorial Fellowship, the Croucher Foundation Fellowship, the Outstanding Achievement Award from National Research Council of Canada, and HKU Merit awards and Research Output Prize.

Wallace Choy has been recognized as the Top 1% most cited Scientists based on Thomson Reuter's Essential Science Indicators (ESI) in 2014 and 2015. He has served as editorial board member for Nature Publishing Group of Scientific Reports and IOP J Physics D, senior editor of IEEE Photonics Journal, topical editor of OSA Journal of the Optical Society of America B (JOSA B; JOSA founded in 1917), and guest editor of OSA Journal of Photonic Research, and Journal of Optical Quantum Electronics. He has delivered over 40 invited talks and served as a committee member in internationally industrial and academic conferences organized by various organizations such as IEEE, OSA and Plastic Electronics Foundation. He is a fellow of OSA and a senior member of IEEE.

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Aleksandra B. Djurišić obtained Ph. D. degree in Electrical Engineering from the School of Electrical Engineering, the University of Belgrade in 1997. After finishing her PhD studies, she worked as a postdoctoral fellow at University of Hong Kong and as an Alexander von Humboldt postdoctoral fellow at TU Dresden. She joined the Dept. of Physics at the University of Hong Kong in 2003 as assistant professor and she is currently a professor. Her research interests include nanomaterials, wide-bandgap semiconductors, and organic materials, and their applications in areas related to energy and environment, such as photocatalysis, antimicrobial materials, solar cells, and batteries. She has published 268 research articles including reviews, and has been cited over 11300 times. Her h-index is 48.

Five selected publications:

[1]F. Z. Liu, Q. Dong, M. K. Wong, A. B. Djurišić, A. Ng, Z. W. Ren, Q. Shen, C. Surya, W. K. Chan, J. Wang, A. M. C. Ng, C. Z. Liao, H. K. Li, K. M. Shih, C. R. Wei, H. M. Su, and J. F. Dai, *Is excess PbI_2 beneficial for perovskite solar cell performance*?, *Adv. Energy Mater.* **6**, 1502206 (2016).

[2] Q, Dong, F. Z. Liu, M. K. Wong, H. W. Tam, A. B. Djurišić, A. Ng, C. Surya, W. K. Chan, A. M. C. Ng, *Encapsulation of perovskite solar cells for high humidity conditions, ChemSusChem* **9**, 2597 (2016).

[3] X. Liu, F. Z. Liu, Q. Sun, A. M. C. Ng, A. B. Djurišić, M. H. Xie, C. Z. Liao, K. M. Shih, *In situ synthesis of CuxO/SnO_x/CNT and Cu_xO/SnO_x/SnO_2/CNT nanocomposite anodes for lithium ion batteries by a simple chemical treatment process, ACS Appl. Mater. & Interfaces* 6, 13478 (2014).

[4] M. Bijelić, X. Liu, Q.Sun, A. B. Djurišić, M. H. Xie, A. M. C. Ng, C. Suchomski, I. Djerdj, Ž. Skoko, J. Popović, *Long cycle life of $CoMn_2O_4$ lithium ion battery anodes with high crystallinity, J. Mater. Chem. A* **3**, 14759 (2015).

[5] X. Liu, Q. Sun, A. M. C. Ng, A. B. Djurišić, M. H. Xie, B. H. Dai, J. Y. Tang, C. Surya, C. Z. Liao, K. M. Shih, *Alumina stabilized graphene oxide wrapped SnO_2 hollow sphere LIB anode with improved lithium storage*, *RSC Adv.* **5,** 100783 (2015).

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Yuqiao Fu is currently a two year PhD student in department of physics and materials science in City University of Hong Kong. She got a Master degree in materials engineering and nanotechnology in City University of Hong Kong. Her topic of research concerns mainly investigation of solar cells in energy consumption materials used in environmental preotection applications.

Selected publications:

[1] Yuqiao Fu, Yan Huang, Wenjun Meng, Zifeng Wang, Yoshio Bando, Dmitri Golberg, Chengchun Tang, Chunyi Zhi, *Highly ductile UV-shielding polymer composites with boron nitride nanospheres as fillers*, *Nanotechnology* **26**, 115702 (2015).

[2] Zifeng Wang, Yuqiao Fu, Wenjun Meng, Chunyi Zhi, *Solvent-free fabrication of thermally conductive insulating epoxy composites with boron nitride nanoplatelets as fillers*, *Nanoscale research letters* **9** 643 (2014).

[3] Wenjun Meng, Yang Huang, Yuqiao Fu, Zifeng Wang, Chunyi Zhi, Polymer composites of boron nitride nanotubes and nanosheets, *Journal of materials chemistry C* **2** 10049 (2014).

[4] Yang Huang, Minshen Zhu, Wenjun Meng, Yuqiao Fu, Zifeng Wang, Yan Huang, Zengxia Pei, Chunyi Zhi, Robust reduced graphene oxide paper fabricated with a household non-stick frying pan: a large-area freestanding flexible substrate for supercapacitors, *RSC Advances* **5** 33981 (2015).

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Dr. Fuentes-Cobas obtained his B. Sc. (1970), M- Sc. (1977) and Ph.D. (1982) in Solid State Physics from Havana University, Cuba. He received a post-doc on neutron texture analysis at the Joint Institute for Nuclear Research, Dubna, Russia (1983 - 85).

In Cuba he worked as Professor and Senior Researcher at Havana University and at the Cuban Academy of Sciences. He was Head of the General Physics Dept. at Havana University, Secretary of the National Commission for Scientific Degrees, Vice-President of the National Commission of Physics Teaching and Head of the Solid State Section of the Cuban Physical Society.

In Mexico he works, since 1997, at the Materials Physics Department, Advanced Materials Research Center, Chihuahua. His teaching and research activities have been centered on electromagnetic theory, materials structure analysis by synchrotron light diffraction-scattering and the structure-properties relationship. He has made original contributions on the representation and prediction of piezo- and magnetoelectric properties of bulk and nanostructured materials. Dr. Fuentes-Cobas coordinates the Materials World Modules-Mexico scientific education program (http://mwm.cimav.edu.mx) and the web page of the Material Properties Open Database project (http://mpod.cimav.edu.mx).

He has been awarded in Russia (Prize for Applied Research, Joint Institute for Nuclear Research, Dubna, 1983), Cuba (National Reward, Cuban Academy of Science, 1997), Spain (Distinguished Visitor, Complutense University, Madrid, 2008) and Mexico (State First Prize of Science and Technology, Chihuahua, 2012).

Five selected publications:

[1] M.L.Calzada, M Torres, L E Fuentes-Cobas et al: *Ferroelectric self-assembled PbTiO3 perovskite nanostructures onto (100)SrTiO3 substrates from a novel microemulsion aided sol-gel preparation method.* Nanotechnology **18,** 375603 (2007). [Cover page article].
[2] J. Silva, A. Reyes, H. Esparza, H. Camacho, L. Fuentes. *$BiFeO_3$: A Review on Synthesis, Doping and Crystal Structure*. Integr. Ferroelectr. **126**, 47 (2011). [most read article of journal].
[3] L. Fuentes-Cobas, L. Pardo, M. E. Montero-Cabrera et al: *The $0.96(Bi_{0.5}Na_{0.5})TiO_3 – 0.04BaTiO_3$ crystal structure: A high-Q, high-counting statistics synchrotron diffraction analysis*. Crys. Res. Tech. **49**, 190 (2014). [Cover page article].
[4] L. Fuentes-Cobas, A. Muñoz-Romero, M. E. Montero-Cabrera et al. *Predicting the Coupling Properties of Axially-Textured Materials.* Materials **6**, 4967 (2013).
[5] L.E. Fuentes-Cobas, J.A. Matutes-Aquino, M.E. Botello-Zubiate, et al: *Advances in Magnetoelectric Materials and their Application*. Ch. 3, Vol. 24, Handbook of Magnetic Materials. Ed.: K.H.J. Buschow. Elsevier (2015).

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1. Education

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Ph.D.: New Mexico State University, Las Cruces, New Mexico, 1988
M.S.: New Mexico State University, Las Cruces, New Mexico, 1985
B.S. Chemical Engineering (Honors – GPA 4.0), Aut. Univ. Chihuahua, Chih., Mexico, 1980

2. Research Interest

Dr. Jorge Gardea-Torresdey is the Dudley Professor of Chemistry and Environmental Science and Engineering, and current Chair of the Chemistry Department at The University of Texas at El Paso (UTEP). His research interests include: applications of spectroscopy techniques in environmental chemistry, novel methods for the bioproduction of nanoparticles, study of the fate of nanoparticles in the environment, and applications of nanotechnology to clean water, among others. His current research is funded by the US NIH, DOE, EPA, USDA, and the NSF. He is a co-investigator in the NSF/EPA funded "Center for Environmental Implications of Nanotechnology" (UCCEIN). He is also a co-investigator in the recently funded NSF Engineering Research Center "Nanotechnology Enabled Water Treatment Systems" (NEWT). He has authored over 400 publications and issued 5 US patents for environmental remediation. Dr. Gardea has graduated 33 PhD and 31 M.Sc. He was awarded the 2016 Graduate Mentor Award, 2015 New Mexico State University Distinguished Alumni Award, 2013 Honorary Professor, Institute of Urban Environment, Chinese Academy of Sciences, and the 2012 Piper Professor Award, the most distinguished Award for a Professor in the State of Texas. His research achievements are highlighted in the Lawrence Hall of Science of the University of California Berkeley. He was Editor of the Journal of Hazardous Material from 2007 to 2010, and he is Associate Editor of ES&T since 2011.

3. Five selected publications

[1] Westerhoff P, Alvarez P, Li, Q, Gardea-Torresdey J, Zimmerman J, *Environ Sci: Nano* (in-press, doi: 10.1039/C6EN00183A).
[2] Majumdar S, Almeida IC, Arigi EA, Choi H, VerBerkmoes NC, Trujillo-Reyes J, Flores- Margez JP, White JC, Peralta-Videa JR, Gardea-Torresdey JL, *Environ Sci Technol* **49** (22), 13283 (2015).
[3] Holden P, Klaessig F, Turco R, Priester J, Rico C, Arias H, Mortimer M, Pacpaco K, Gardea-Torresdey J, *Environ Sci Technol* **48**, 10541 (2014).
[4] Priester JH, Ge Y, Mielke RE, Horst AM, Cole Moritz S, Espinosa K, Gelb J, Walker SL, Nisbet RM, An Y-J, Schimel JP, Palmer RG, Hernandez-Viezcas JA, Zhao L, Gardea-Torresdey JL, Holden PA, *PNAS* **109** E2451 (2012).
[5] Rico C M, Majumdar S, Duarte-Gardea M, Peralta-Videa JR, Gardea-Torresdey JL, *J Agric food Chem* **59** (8)3485 (2011).

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Prof. Garzón is a Professor of Physics at Universidad Nacional Autónoma de México (UNAM) and is recognized as one of the leading theoreticians in Mexico in the area of numerical modeling of nanosystems and atomic clusters. His area of research includes theoretical studies on the shape and morphology of bare and ligand-protected metal clusters in order to predict and understand their electronic, optical, and other physical properties, combining genetic algorithms and many-body potentials (to perform global structural optimizations), with first-principles density functional theory (to confirm stability and energy ordering of the local minima); chirality in metal clusters and chirality index calculations; and vibrational and thermal properties of metal nanoparticles. He has published 77 journal papers in high-impact journals such as Journal of the American Chemical Society, Physical Review Letters, Chemical Society Reviews, the Journal of Physical Chemistry, and Physical Review B, among others. He has been cited ~ 4000 times and his H index is equal to 33. Prof. Garzón received a Ph. D. in Physics from UNAM in 1985, and occupied a postdoctoral position at the Department of Chemistry of the University of California, San Diego, USA between 1985 and 1986. He has been Visiting Professor at research institutions of USA, Italy, France, and Spain. He is currently an active member of the International Advisory Committee of the International Symposium on Small Particles and Inorganic Clusters (ISSPIC), and of the International Conference on Nanostructured Materials (ICNM). Prof. Garzón is member of Mexican Academy of Sciences.

Five selected publications:

[1] A. Sánchez-Castillo, C. Noguez, and I.L. Garzón, “On the Origin of the Optical Activity Displayed by Chiral Ligand-Protected Metallic Nanoclusters” J. Am. Chem. Soc, 132 1504 (2010).
[2] C. Noguez and I.L. Garzón, “Optically Active Metal Nanoparticles,” Chemical Society Reviews, 38 75 (2009).
[3] X. López-Lozano, L.A. Pérez, and I.L. Garzón, “Enantiospecific adsorption of chiral molecules on chira Au clusters,” Physical Review Letters, 97 233401 (2006).
[4] I.L. Garzón, C. Rovira , K. Michaelian, M.R. Beltrán, J. Junquera,P. Ordejón, E. Artacho, D. Sánchez-Portal, and J.M. Soler, “Do Thiols Merely Passivate Gold Nanoclusters ?” Physical Review Letters 85, 5290 (2000).
[5] I.L. Garzón, K. Michaelian, M.R. Beltrán, A. Posada-Amarillas, P. Ordejón, E. Artacho, D. Sánchez-Portal, and J.M. Soler. “Lowest Energy Structures of Gold Nanoclusters” Physical Review Letters, 81, 1600 (1998).

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Selected publications:

[1] **M. Gen**, I. W. Lenggoro, Probing a dip-coated layer of organic molecules by aerosol nanoparticles sensor with sub-100 nm resolution based on surface-enhanced Raman scattering, *RSC Advances*, **5**, 5158-5163 (2015).

[2] K. Kusdianto, **M. Gen**, I. W. Lenggoro, Area-selective deposition of charged particles derived from colloidal aerosol droplets on a surface with different hydrophilic levels, *Journal of Aerosol Science*, **78**, 83-96 (2014).

[3] **M. Gen**, S. Ikawa, S. Sagawa, I. W. Lenggoro, Simultaneous deposition of submicron aerosols onto both surfaces of a plate substrate by electrostatic forces, *e-Journal of Surface Science and Nanotechnology*, **12**, 238-241 (2014).

[4] **M. Gen**, H. Kakuta, Y. Kamimoto, I. W. Lenggoro, A colloidal route to detection of organic molecules based on surface-enhanced Raman spectroscopy using nanostructured substrate derived from aerosols, *Japanese Journal of Applied Physics*, **50**, 06GG10 (2011).

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Five selected publications:

[1] Ligang Hu, Yong Cai, Guibin Jiang, *Occurrence and speciation of polymeric chromium(III), monomeric chromium(III) and chromium(VI) in environmental samples*, *Chemosphere*, **156**, 14 (2016).
[2] Yau-Tsz Lai, Yuen-Yan Chang, Ligang Hu, Ya Yang, Ailun Chao, Zhi-Yan Du, Julian A. Tannner, Mee-Len, Chye, Chengmin Qian, Kwan-Ming Ng, Hongyan Li, Hongzhe Sun, *Rapid labeling of intracellular His-tagged proteins in living cells*, *Proceedings of the National Academy of Sciences of the United States of America*, **112**, 2948 (2015).
[3] Ligang Hu, Tianfan Cheng, Bin He, Lu Li, Yuchuan Wang, Yau-Tsz Lai, Guibin Jiang Hongzhe Sun, *Identification of Metal-Associated Proteins in Cells by Using Continuous-Flow Gel Electrophoresis and Inductively Coupled Plasma Mass Spectrometry*, *Angewandte Chemie International Edition*, **52**, 4916 (2013).
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Miguel Lastras is a PhD Candidate in the Electrical and Computer Engineering Department at the University of California, Santa Barbara. He received his B.Sc. degree in Engineering Physics and M.Sc. degree in Applied Sciences from the Universidad Autonoma de San Luis Potosi, Mexico, in 2008 and 2010, respectively; and a M.Sc. in Computer Engineering from University of California, Santa Barbara in 2012. His research interests include the architectural aspects of low-power crossbar-based memristive memories and its 3D monolithic integration with standard CMOS processes. He is additionally interested in the general-purpose computing on graphics processing units (GPGPU) for scientific applications. He is currently a Visiting Scholar at the Hong Kong University of Science and Technology.

Five selected publications:

[1] M. A. Lastras-Montaño, B. Chakrabarti, D. B. Strukov and K. T. Cheng, *3D-DPE: A 3D High-Bandwidth Dot-Product Engine for High-Performance Neuromorphic Computing,* Accepted in *2017 Design, Automation & Test in Europe Conference & Exhibition (DATE'17)*, Lausanne, 2017.
[2] M. A. Lastras-Montaño, A. Ghofrani and K. T. Cheng, *A low-power hybrid reconfigurable architecture for resistive random-access memories*, *2016 IEEE International Symposium on High Performance Computer Architecture (HPCA'16)*, Barcelona, 2016, pp. 102-113.
[3] M. A. Lastras-Montaño, A. Ghofrani and K. T. Cheng, *HReRAM: A hybrid reconfigurable resistive random-access memory*, *2015 Design, Automation & Test in Europe Conference & Exhibition (DATE'15)*, Grenoble, 2015, pp. 1299-1304.
[4] M. A. Lastras-Montaño, A. Ghofrani and K. T. Cheng, *Architecting energy efficient crossbar-based memristive random-access memories*, *Proceedings of the 2015 IEEE/ACM International Symposium on Nanoscale Architectures (NANOARCH'15)*, Boston, MA, 2015, pp. 1-6.
[5] A. Rahimi, A. Ghofrani, M. A. Lastras-Montano, K. T. Cheng, L. Benini and R. K. Gupta, *Energy-efficient GPGPU architectures via collaborative compilation and memristive memory-based computing*, *2014 51st ACM/EDAC/IEEE Design Automation Conference (DAC'14)*, San Francisco, CA, 2014, pp. 1-6.

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TEDx speaker–Mexico, government delegate for the G20–YEA, honorary president of the Mexican expat community - chapter New Zealand.. Nano entrepreneur, freelance consultant, public speaker and nanotechnology business analysist. Supporter of many government funding bids and analyst for various private investment rounds (seed, angel, and series A).
Organizer and/or presenter for over a dozen of international conferences on entrepreneurship, business, science and technology. Member of several international engineering, business and science organizations. Founder of the first NGO for Latin-American migrant business support in New Zealand and advocate for various human right and non-for profit organizations. Advisor for various SME's, and co-founder of various start-ups and NGO's.

Selected publications:

1. Pablo Lepe et al. *Furthering New Zealand's materials opportunities through electrospinning*. Processing and Fabrication of Advanced Materials XIX - New Zealand. 2011. p.1-12.
2. Pablo Lepe et al. *Sub-micron sized saccharide fibres via electrospinning.* De Gruyter Open - Electrospinning 2016; 1:p.1-9.
3. Pablo Lepe et al. *The electrospinnability of sugars: nano-candyfloss.* Carbobydrate research, 2016. Submitted.

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Prof. Jun Li received a Ph.D. degree in Physical Chemistry from Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences in 1992. He was a postdoctoral researcher at the Department of Chemistry, University of Siegen (Germany) and at the Department of Chemistry, The Ohio State University (USA) from 1993 to 1997. He worked as a Research Scientist at The Ohio State University from 1997 to 2000 and then became a staff member at the Pacific Northwest National Laboratory (PNNL, USA) in 2001, where he was appointed as a Senior Research Scientist and later promoted to a Chief Scientist. He was also an affiliated full professor at University of Idaho and Washington State University. Since 2007 he has been a ChangJiang Chair Professor at the Department of Chemistry, Tsinghua University, China.

Prof. Li has some 30 years experience in teaching and research in computational chemistry and theoretical heavy-element chemistry. He has published over 200 peer-reviewed papers and six book chapters, including more than 60 articles in high-impact journals (Science, Nature, Proc. Nat. Acad. Sci. USA, Nature Chem., Nature Mat., Nature Commun., Angew. Chem. Int. Ed., J. Am. Chem. Soc., Chem. Sci. and Acc. Chem. Res.). He has presented more than 100 invited talks and seminars and organized a dozen of international conferences. His research interests include computational catalysts, theoretical nanocluster chemistry, and theoretical heavy-element (actinide and lanthanide) chemistry. His recent research works focus on computational modeling of catalytic and energy materials, ab initio theoretical investigations of electronic structures and spectra of transition-metal complexes and nanoclusters, and relativistic quantum chemical studies of lanthanide and actinide compounds of environmental significance.

Five selected publications:

[1] B.-T. Qiao, A.-Q. Wang, X.-F. Yang, L. F. Allard, Z. Jiang, Y.-T. Cui, J.-Y. Liu, J. Li, T. Zhang, *Single-Atom Catalysis of CO Oxidation Using* Pt_1/FeO_x, *Nature Chem.* **3(8)**, 634-641 (2011).

[2] Y.-G. Wang, Y. Yoon, V.A. Glezakou, J. Li, R. Rousseau, *The Role of Reducible Oxide-Metal Cluster Charge Transfer in Catalytic Processes: New Insights on the Catalytic Mechanism of CO Oxidation on Au/*TiO_2 *from Ab Initio Molecular Dynamics*, *J. Am. Chem. Soc.* **135(29)**, 10673-10683 (2013).

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[5] B.-T. Qiao, J.-X. Liang, A.-Q. Wang, C.-Q. Xu, J. Li, T. Zhang, J. -Y (Jimmy) Liu, *Ultrastable Single-Atom Gold Catalysts with Strong Covalent Metal-Support Interaction (CMSI)*, *Nano Res.* **8(9)**, 2913-2924 (2015).

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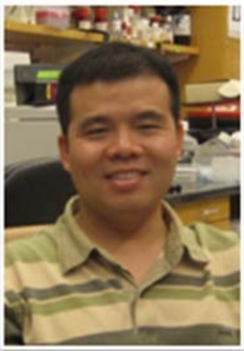
Five selected publications:

[1] Lingxiangyu Li, Qunfang Zhou, Fanglan Geng, Yawei Wang, Guibin Jiang. *Environ. Sci. Technol.* doi: 10.1021/acs.est6b04042 (**2016**).
[2] Lingxiangyu Li, Yawei Wang, Qian Liu, Guibin Jiang. *Environ. Sci. Technol.* 50, 188-196 (**2016**).
[3] Lingxiangyu Li, Monika Stobier, Andreas Wimmer, Zhenlan Xu, Claus Lindenblatt, Brigite Helmreich, Michael Schuster. *Environ. Sci. Technol.* 50, 6327-6333 (**2016**).
[4] Lingxiangyu Li, Ligang Hu, Qunfang Zhou, Chunhua Huang, Yawei Wang, Cheng Sun, Guibin Jiang. *Environ. Sci. Technol.* 49, 2486-2495 (**2015**).
[5] Lingxiangyu Li, Georg Hartmann, Markus Döblinger, Michael Schuster. *Environ. Sci. Technol.* 47, 7317-7323 (**2013**).



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Dr. Chunyang Liao is currently a professor at the Research Center for Eco-Environmental Sciences (RCEES), Chinese Academy of Sciences (CAS). He received his Ph.D. degree from the RCEES in 2007, followed by postdoctoral training at the Wadsworth Center, New York State Department of Health from 2009-2013. Thereafter, he became an Assistant Specialist at the University of California, Riverside from 2014-2015. Dr. Liao moved to the current position in June 2015. He is the (co)author of over 80 peer-reviewed journal articles and 2 book chapters. He currently serves as an editorial board member for *Environmental Pollution* and *Current Nanomaterials*. Dr. Liao is a recipient of the "*Thousand Young Talents Program*" (2015) and the "*Excellent Young Scientist*" awarded by the NSFC (2015).

Five selected publications:

[1] Chunyang Liao, Kurunthachalam Kannan. *Environ. Sci. Technol.* 48, 4103-4109 (**2014**).

[2] Chunyang Liao, Sunggyu Lee, Hyo-Bang Moon, Nobuyoshi Yamashita, Kurunthachalam Kannan. *Environ. Sci. Technol.* 47, 10895-10902 (**2013**).

[3] Chunyang Liao, Fang Liu, Kurunthachalam Kannan. *Environ. Sci. Technol.* 47, 3918-3925 (**2013**).

[4] Chunyang Liao, Fang Liu, Hyo-Bang Moon, Nobuyoshi Yamashita, Sehun Yun, Kurunthachalam Kannan. *Environ. Sci. Technol.* 46, 11558-11565 (**2012**).

[5] Chunyang Liao, Fang Liu, Ying Guo, Hyo-Bang Moon, Haruhiko Nakata, Qian Wu, Kurunthachalam Kannan. *Environ. Sci. Technol.* 46, 9138-9145 (**2012**).

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Prof. Jian LU is Chair Professor of Mechanical Engineering; Vice President (R&T) and Dean of graduate studies at the City University of Hong Kong (CityU). He obtained the Dip. Ing., Master (DEA) degree and Doctoral degree from University of Technology of Compiegne in 1984 and 1986 respectively. From 1986 to 1994, he was appointed as Senior Research Engineer at the CETIM (French Technical Centre for Mechanical Industry). In 1994, he was appointed as Professor; Head of Department of Mechanical Systems Engineering and Director of Mechanical Systems and Concurrent Engineering Laboratory jointly supported by the French Ministry of Education and CNRS at the University of Technology of Troyes, France. From 2005 to 2010, he was Chair Professor and Head of Department of Mechanical Engineering at the Hong Kong Polytechnic University. Professor LU's primary research interest is advanced materials and its integration in mechanical and energy systems using the combination of experimental mechanics and mechanical simulation. He has also branched out into several other areas of interest including surface engineering, biomechanics, residual stresses, and mechanics of nanomaterials. He has published more than 320 SCI journal papers including 30 papers in Science, Nature Materials, Nature Communications, Advanced Materials, PRL, Acta Materialia, Journal of the Mechanics and Physics of Solids and 17 granted patents (including international extension in China, Europe and USA. He was elected as a Fellow of the National Academy of Technologies of France in 2011.

Five selected publications:

[1] W.P.Tong, N.R.Tao, Z.B.Wang, J.Lu, K.Lu, Nitriding iron at lower temperatures, **Science**, Jan. 2003, p. 686-688.
[2] J.C.Ye, J.Lu**,** C.T.Liu, Q.Wang, Y.Yang, Atomistic Free-Volume Zones and Inelastic Deformation of Metallic-Glasses Characterized by High-Frequency Dynamic Micropillar Tests, **Nature Materials**, Volume 9, Issue 8, August 2010, pages 619-623.
[3] Q.Wang, C.T.Liu, Y.Yang, Y.D.Dong, J.Lu, Atomic-Scale Structural Evolution and Stability of Supercooled Liquid of a Zr-Based Bulk Metallic Glass, **Physical Review Letters**, May 2011, Volume 106, Issue 21, N. 215505
[4] H.N.Kou, J.Lu, Y.Li, High-Strength and High-Ductility Nanostructured and Amorphous Metallic Materials, **Advanced Materials**, 2014, 26, p5518–5524
[5] Q. Wang, S.T.Zhang, Y.Yang, Y.D.Dong, C.T.Liu, J.Lu, Unusual fast secondary relaxation in metallic glass, **Nature Communications**, 24 Jul 2015, DOI: 10.1038/ncomms8876

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Hongyun Niu, associate professor of Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, received her Ph.D. in 2008 at Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, and joined the faculty of this institute after graduation. The main research areas include preparation of magnetic nanocomposites, porous nanomaterials, and their application in environmental and analytical chemistry. As the first or corresponding author, 20 scientific papers have been published in SCI journals such as Analytical Chemistry, Chemical Communications, and Journal of Material Chemistry.

Five selected publications:

[1] Hongyun Niu, Saihua Wang, Yixin Tan, Yaqi Cai, *Chem. Commun.* **51**, 17140 (2015).
[2] Hongyun Niu, Saihua Wang, Zhen Zhou, Yurong Ma, Xunfeng Ma, Yaqi Cai, *Anal. Chem.* **86**, 4170 (2014).
[3] Hongyun Niu, Saihua Wang, Tao Zeng, Yixuan Wang, Xiaole Zhang, Zhaofu Meng, Yaqi Cai, *J. Mater. Chem.* **22**, 15644 (2012).
[4] Hongyun Niu, Yixuan Wang, Xiaole Zhang, Zhaofu Meng, Yaqi Cai, *ACS Appl. Mater. Interfaces*, *4*, 286 (2010).
[5] Yixuan Wang, Saihua Wang, Hongyun Niu*, Yurong Ma, Tao Zeng, Yaqi Cai, Zhaofu Meng, *J. Chromatogr. A* 1283, 20 (2013).

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Dr. Gerko Oskam obtained his doctorate degree in chemistry from the Universiteit Utrecht (The Netherlands) in 1993 under supervision of Dr. John J. Kelly and Dr. Daniel Vanmaekelbergh. From 1993 to 2001, he worked in the Department of Materials Science and Engineering at the Johns Hopkins University (Baltimore, MD, USA), first as a post-doc then as an associate research scientist, under the supervision of Dr. Peter C. Searson. Since 2001, Dr. Oskam is a Professor in the Department of Applied Physics at CINVESTAV-IPN. Current research interests are focused on three main topics, all related to the conversion of solar energy: (i) Dye-sensitized solar cells: synthesis and characterization of functional metal oxide nanomaterials, novel dyes and redox couples; electron transport and recombination mechanisms; hybrid perovskite solar cells. (ii) Photoelectrochemical hydrogen generation: novel materials; small perturbation electrochemical methods. (iii) Solar-to-thermal energy conversion: selective coatings by sputtering and electrochemical deposition.

He has served as an Associate Editor of the journals Science of Advanced Materials (2008-2012) and Journal of the Mexican Chemical Society (2014 - present), and was the Academic Coordinator of the Department of Applied Physics from 2009-2015. He is a recipient of the Elsevier Scopus Award Mexico 2011. Dr. Oskam has graduated >20 PhD and MSc students and has published >80 articles, which have received >3,500 citations, with an h-index of 32. He has published several book chapters and holds two US patents.

Five selected publications:

[1] Influence of a metallic nickel interlayer on the performance of solar absorber coatings based on black nickel electrodeposited onto copper. M.A. Estrella-Gutiérrez, F.I. Lizama-Tzec, O. Arés-Muzio and G. Oskam, *Electrochim. Acta* **213**, 460-468 (2016).
[2] The effect of recombination under short-circuit conditions on the determination of charge transport properties in nanostructured photoelectrodes. J. Villanueva-Cab, J. A. Anta, and G. Oskam. *Phys. Chem. Chem. Phys.* **18**, 2303-2308 (2016).
[3] Photoelectrochemical water oxidation at electrophoretically deposited WO_3 films as a function of crystal structure and morphology. M. Rodríguez-Pérez, C. Chacón, E. Palacios-González, G. Rodríguez-Gattorno and G. Oskam, *Electrochim. Acta* **140**, 320-331 (2014).
[4] Charge separation at disordered semiconductor heterojunctions from random walk numerical simulations. H.J. Mandujano-Ramírez, J.P. González-Vázquez, G. Oskam, T. Dittrich, G. Garcia-Belmonte, I. Mora- Seró, J. Bisquert and J.A. Anta. *Phys. Chem. Chem. Phys.* **16**, 4082-4091 (2014).
[5] Phase-pure TiO_2 nanoparticles: anatase, brookite and rutile. D. Reyes-Coronado, G. Rodríguez-Gattorno, M.E. Espinosa-Pesqueira, C. Cab, R. de Coss, and G. Oskam, *Nanotechnology* **19**, 145605 (10 pp) (2008).

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Five selected publications:

[1] Abhijit Pramanick,* Alexandru D. Stoica, Ke An, *High-resolution 2-D Bragg scattering reveal heterogeneous domain transformation behavior in a bulk relaxor ferroelectric*, *Appl. Phys. Lett.* **109**, 092907 (2016)
[2] Abhijit Pramanick,* Mads R. V. Jørgensen, Soulemane O. Diallo, Andrew D. Christianson, Christina Hoffmann, Xiaoping Wang, Jaime A. Fernandez-Baca, Si Lan, Xun-Li Wang, *Nanoscale atomic displacements ordering for enhanced piezoelectric properties in lead-free ABO_3 ferroelectrics*, *Adv. Mater.* **27**, 4330-4335, (2015) Frontispiece Article
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[4] Abhijit Pramanick,* Anderson D. Prewitt, Jennifer Forrester and Jacob L. Jones, *Domains, domain walls and defects in perovskite ferroelectric oxides: a review of present understanding and recent contributions*, *Crit. Rev. Sol. State Mater. Sci.* **37**, 243-275 (2012) Invited Review Article
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NANOMXCN
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Five selected publications:

[1] Qu, G. B.; Bai, Y. H.; Zhang, Y.; Jia, Q.; Zhang, W. D.; Yan, B., The effect of multiwalled carbon nanotube agglomeration on their accumulation in and damage to organs in mice. *Carbon* **2009,** *47*, (8), 2060-2069.

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Dr. Ren obtained his Bachelor's and Doctor's degree both from Tsinghua University, with a major in Chemistry. Supervised by Prof. Guoan Luo, Dr. Ren's Ph.D work focused on micro-total analytical systems. After graduation in 2008, he worked as a postdoc in Prof. Hongkai Wu's group at HKUST, Department of Chemistry, with research focused on microfabrication, biomaterials, and microfluidics, and point of care analysis. From 2011 to 2014, he conducted research as a postdoc fellow in Prof. Richard N. Zare's group at Stanford University, Department of Chemistry. During that period, he continued research on biomaterials, microfluidics, and further extended his research on point-of-care analysis, with a focus on diagnosis and food safety test. In late 2014, he joined HKBU as assistant professor in the department of Chemistry. His current research interests center on functional materials and advanced analytical chemistry technologies, with particular emphasis on materials engineering and analytical technologies based on microfluidics.

Five selected publications:

[1] Chong Hu, Sheng Lin, Wanbo Li, Han Sun, Yangfan Chen, Chiu-Wing Chan, Chung-Hang Leung, Ma Dik-Lung*, Hongkai Wu* and Kangning Ren*, A One-Step Strategy for Ultra-Fast and Low Cost Mass Production of Plastic Membrane Microfluidic Chips, *Lab Chip*, 2016, 16, 3909-3918.

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Rodil`s research interests are focused on the synthesis and application of coatings or thin films deposited by plasma-assisted methods. As a Materials scientist, she found exciting the opportunities offered by the non-thermodynamic conditions of the plasma to synthesize materials presenting amorphous or crystalline phases that are not attainable under thermodynamic conditions. Rodil's group (PLASNAMAT) is mainly conformed by postgraduate students, which keep alive the different research lines. She has graduated 8 PhD and about 16 master's students and published more than 100 articles, 17 papers in proceedings and eight book chapters..

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Five selected publications:

1. Sitaramanjaneya Mouli Thalluri, Roberto Jose Mirabal, Osmary Lissette Depablos, Simelys Hernandez, Nunzio Russo, Sandra E Rodil, Chemical induced porosity on $BiVO_4$ films produced by double magnetron sputtering to enhance the photo-electrochemical response. Physical Chemistry Chemical Physics 17(27) 17821-17827

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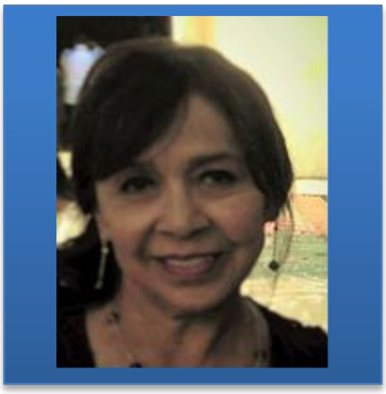

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Environmental Biotechnology and Biengineering, Nanotechnology aplications for waste water treatment, we have developed a nano-TiO_2 Photoreactor for wastewater pretreated by biological processes. We are working in the treatment for drinking water contaminated with arsenic, chromium and cadmium metals using nano-TiO_2.

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Andrey L. Rogach is a Chair Professor of Photonics Materials at the Department of Physics and Materials Science, and the Founding Director of the Centre for Functional Photonics at City University of Hong Kong. He received his Ph.D. in chemistry (1995) from the Belarusian State University in Minsk, and worked as a staff scientist at the University of Hamburg (Germany) from 1995 to 2002. From 2002–2009 he was a lead staff scientist at the Ludwig-Maximilians-Universität in Munich (Germany), where he completed his habilitation in experimental physics. His research focuses on synthesis, assembly and optical spectroscopy of colloidal semiconductor and metal nanocrystals and their hybrid structures, and their use for energy transfer, light harvesting and light emission. He has published over 270 papers and book contributions in these areas, which have been cited more than 22,000 times so far (*h-index 79*). His name is on the list of Top 100 Materials Scientists and on the list of Top 20 Authors publishing on nanocrystals in the past decade by Thomson Reuters, ISI Essential Science Indicators. Andrey Rogach is an Associate Editor of ACS Nano, holds honorary appointments at Trinity College Dublin (Ireland), Xi'An Jiaotong University, Jilin University and Peking University (China), and has been a visiting professor at Nanyang Technological University of Singapore in 2013 and 2015.

Five selected publications:

[1] L. Jing, K. Ding, S. V. Kershaw, I. M. Kempson, A. L. Rogach, M.Y. Gao. *Magnetically Engineered Semiconductor Quantum Dots as Multimodal Imaging Probes. Adv. Mater.* **26**, 6367 (2014).

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[5] L. Su, X. Zhang, Y. Zhang, A. L. Rogach. *Recent Progress in Quantum Dot Based White Light-Emitting Devices. Top. Curr. Chem.* **374**, 42 (2016).

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Shaoxian Song was born in China in 1962, and has actually the nationality of Mexico. He obtained his Ph. D. degree in Mineral Engineering in 1991 from the Central-South University, China. Then, he worked as postdoctoral fellow in the China University of Mining and Technology during 1991 and 1993, and in the University of Toronto in 1994. In 1996, he joined in the Universidad Autónoma de San Luis Potosí, México, first visiting professor, and then tenured professor. In 2013, he returned his motherland. Currently, he works as chief professor and dean in the School of Resource and Environmental Engineering, Wuhan University of Technology, China.
Dr Song's research interests are mineral processing and nano-scale mineral materials as adsorbents for wastewater treatments. He has published over 300 papers in international and national journals and conference proceedings, of which 151 papers are indexed by the Web of Science. He is also the author or coauthors of 3 books and 10 chapters in books. He is the member of the Academia Mexicana de Ciencia, and the member of the Sistema Nacional de Investigadores level 3 in Mexico.

Five selected publications:

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Charles Surya received his PhD in Electrical Engineering from the University of Rochester. His research interest focuses on optoelectronic materials and devices including: low-frequency excess noise in semiconducting materials and devices; growth, fabrication and characterization of III-nitride based materials and optoelectronic devices; reliability studies of semiconductor devices; and perovskite based photovoltaic materials and devices. He had held academic positions in both the US and Hong Kong. He joined the Electronic and Information Engineering Department of The Hong Kong Polytechnic University in 1994. From 2007 to 2010 he served as the Associate Dean of the Faculty of Engineering. From 2010 to 2012 he served as the Acting Dean of the Faculty of Engineering. Since 2013 he was appointed Clarea Au Endowed Professor in Energy at the Department of Electronic and Information Engineering. Dr. Surya served as the Chairman of the IEEE Electron Devices Society, Hong Kong Chapter, in 1997 and 2013. He is currently serving as the Chair of the Optoelectronic Devices Technical Committee of IEEE Electron Devices Society and an Editor of the Journal Electron Devices Society.

Five selected publications:

[1] A. Ng, Z. Ren, Q. Shen, S. H. Cheung, H. C. Gokkaya, S. K. So, A. B. Djurišić, Y. Wan, X. J. Wu and C. Surya, ACS Appl. Mat. Interfaces, DOI:10.1021/acsami.6b07513.

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Alberto Tépox Moreno is a lawyer and consultant specialized in international energy, environmental protection and new technologies law. Currently he collaborates with Strasbourg University (UNISTRA) on the creation of an interdisciplinary business chair for the study of the role of citizens in the deployment of smart initiatives. He is a doctoral candidate by the Bordeaux University. He is a member of the European and International Documentation Research Centre. His doctoral research focuses on **the legal analysis of the regulation for the implementation of nanotechnology, biotechnology, cognitive science and information technology in the energy sector**, with a fellowship of the Sectorial Fund of the National Council for Science and Technology and the Energy Minister of Mexico.

In addition to numerous courses on new technologies, intellectual property, international negotiations, his training and pre-doctoral formation include a Master in Management and Regulation of Energy and Sustainable Development (UNISTRA), an Interdisciplinary Master in Environment: Human and Socioeconomic Dimensions, and a Master of Environmental Law, both from the Complutense University of Madrid (UCM), under the auspices of the Spanish Agency for International Cooperation and Development (AECID). He graduated in law from the Autonomous University of Puebla (BUAP). It has an excellent command of English and French.

At the professional level, Alberto has served as attorney and later as director of the legal department of a company dedicated to environmental management in Mexico, achieving the restructuring of the company in order to compete in public and private tenders, obtaining large results and major contracts in the central region of Mexico. He participated in the establishment of the Forum of Young Researchers in Law, sponsored by the Institute of Parliamentary Law at UCM and the Spanish Parliament and he is a member of the Mexicans Abroad Global Network.

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Dr Stephen Sai-Wing Tsang is an assistant professor in the department of Physics and Materials Science at the City University of Hong Kong. Dr Tsang received his PhD in 2009 in the Materials Science and Engineering Department at the University of Toronto, Canada. His PhD was focused on developing experimental approaches and models to investigate the charge carrier transport across organic heterojunction, under the supervision of Prof. Zheng-Hong Lu. After his PhD, he joined the National Research Council (NRC) Canada as an Assistant Research Officer to develop solution processed quantum dots for photovoltaic applications. At 2011, he joined Prof. Franky So's group at the University of Florida as a Postdoc Fellow to develop high efficiency polymer solar cells and investigate the corresponding device physics. Before joining CityU, he joined the Nano and Advanced Materials Institute (NAMI) in Hong Kong as an Assistant Technical Manager in the Energy division to develop CIGS and a-Si photovoltaic cells.

Dr Tsang has published over 60 peer-review papers in prestigious journals including Nature Photonics, Adv. Mater., Adv. Energy Mater., Adv. Funct. Mater., Phys. Rev. B, and Appl. Phys. Lett. etc.

Five selected publications:

[1] H.-W. Li, Z. Guan, Y. Cheng, T. Lui, Q. Yang, C.-S. Lee, S. Chen, S.-W. Tsang*, "On the Study of Exciton Binding Energy with Direct Charge Generation in Photovoltaic Polymers" Advanced Electronic Materials, 2016, DOI: 10.1002/aelm.201600200 (2016)

[2] Q. Yang, Y. Cheng, H.-W. Li, J. Liu, S.-H. Cheung, S.-K. So, K.-W. Wong, W.-M. Lau, S.-W. Tsang*, "Locking the morphology with a green, fast and efficient physical cross-linking approach for organic electronic applications" Organic Electronics 28, 53 (2016)

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He has produced over 390 publications, incl.11 books, 10 edited proceedings volumes, 55 reviews and book chapters, 35 letters, 246 regular articles, and 29 proceedings articles. He has about 14,000 citations, and an h-index of 71 (SCI) or 80 (Google). He has organized or co-organized many international meetings and has been on the Editorial Board of 10 international journals.

Five selected publications:

[1] X.Q. Shi, M.A. Van Hove and R.Q. Zhang, Adsorbate-Induced Reconstruction by C_{60} on Close-Packed Metal Surfaces: Mechanism for Different Types of Reconstruction, *Phys. Rev. B* **85**, 075421 (2012).
[2] Y. Li, R.Q. Zhang, X.Q. Shi, Z.J. Lin and M.A. Van Hove, A Random Rotor Molecule: Vibrational Analysis and Molecular Dynamics Simulations, *J. Chem. Phys.* **137**, 234302 (2012).
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Born in 1968, he obtained his high school diploma in Mathematics and Life Sciences in 1986 in the Academy of Grenoble. He then moved to Paris and studied at the Université Pierre et Marie Curie where he received a BSc. and a MSc in Chemical Physics and a postgraduate diploma in Inorganic Chemistry in 1989, 1990, and 1991 respectively as well as a PhD in Chemistry in 1995 for his research work on *the Interfacial & thermodynamic growth control of metal oxide nanoparticles in aqueous solutions*. Thereafter, he joined Uppsala University, Sweden as a postdoctoral researcher for the Swedish Materials Consortium on Clusters and Ultrafine Particles to extend his concepts and develop *purpose-built metal oxide nanomaterials* as well as to characterize their electronic structure by x-ray spectroscopies at synchrotron radiation facilities. He has been carried out his research work as a visiting scientist at: the University of Texas at Austin; the UNESCO Centre for Macromolecules & Materials, Stellenbosch University, and iThemba LABS, South Africa; the Glenn T. Seaborg Center, Chemical Sciences Division, at Lawrence Berkeley National Laboratory; Texas Materials Institute; The Ecole Polytechnique Fédérale de Lausanne, Switzerland; the University of Queensland, Australia, and Nanyang Technological University, Singapore. He was an independent scientist at the National Institute for Materials Science, Tsukuba, Japan for 8 years. He has (co-)authored 115 publications (75 SCI) in major international journals and book series which have already generated over 9800+ citations since the year 2000 (5280+ since 2011, Google Scholar); Top 1% scientist in Materials Science. All time 8 ISI highly cited papers (5 as first author). He has been interviewed by In-Cites and ScienceWatch (Thomson Reuters) in 2006 for a single author original research paper cited now over 2580+ times and again in 2010 for another highly cited paper in Chemistry. He has given 360 lectures: 177 talks at international conferences (48 plenary, 106 invited, 21 contributed, 2 tutorials) and 183 seminars at universities, governmental and industrial research institutes in 30 countries and acted as an organizer, chairman, executive program committee and advisory member for major international conferences (MRS, ACS, SPIE, IUPAC, ACerS, IEEE). He is currently a full time 1000-talent scholar Professor at Xi'an Jiaotong University, P.R. China, co-founder and co-director of the *International Research Center for Renewable Energy* (291 articles/5450 citations since 2011, 13 ESI Highly Cited Papers) funded by NSF China. He is also, since 2003, the founding editor-in-chief of *Int. J. Nanotechnol.*, a referee for 80 SCI journals as well as major funding agencies in Americas, Europe, Asia, and Africa and a guest scientist at Lawrence Berkeley National Laboratory, Chemical Sciences Division, USA.

Five selected publications:

[1]**L.Vayssieres**, "**Growth of arrayed nanorods and nanowires of ZnO from aqueous solutions**", *Adv. Mater.* **15**, 464 (2003)

[2]Yasuhiro Tachibana*****, **Lionel Vayssieres***, James R. Durrant, "**Artificial photosynthesis for solar water splitting**", *Nature Photonics* **6**, 511 (2012)

[3]**L.Vayssieres***, C. Sathe, S. M. Butorin, D. K. Shuh, J. Nordgren, J.-H. Guo*, "**One-dimensional quantum-confinement effect in α-Fe_2O_3 ultrafine nanorod arrays**", *Adv. Mater. 17*, 2320 (2005)

[4]**L.Vayssieres*** and M. Graetzel, "**Highly ordered SnO_2 nanorod-arrays from controlled aqueous growth**", *Angew. Chem. Int. Ed. 43,* 3666 (2004)

[5]**L.Vayssieres***, C. Persson, J.-H Guo, **"Size effect on the conduction band orbital character of Anatase TiO_2 nanocrystals**", *Appl. Phys. Lett. 99(18)*, 183101 (2011)

Bing Yan

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Bing Yan got his Ph.D. from Columbia University in 1990 and did postdoctoral research at University of Cambridge and University of Texas Medical School in Houston from 1990 to 1993. He carried out drug discovery research from 1999 to 2005 and then entered academia. He served as an editorial board member and then Associate Editor for “Journal of Combinatorial Chemistry (now ACS Combinatorial Sciences)” published by ACS from 1999 to 2011. He is now Associate Editor for Elsevier’s new journal “NanoImpact”. He has published 10 books and more than 210 peer-reviewed papers.

Five selected publications:

[1] Mu, Q.X., Du, G.Q., Chen, T.S., Zhang, B., Yan, B. Suppression of Human Bone Mophorgenetic Protein (BMP) Signaling by Carboxylated Single-Walled Carbon Nanotubes. ACS Nano 2009, 3, (5), 1139-1144.

[2] Mu, Q.X., Jiang, G.B., Chen, L., Zhou, H., Fourches, D., Tropsha, A., Yan, B. Chemical Basis of Interactions Between Engineered Nanoparticles and Biological Systems. Chemical Reviews.2014; 114(15):7740-7781.

[3] Zhang, Y., Bai, Y.H., Jia, J.B., Gao, N.N., Li, Y., Zhang, R.N., Jiang, G.B., Yan, B. Perturbation of Physiological Systems by Nanoparticles. Chem. Soc. Rev. 2014, 43, 3762-3809.

[4] Bai, Y.H., Zhang, Y., Zhang, J.P., Mu, Q.X., Zhang, W.D., Butch, E., Snyder, S., Yan, B. Repeated carbon nanotube administrations in male mice cause reversible testis damage without affecting fertility. Nature Nanotechnology, 2010, 5(9), 683-689.

[5] Zhou, H., Mu, Q., Gao, N., Liu, A., Xing, Y., Gao, S., Zhang, Q., Qu, G., Chen, Y., Liu, G., Zhang, B., Yan. B. A Nano-Combinatorial Library Strategy for the Discovery of Nanotubes with Reduced Protein-Binding, Cytotoxicity, and Immune Response, Nano Lett. 2008, 8 (3), 859-865.

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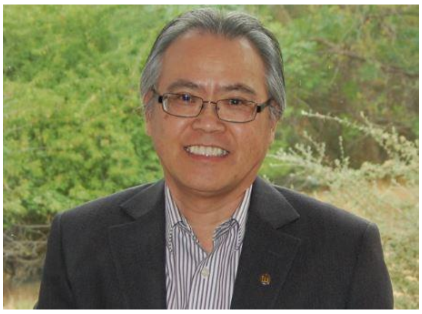
Professor Kin Man YU



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Kin Man Yu received his B.S. in Engineering Physics and Ph. D. in Materials Science and Mineral Engineering, both from the University of California, Berkeley.

From 1987-2014, Prof. Yu was Staff Scientist and Principal Investigator in the Materials Sciences Division at the Lawrence Berkeley National Laboratory (LBNL). He also served as the director of the Ion Beam Analysis Facility managing a state-of-the-art ion beam laboratory which was capable of preforming a wide spectrum of material analysis techniques. At LBNL Prof. Yu co-led the Solar Energy Materials Research Group and conducted fundamental research on defects in semiconductors and advanced photovoltaic materials. His current research interests include structural, optical and electronic properties of thin film semiconductors and transparent conductors; the design, synthesis and characterization of group III nitrides as well as novel highly mismatched III-V and II-V semiconductor alloys for full spectrum photovoltaic and photoelectrochemical water splitting applications.

Prof. Yu has published over 400 journal articles with about 11000 citations and has an h-index of 48 (Web of Science). He has also coauthored 14 book chapters and invited reviews. In 2006, he received a R&D 100 award (Editor's choice for most promising technology) for his work on multiband semiconductors for high efficiency solar cells. He also co-authored several patents related to advanced PV technology. In October 2014, Prof. Yu joined the City University of Hong Kong as a professor in the Department of Physics and Materials Science.

Five selected publications:

[1] **K. M. Yu**, W. L. Sarney, S. V. Novikov, Natalie Segercrantz, Min Ting, M. Shaw, S.P. Svensson, R. W. Martin, W.Walukiewicz, and C. T. Foxon, "Highly Mismatched $GaN_{1-x}Sb_x$ Alloys: Synthesis, Structure and Electronic Properties," invited topical review, Semicond. Sci. Technol. **31**, 083001 (2016).

[2] **Kin Man Yu**, Marie A. Mayer, Derrick T. Speaks, Hongcai He, Ruying Zhao, L. Hsu, Samuel S. Mao, E. E. Haller, and Wladek Walukiewicz, "Ideal Transparent Conductors for Full Spectrum Photovoltaics," J. Appl. Phys. **111**, 123505 (2012).

[3] Nair. López, Lothar A. Reichertz, **K. M. Yu**, Kenneth Campman, and Wladek. Walukiewicz, "Engineering the Electronic Band Structure for Multiband Solar Cells," Phys. Rev. Lett. **106**, 028701 (2011).

[4] **K. M. Yu**, W. Walukiewicz, J. Wu, W. Shan, and J. W. Beeman, M. A. Scarpulla, O. D. Dubon, and P. Becla, "Diluted II-VI Oxide Semiconductors with Multiple Band Gaps," Phys. Rev. Lett. **91**, 246203 (2003).

[5] **K. M. Yu**, W. Walukiewicz, J. Wu, D. Mars, D. R Chamberlin M. A. Scarpulla, O. D. Dubon, and J. F. Geisz, , "Mutual Passivation of Electrically Active and Isovalent Impurities," Nature Materials **1**, 185 (2002).

K. C. Wong Education Foundation
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Rodolfo Zanella is a chemical engineer (1998) by UNAM, he earned a Master's degree in Chemical Engineering (2000) by UNAM and a Ph. D. degree in Process Engineering and Catalysis from the Université Pierre et Marie Curie-Paris VI, France in 2003. After a post-doctoral stay at the Center for Applied Sciences and Technological Development (CCADET), in 2004 he was hired first as research assistant (2006) and then as senior researcher (2009); he was Academic Deputy and currently he is Director of the Center. He is member of the National Research System of Mexico (SNI II). His scientific interests lie in the deposition of monometallic and bimetallic nanoparticles on reducible and non reducible powder oxides; the synthesis of pure and doped metal oxides; the catalysis focused on exhaust gas reactions (CO oxidation, NO reduction, total oxidation), the production and purification of H_2 (water-gas shift reaction), preferential CO oxidation; the photocatalytic degradation of organic compounds and the photocatalytic production of hydrogen. He has published about 80 research papers that have been cited about 3000 times (H index 23), 5 book chapters and has been in charge of 18 founded projects. He has been recognized twice by Elsevier for being the first author of one of the most cited articles in Chemical Engineering Journals, and by UNAM with the National University Award of Distinction for Young Scientist, UNAM, and for being one of the most cited researchers (at UNAM) in the field of chemistry.

Five selected publications

[1] A. Aguilar-Tapia, R. Zanella, C. Calers, C. Louis, L. Delannoy, Synergetic effect in Ir-Au/TiO_2 catalysts in the total oxidation of propene: Influence of the activation conditions, Phys. Chem. Chem. Phys., 17 (2015), 28022-28032

[2] Ch. W. Han, E. Marinero, A. Aguilar-Tapia, R. Zanella, J. Greeley, V. Ortalan, Highly stable bimetallic AuIr/TiO_2 catalyst: physical origins of the intrinsic high stability against sintering Nano Letters 15 (2015) 8141−8147

[3] A. Sandoval, C. Louis, R. Zanella, Improved Activity and Stability in CO Oxidation of Bimetallic Au-Cu/TiO_2 Catalysts Prepared by Deposition-Precipitation with Urea Applied Catalysis B: Environmental, 140-141 (2013) 363-377

[4] A. Sandoval, A. Aguilar, C. Louis, A. Traverse, R. Zanella. Bimetallic Au-Ag/TiO_2 Catalyst Prepared by Deposition-Precipitation. High Activity and Stability in CO Oxidation. Journal of Catalysis (2011)

[5] R. Zanella, S. Giorgio, C. Henry, C. Louis, Alternative methods for the preparation of gold nanoparticles supported on TiO_2 , Journal of Physical Chemistry B, 106, (2002) 7634-7642.

Prof. Bin Zhao

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Prof. Bin Zhao received his Ph.D degree from Biology Department, Hong Kong University of Science and Technology in 2002. He got his postdoctoral training in molecular/environment toxicology from University of California, Davis from 2003-2008. His current research interests include molecular toxicology; environment and health; molecular mechanisms of action of dioxins and related persistent organic pollutants (POPs); development and application of bioanalytical methods for detection and analysis of environmental contaminants. He is currently serving as the Regional Editor & Editorial Board member of Environmental Health Perspectives; Editorial Board Member of Toxicological Sciences, Environmental Chemistry (Chinese). Academic Awards: The National Science Fund for Distinguished Young Scholars, 2015; Outstanding Science and Technology Achievement Prize of Chinese Academy of Sciences, 2013, Young Scientist Award, ISPTS 2013; Outstanding Young Scientist Award, Chinese Society of Toxicology, 2011.

Five selected publications:

[1] Yu Feng, Jijing Tian, Heidi Qunhui Xie, Jianwen She, Sherry Li Xu, Tuan Xu, Wenjing Tian, Hualing Fu, Shuaizhang Li, Wuqun Tao, Lingyun Wang, Yangsheng Chen, Songyan Zhang, Wanglong Zhang, Tai L. Guo, Bin Zhao. *Environmental Health Perspectives*, DOI:10.1289/ehp.1510314 (**2016**)

[2] Jijing Tian, Yu Feng, Hualing Fu, Heidi Qunhui Xie, Joy Xiaosong Jiang, Bin Zhao. *Environmental Science and Technology*. 49: 9518-9531(**2015**)

[3] Chengfang Pang, Andrea Brunelli, Conghui Zhu, Danail Hristozov, Ying Liu, Elena Semenzin, Wenwen Wang, Wuqun Tao, Jingnan Liang, Antonio Marcomini, Chunying Chen, Bin Zhao. *Nanotoxicology*, DOI: 10.3109/17435390.2015.1024295 (**2015**)

[4] Bin Zhao. *Environmental Health Perspectives*. 121(9):A264-265 (**2013**)

[5] Heidi Xie, Haiming Xu, Hualing Fu, Qin Hu, Wenjing Tian, Xinhui Pei, Bin Zhao. *Environmental Health Perspectives*. 121: 613-618 (**2013**)

Mr, Xingchen Zhao

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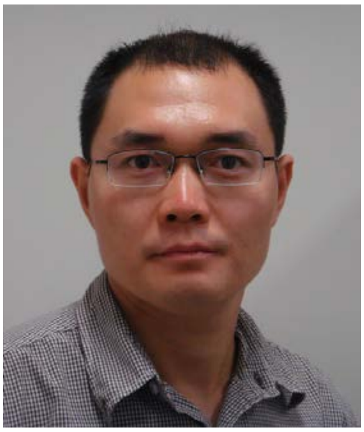
Mr Xingchen Zhao is now a PhD candidate at Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences. He received his B.S. degree in Material Chemistry in 2008 when he changed his major into Environmental Sciences. His current scientific interests fall into the field of (1) natural product extraction and identification, (2) environmental pollutant and biomacromolecule interactions and (3) trophic transfer of engineered nanomaterials and nanotoxicology.

Five selected publications:

[1] Zhao X, Hao F, Lu D, et al. *Influence of the surface functional group density on the carbon-nanotube-induced α-chymotrypsin structure and activity alterations. ACS Appl. Mater. Inter.*, **7**, 18880-18890 (2015).
[2] Zhao X, Lu D, Hao F, et al. *Exploring the diameter and surface dependent conformational changes in carbon nanotube-protein corona and the related cytotoxicity. J. Hazard. Mater.*, **292**, 98-107 (2015).
[3] Zhao X, Liu R, Chi Z, et al. *New insights into the behavior of bovine serum albumin adsorbed onto carbon nanotubes: comprehensive spectroscopic studies. J. Phys. Chem. B*, **114**, 5625-5631 (2010).
[4] Zhao X, Liu R. *Recent progress and perspectives on the toxicity of carbon nanotubes at organism, organ, cell, and biomacromolecule levels. Environ. Int.*, **40**, 244-2552 (2012).
[5] Zhao X, Sheng F, Zheng J, et al. *Composition and stability of anthocyanins from purple solanum tuberosum and their protective influence on Cr (VI) targeted to bovine serum albumin. J. Agricul. Food Chem.*, **59**, 7902-7909 (2011).



Dr. ZHI Chunyi
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Dr. Chunyi Zhi got his PhD degree in physics from institute of physics, Chinese Academy of sciences. After that, he started to work as a postdoctoral researcher in National Institute for Materials Science (NIMS) in Japan, followed by a research fellow in International Center for Young Scientists in NIMS and a permanent position in NIMS as a senior researcher. He is currently an assistant professor in Department of Physics & Materials science, City University of Hong Kong. Zhi's research field is mainly about synthesis and functionalization of boron nitride nanotubes/nanosheets, polymer composites, as well as flexible/wearable energy storage devices and sensors etc. He has published more than 160 papers with a citation of >7500 and h-index of 48.

Five selected publications:

[1] Huang, Y.; Zhu, M.; Huang, Y.; Pei, Z.; Li, H.; Wang, Z.; Xue, Q.; Zhi, C*., Smart Energy Storage Devices. *Advanced Materials. DOI: 10.1002/adma.201601928* (2016)

[2] Zhu, M.; Huang, Y.; Deng, Q.; Zhou, J.; Pei, Z.; Xue, Q.; Huang, Y.; Wang, Z.; L, H.; Huang, Q.; Zhi, C*. Highly flexible, freestanding supercapacitor electrode with enhanced performance obtained by hybridizing polypyrrole chains with MXene. *Advanced Energy Materials, Accepted.* (2016)

[3] Zhu, M.; Huang, Y.; Ng, W.; Liu, J.; Wang, Z.; Wang, Z.; Hu, H*.; Zhi, C*. 3D Spacer Fabric Based Multifunctional Triboelectric Nanogenerator with Great Feasibility for Mechanized Large-scale Production. *Nano Energy 2016, Accepted.* (2016)

[4] Zhu, M.; Huang, Y.; Huang, Y.; Pei, Z.; Xue, Q.; Li, H.; Geng, H.; Zhi, C*. Capacitance Enhancement in a Semiconductor Nanostructure-Based Supercapacitor by Solar Light and a Self-Powered Supercapacitor–Photodetector System. *Advanced Functional Materials. DOI: 10.1002/adfm.201601260* (2016)

[5] Huang, Y.; Zhong, M.; Huang, Y.; Zhu, M.; Pei, Z.; Wang, Z.; Xue, Q.; Xie, X*.; Zhi, C*. A self-healable and highly stretchable supercapacitor based on a dual crosslinked polyelectrolyte. *Nature Communications* **6**, 10310 (2015)

Professor Linjie Zhi

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Dr Zhi received his PhD in 2000 at the Institute of Coal Chemistry, Chinese Academy of Sciences. He than worked in the Institute of Chemistry, Chinese Academy of Sciences, for two years as a postdoc. Since january 2003 he had worked with Prof. Klaus Müllen at the Max-Planck Institute for Polymer Research for two years before assuming the position of project leader until the end of 2007. After that, he was appointed a full professor in the National Center for Nanoscience and Technology, and moved back to China in early 2008. His research interests focus on graphene-based carbon-rich nanomaterials and their application in energy-related areas. He has published over 150 papers in high quality journals, and attracted a total citation of over 10000 times, with a H-index of 48.

Five selected publications:

[1] Long Hao, Shuangshuang Zhang, Rongji Liu, Jing Ning, Guangjin Zhang,* Linjie Zhi,* ***Adv. Mater.*, 2015**, 27(20), 3190-3195.
[2] Bin Wang, Xianglong Li,* Bin Luo, Long Hao, Min Zhou, Xinghao Zhang, Zhuangjun Fan, Linjie Zhi,* ***Adv. Mater.*, 2015**, 27(9), 1526.
[3] Long Hao, Jing Ning, Bin Luo, Bin Wang, Yunbo Zhang, Zhihong Tang, Junhe Yang, Arne Thomas, Linjie Zhi,* ***J. Am. Chem. Soc.*, 2015**, 137(1), 219-225.
[4] Bin Wang, Xianglong Li*, Xianfeng Zhang, Bin Luo, Yunbo Zhang, **Linjie Zhi***, ***Nano Lett.* 2013**, 13, 5578-5584.
[5] Bin Wang, Xianglong Li*, Xianfeng Zhang, Bin Luo, Yunbo Zhang, **Linjie Zhi***, ***Adv. Mater.*, 2013**, 25, 3560-3565.

Professor, Erjun Zhou

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Research Experience

2007.9-2011.5 **Researcher**, *Japan Science and Technology Agency (JST),*

2011.5-2013.3 **Postdoctoral fellow**, *University of Tokyo, Japan*

2013.4-2014.2 **Research Scientist**, *RIKEN Advanced Science Institute, Japan*

2014.3-present **Professor**, *National Center for Nanoscience and Technology, China*

Education

1997.9-2001.7 **B.S.** in Applied Chemistry

Dept. of Chemistry, University of Science and Technology Beijing **(USTB)**

2002.9-2007.7 **Ph.D.** in Physical Chemistry

Institute of Chemistry, Chinese Academy of Sciences **(ICCAS)** (Supervisor: Prof. Yongfang Li)

Research Interest and Achievement.

Design and synthesis of novel conjugated polymers or small molecules for optoelectronic devices, such as organic photovoltaics (OPVs), organic light-emitting diodes (OLEDs), and organic field-effect transistors (OFETs). Dithieno[3,2-b:2',3'-d]pyrrole (DTP) was introduced to the design of photovoltaic polymers for the first time. The highest Jsc of 22 mA/cm^2 was achieved and hundreds of donor-acceptor type polymers and small molecules were synthesized and used in OPVs.

Five selected publications:

1) Ailing Tang, Chuanlang Zhan*, Jiannian Yao, **Erjun Zhou***. *Adv. Mater.* **2016**, *accepted*

2) Yanfang Geng, Bo Xiao, Jianming Huang, Keisuke Tajima*, Qingdao Zeng and **Erjun Zhou***. *J. Mater. Chem. A* **2015**, *3*, 22325.

3) **Erjun Zhou**, Junzi Cong, Kazuhito Hashimoto*, Keisuke Tajima*.*Adv. Mater.* **2013**, *25*, 6991.

4) **Erjun Zhou**, Junzi Cong, Kazuhito Hashimoto*, Keisuke Tajima*.*Energy Environ. Sci.* **2012**, *5*, 9756.

5) **Erjun Zhou**, Junzi Cong, Qingshuo Wei, Keisuke Tajima*, Chunhe Yang, Kazuhito Hashimoto*. *Angew. Chem. Int. Ed.* **2011**, *50, 2799.*

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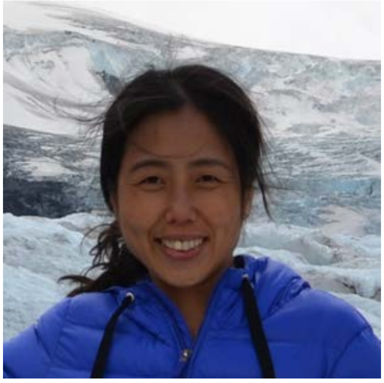

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Research Interest:

Toxicological effects of emerging chemicals (mainly includes endocrine disrupting effects of organohalogenated compounds, and nanotoxicology of metallic nanomaterials).

Education:

September, 1997-July, 2002: Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Ph.D, Environmental Science;
September, 1992-July, 1997: Peking University Health Science Center, B.Sc., Pharmacy.

Research Experiences:

January, 2016-Present: State Key Laboratory of Environmental Chemistry and Ecotoxicology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Professor;
January, 2005-December, 2015: State Key Laboratory of Environmental Chemistry and Ecotoxicology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Associate Professor;
August, 2010-June, 2013: Joslin Diabetes Center, Harvard Medical School, Visiting scholar;
November, 2009-July, 2010: St. Jude Children's Research Hospital; Visiting scholar
January, 2003-March, 2003: Metocean Environment Inc, Visiting scholar;
July, 2002-December, 2004: State Key Laboratory of Environmental Chemistry and Ecotoxicology, Assistant Professor.

Awards:

Chinese Society of Toxicology, Young Innovator Award, August, 2014; Chinese Medical Association, Chinese Medical Science Prize, Dec 2012; Chinese Medical Association, Chinese Medical Science Prize, Dec 2009; Chinese Institute of Food Science and Technology, The Award of Science and Technology Advancement, Oct 2008; China Association for Instrumental Analysis, Science and Technology Award, Sep 2005; State Environmental Protection Administration, Science and Technology Award, Oct 2004; China Association for Instrumental Analysis, Science and Technology Award, Sep 2001.

Five selected publications:

[1] Yanmin Long, Xingchen Zhao, Allen C. Clermont, Qunfang Zhou*, Qian Liu, Edward P. Feener, Bing Yan, Guibin Jiang*, *Nanotoxicology*, **10**, 501 (2016)
[2]Xingchen Zhao, Fang Hao, Dawei Lu, Wei Liu, Qunfang Zhou*, Guibin Jiang, *ACS Applied Materials & Interfaces*, **7**, 18880 (2015).
[3] Nuoya Yin, Qian Liu, Jiyan Liu, Bin He, Lin Cui, Zhuona Li, Zhaojun Yun, Guangbo Qu, Sijin Liu, Qunfang Zhou*, Guibin Jiang, *Small*, **9**, 1831 (2013).
[4] Qunfang Zhou, Sergey A. Dergunov, Yi Zhang, Xi Li, Qingxin Mu, Qiu Zhang, Guibin Jiang, Eugene Pinkhassik, Bing Yan*, *Nanoscale*, **3**, 2576 (2011)
[5] Qunfang Zhou, Jianbin Zhang, Jianjie Fu, Jianbo Shi, Guibin Jiang*, *Analytica Chimica Acta*, **606**, 135 (2008).

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PROGRAMME
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4^{th} – 6^{th} December, 2016

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SUNDAY 4/12/2016			
NANOMXCN-2016			
9:00 AM	9:30 AM	INAUGURATION	
9:30 AM	10:00 AM	Keynote-1	Environmental Nanotechnology and impact study in China, *Guibin Jiang, Research Center for Eco-Environmental Sciences, CAS, Beijing, China.*
10:00 AM	10:30 AM	Keynote-2	Recent development of metallic nanomaterials for structural applications, *Jian Lu, City University of Hong Kong, China.*
10:30 AM	10:45 AM	Invited-1	Novel III-V and II-VI Semiconductors for Intermediate Band Solar Cells, *Kin Man Yu, City University of Hong Kong, China.*
10:45 AM	11:15 AM	Keynote-3	Nanomaterials for Solar Energy Conversion Systems, *Gerko Oskam, Dept. Applied Physics, CINVESTAV Merida, México.*
11:15 AM	11:45 AM	COFFEE	
11:45 AM	12:15 PM	Keynote-6	Low Cost HeteroNanostructures for Efficient Solar Water Splitting, *Lionel Vayssieres, Int. Res. Center for Renewable Energy, School of Energy & Power Engineering, Xi'an Jiaotong University, China.*
12:15 PM	12:30 PM	Invited-2	Photovoltage Loss in Excitonic Solar cells, Stephen *Sai-Wing Tsang, City University of Hong Kong, China.*
12:30 PM	12:45 PM	Invited-3	Controlling the Formation of Perovskite Films by Low-temperature Solution Schemes for High Performance Solar Cells, *Wallace C. H. Choy, Dept. of Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong, China.*
12:45 PM	1:15 PM	Keynote-5	Chirality at the Nanoscale: Geometric Quantification of Chirality in Bare and Ligand-Protected Metal Clusters, *Ignacio Garzon, Inst.de Fisica, Universidad Nacional Autonoma de Mexico, Mexico City, Mexico.*
1:15 PM	1:30 PM	Oral-1	Analysis of nanoparticles with ICP-MS, *Ligang Hu, Research Center for Eco-Environmental Sciences, CAS, Beijing, China.*
1:30 PM	3:00 PM	LUNCH	
3:00 PM	3:30 PM	Keynote-7	Oxide Materials for Energy Conversion and Storage, *Aleksandra B. Djurišić, Dept of Physics, The University of Hong Kong, Hong Kong, China.*
3:30 PM	3:45 PM	Invited-4	Design and synthesis of n-type photovoltaic polymers and small molecules, *Erjun Zhou, National Center for Nanoscience and Technology, Beijing, P. R. China.*
3:45 PM	4:00 PM	Invited-5	Well-defined Graphene-based Hybrids for Energy Storage Applications, *Linjie Zhi, National Center for Nanoscience and Technology, Beijing, P. R. China.*
4:00 PM	4:15 PM	Oral-3	Rethinking the Safety of Sulfidation: Case of CuO Nanoparticles, *Lingxiangyu Li, Research Center for Eco-Environmental Sciences, CAS, Beijing, China.*
4:15 PM	4:45 PM	COFFEE	
4:45 PM	5:00 PM	Invited-6	Revealing Nanostructure-Toxicity Relationship Using Nanoparticle Library Approach, *Bing Yan, Shandong University, Jinan, China.*
5:00 PM	5:15 PM	Oral-2	The toxicological effects of nanosilver and the influencing factors, *Qunfang Zhou, Research Center for Eco-Environmental Sciences, CAS, Beijing, China.*
5:15 PM	5:30 PM	Invited-8	Antibiotics and Antibiotic Resistance Genes (ARGs) in Water Environments of China, *Xiangdong LI, Dept. of Civil & Environmental Engineering, The Hong Kong Polytechnic University, Hong Kong, China.*
5:30 PM	5:45 PM	Invited-7	Adsorption of Biotin on Titanium Nitride Thinfilm for Label-Free Surface Plasmon Resonance Biosensing, *Chi-Man Lawrence Wu, Dept. of Physics and Materials Science, City University of Hong Kong, China*
5:45 PM	6:15 PM	Keynote-8	News about Technology Innovation & Incubation in China, *Leo W.M. Lau,Center for Green Innovation, University of Science & Technology Beijing, Beijing, China.*
WORKSHOP DINNER: HONG KONG STYLE SEAFORD DINNER. Bus leaves from University Circle, CityU. at 6:30			

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MONDAY 5/12/2016			
NANOMXCN-2016			
9:00 AM	9:30 AM	Keynote-9	Energy sources for molecular machines, *Michel Van Hove, Dept. of Physics and Institute of Computational and Theoretical Studies, Hong Kong Baptist University, Hong Kong, China.*
9:30 AM	10:00 AM	Keynote-10	Colloidal Nanostructures for Light Harvesting and Light Generation, *Andrey L. Rogach, Dept. of Physics and Materials Science & Centre for Functional Photonics, City University of Hong Kong, Hong Kong, China.*
10:00 AM	10:30 AM	Keynote-11	Investigation of High Efficiency Perovskite-based Solar Cells, *Charles Surya Clearea Au, Dept. of Electronic and Information Engineering, The Hong Kong Polytechnic University, Hong Kong, China.*
10:30 AM	11:00 AM	Keynote-12	Environmental Implications of Nanomaterials in the Environment. Effects of Nanoceria on Common bean: An Spectroscopic and Proteomic Analysis, *Jorge Gardea-Torresdey, Dept. of Chemistry, The University of Texas at El Paso, El Paso, TX, USA.*
11:00 AM	11:15 AM	Oral-4	Synthesis, Characterization, Photocatalytic and Toxicological Evaluation of M-TiO2 (M = Ag, Cu2+) materials, *Iliana Medina Ramírez, Depto. de Química, Universidad Autónoma de Aguascalientes, Aguascalientes, Mexico.*
11:15 AM	11:45 AM	COFFEE	
11:45 AM	12:15 PM	Keynote-13	Photocatalytic Properties of Bismuth-Based Coatings, *Sandra Rodil, Instituto de Investigaciones en Materiales, Universidad Nacional Autonoma de Mexico, CDMX, Mexico.*
12:15 PM	12:30 PM	Invited-8	Materials for drug delivery, *Hector A. Cabrera-Fuentes, Institute of Biochemistry, Medical School, Justus-Liebig University, Giessen, Germany*
12:30 PM	1:00 PM	Keynote-14	TBC, *King Lun Yeung, Dept, of Chemical Engineering Hong Kong University of Science and Technology, Hong Kong, China.*
1:00 PM	1:30 PM	Keynote-15	Commercial single-walled carbon nanotubes effects in fibrinolysis of human umbilical vein endothelial cells, *Arnulfo Albores Medina, Depto. de Biotecnología, CINVESTAV Zacatenco, CDMX, México.*

FREE TIME

RECEPTION & POSTER SESSION

The Consulate General of Mexico in Hong Kong and Macau.
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(Phone: +852 2511 3305)

Pick-up from Metropark Hotel at 5:30 pm.

MEXICAN DINNER

7:30 - 9.30 pm.

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TUESDAY 6/12/2016

NANOMXCN-2016

9:00 AM	9:30 AM	Keynote-16	Bimetallic Au-M/TiO2 catalysts for the oxidation of CO and propene, *Rodolfo Zanella Specia, CCADET, Universidad Nacional Autonoma de Mexico, CDMX, Mexico.*
9:30 AM	10:00 AM	Keynote-17	Single-Atom Catalysis (SAC): Bridging Heterogeneous and Homogenous Catalysis, *Jun Li, Dept. of Chemistry, Tsinghua University, Beijing, China.*
10:00 AM	10:15 AM	Oral-5	3D Integrated CMOS-Memristor Hybrid Circuits: Devices, Integration, Architecture, and Applications, *Miguel Angel Lastras-Montaño, Dept. of Electrical and Computer Engineering, University of California, Santa Barbara, CAL, USA.*
10:15 AM	10:30 AM	Invited-9	The Structure-Symmetry-Properties Relationship at Nanoscale: The Case of Electromagnetic Transduction, *Luis Fuentes-Cobas, Grupo de Cristalofísica, Centro de Investigación en Materiales Avanzados, S.C., Chihuahua, México.*
10:30 AM	10:45 AM	Invited-10	Nanoscale Atomic Ordering for Enhanced Electromechanical Properties in Lead-free Ferroelectrics, *Abhijit Pramanik, Dept. of Physics and Materials Science, City University of Hong Kong, Hong Kong, China.*
10:45 AM	11:15 AM	COFFEE	
11:15 AM	11:45 AM	Keynote-18	Two-dimension nanoscale minerals as adsorbent in water treatment, *Shaoxian Song, Hubei Key Lab. of Mineral Resources Processing and Environment, Wuhan University of Technology, Wuhan, Hubei, China.*
11:45 AM	12:00 PM	Invited-11	Robust Self-cleaning Coating Made of Surface-molded Teflon Thin Film, *Kangning Ren, Dept. of Chemistry, Hong Kong Baptist University, Hong Kong, China.*
12:00 PM	12:15 PM	Oral-6	Nanoparticles and nanocomposite thin films prepared using a toroidal planar hollow cathode, *S. Muhl, Instituto de Investigaciones en Materiales, Universidad Nacional Autonoma de Mexico, CDMX, Mexico.*
12:15 PM	12:30 PM	Oral-7	Aerosol Assisted Surface Enhanced Raman Spectroscopy for Characterizing Organic Thin Films, *Masao Gen, School of Energy and Environment, City University of Hong Kong, Hong Kong, China.*
12:30 PM	12:45 PM	Invited-12	Decontamination and desinfection of domestic wastewater by sequential biological-Nano-TiO2/O2/UV photocatalysis treatment, *Refugio Rodríguez Vázquez, Depto. de Biotecnología, CINVESTAV Zacatenco, CDMX, México.*
12:45 PM	1:00 PM	Oral-8	One-Step Synthesis of Hierarchical Metal-Gallic Acid Frameworks for Fast and Efficient Wastewater Treatment End Fragment, *Hongyun Niu, , Research Center for Eco-Environmental Sciences, CAS, Beijing, China.*
1:00 PM	2:30 PM	LUNCH	
2:30 PM	3:00 PM	Keynote-19	The Clean Energy Project: from Prediction to Synthesis, *Carlos Amador--Bedolla, Dept. of Physics and Theoretical Chemistry, School of Chemistry, National Autonomous University of Mexico, CDMX, Mexico.*
3:00 PM	3:30 PM	Keynote-20	Nanophotonics for biomedical and optoelectronics applications, *Elder de la Rosa Cruz, Centro de Investigaciones en Óptica, León, Gto. México.*
3:30 PM	3:45 PM	Oral-9	Quantitative optical characterization for nano-photonic and nano-plasmonic applications in sensing, energy conversion and light emission and extraction, *Juan Antonio Zapien, City University of Hong Kong, Hong Kong SAR, China.*
3:45 PM	4:00 PM	Invited-13	Flexible multifunctional supercapacitor devices, *Chunyi Zhi, Dept. of Physics and Materials Science, City University of Hong Kong, China.*
4:00 PM	4:30 PM	Keynote-21	Renewable Energy Storage: High-Performance Supercapacitors, *Ching Ping Wong, Dept. of Electronic Engineering, The Chinese University of Hong Kong, Hong Kong, China.*
4:30 PM	5:00 PM	FINAL REMARKS & CLOSURE	

NANOMXCN 4 - 6 December 2016 HONG KONG

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Mid-Infrared Field Effect Transistors using HgTe Quantum Dots

Mengyu Chen,[1] *Haipeng Lu,*[1] ***Nema Abdelazim,***[2] *Stephen V. Kershaw,*[2] *Andrey L. Rogach,*[2] and *Ni Zhao*[1]

[1]Department of Electronic Engineering, The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong

[2]Department of Physics and Materials Science and Centre for Functional Photonics (CFP), City University of Hong Kong, Hong Kong S.A.R.

Abstract

Colloidal quantum dots (QDs) offer advantages such as highly tunable optical and electronic properties, low-temperature solution processing, and compatibility with silicon integrated circuits and flexible substrates. One of the important applications of QD based devices are low-cost infrared photodetectors for wavelengths beyond 1.5 microns. Most current commercial MIR photodetectors are fabricated with high-cost epitaxially grown technologies and require low-temperature operation primarily in order to suppress signal noise and improve signal to noise performance. We have developed a new aprotic method to synthesize colloidal HgTe nanocrystals at room temperature which is scalable and which yields QDs with comparatively good QY and emission in the 2-3 μm range or even longer. The QDs were incorporated as solid films in bottom contact/bottom gate transistor structures on oxide coated silicon using a simple multi-pass spray-coating process and showed excellent stability in ambient conditions. With these devices we demonstrated the first room-temperature operated QD photodetector with > 10^{10} Jones detectivity in the MIR (>2 μm) range.

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Commercial single-walled carbon nanotubes effects in fibrinolysis of human umbilical vein endothelial cells.

Yury Rodríguez-Yáñez[1], Daniel Bahena-Uribe[2], Bibiana Chávez-Munguía[3], Rebeca López-Marure[4], Stuart González-Monroy[5] and Arnulfo Albores[1].

[1]Departamento de Toxicología, [2]Laboratorio Avanzado de Nanoscopía Electrónica (LANE), [3]Departamento de Infectómica y Patogénesis Molecular, Centro de Investigación y de Estudios Avanzados del IPN (Cinvestav), México. [4]Departamento de Biología Celular. Instituto Nacional de Cardiología "Ignacio Chávez", [5]Hospital General de Ticomán. Secretaría de Salud del Distrito Federal, México.

Recent studies have demonstrated that carbon nanotubes (CNTs) induce platelet aggregation, endothelial dysfunction and vascular thrombosis. However, there is little information on the effects of CNTs on fibrinolysis. We investigated the role of pristine-commercial single-walled carbon nanotubes (SWCNTs) with <3% Co content in fibrinolysis and their contribution to the induction of pro-thrombotic processes in human vein endothelial cells (HUVEC). SWCNTs alone produced concentration-dependent oxidation, as measured by a dithiothreitol oxidation assay. Internalized SWCNTs were located in HUVEC treated with 25 µg/ml using transmission electron microscopy, whereas treatment with 50 µg/ml compromised cell viability, and oxidative stress increased significantly at 5 µg/ml. The study showed that in HUVEC treated with 25 µg SWCNT/ml, fibrinolysis-related gene expression and protein levels had increased by 3–12 h after treatment (*Serpine-1*: 13-fold; *PLAT*: 11-fold and *PLAU*: 2-fold), but only the PAI-1 protein was increased (1.5-fold), whereas tissue and urokinase plasminogen activator proteins (tPA and uPA, respectively) tended to decrease. In summary, pristine SWCNTs treatment resulted in evident HUVEC damage caused by cell fiber contact, internalization, and oxidative stress due to contaminant metals. The generation of endothelial dysfunction, as shown by the altered expression of genes and proteins involved in fibrinolysis, suggest that SWCNTs display pro-thrombotic effects.

Acknowledgements. If any, acknowledgements should be placed before the References. Use font 10pt Times, justified.

The Clean Energy Project: from Prediction to Synthesis

Carlos Amador-Bedolla [1]

1. Department of Physics and Theoretical Chemistry, School of Chemistry, National Autonomous University of Mexico, CDMX Mexico

The Harvard Clean Energy Project (HCEP) [1,2,3] is a distributed computing study of 2.3 million candidate molecules for creating donor polymers to be used in Organic PhotoVoltaic (OPVs) heterojunction solar cells. We calculated the ground state electronic properties of these molecules —via 150 million density functional theory calculations— and used the Scharber model [4] as applied to a PCBM acceptor to rank them in terms of Power Conversion Efficiency (PCE), where we found 0.04% molecules that exceed 11% efficiency [5]. The building blocks employed in the virtual synthesis of these postulated high-efficiency molecules are analyzed.

An experimental program to synthesize some of these molecules and use them in the construction of OPVs to test the effectiveness of our theoretical predictions is currently under way. Additional hierarchization methods considering, for instance, other kinds of acceptor molecules and/or topological effects on PCE are also being developed, and the adaptation from these results of the synthetic goals of the experimental program is discussed.

Acknowledgements. This research has been partially funded by CONACyT-SENER-Fondo de Sustentabilidad Energética under project 245754.

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PDMS/PVDF hybrid electrospun membrane with superhydrophobic property and drop impact dynamics for dyeing wastewater treatment using membrane distillation

Alicia Kyoungjin An[1*], Jiaxin Guo[1], Eui-Jong Lee[1], Sanghyun Jeong[2], Yanhua Zhao[3], Zuankai Wang[3], TorOve Leiknes[2]

[1]School of Energy and Environment, City University of Hong Kong, Tat Chee Avenue Kowloon, Hong Kong, China,

[2]King Abdullah University of Science and Technology (KAUST), Water Desalination and Reuse Center (WDRC), Biological and Environmental Science & Engineering (BESE), Thuwal 23955- 6900, Saudi Arabia

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Fouling in membrane distillation (MD) results in an increase in operation costs and deterioration in a water quality. In this work, a poly(vinylidene fluoride-co-hexafluoropropene) (PVDF-HFP)electrospun (E-PH) membrane was fabricated by hybridizing polydimethylsiloxane (PDMS) polymeric microspheres with superhydrophobicity onto the E-PH membrane via electrospinning. The resulting hybrid PDMS with E-PH (E-PDMS) membrane showed a significant enhancement in surface hydrophobicity (contact angle, CA = 155.4°) and roughness (Ra = 1,285mm). The zeta potential of E-PDMS membrane surface showed a higher negative value than that of acommercial PVDF (C-PVDF) membrane. These properties of E-PDMS membrane provided an antifouling in treating of differently-charged dyes and generated a flake-like dye–dye (loosely bound foulant) structure on the membrane surface rather than in the membrane pores. This also led to a high productivity of E-PDMS membrane (34 $Lm^{-2}h^{-1}$, 50% higher than that of C-PVDF membrane) without fouling or wetting. In addition, complete color removal and pure water production were achieved during a long-term operation. An application of intermittent water flushing (WF) in direct contact MD (DCMD) operation led to a 99% CA recovery of E-PDMS membrane indicating its sustainability. Therefore, the E-PDMS membrane is a promising candidate for MD application in dyeing wastewater treatment.

Acknowledgements. This work was supported by City University of Hong Kong under its Start-up Grant for new faculty (Project number: 7200447) and the Research Grants Council of Hong Kong for Early Career Scheme (Project number: 9048074).

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Nanoparticle Drug Delivery Systems for Prevention of Cardiovascular Disease

Shengjie Lu[1] and Hector A. Cabrera-Fuentes[1,2,3]

1. *National Heart Research Institute Singapore, National Heart Centre Singapore, Singapore*
2. *Cardiovascular and Metabolic Disorders Program, Duke-National University of Singapore, Singapore*
3. *Institute for Biochemistry, Medical Faculty Justus-Liebig-University Giessen, Germany*

Since the enhanced permeability and retention (EPR) effect has been found, under which tumor vessels are highly disorganized and dilated with a high number of pores resulting in weak lymphatic drainage and leaky vascularization [1], nanoparticles gained mountain of attentions as delivery vehicles in cancer therapy [2-4]. Nanoparticulate formulations of <500 nm in size could penetrate through the endothelial lining of leaky vessels, thereby making it possible for passive targeting delivery of cargoes via EPR effect [5]. Recently, studies have shown that this phenomenon extends to other pathological tissues including ischemic heart [6]. A few studies on nanoparticle-based drug delivery system have been reported to improve the therapies for myocardial ischemia-reperfusion (IR) injury. In an *in vivo* murine acute myocardial infarction (AMI) model [7, 8], PLGA nanoparticles containing cardioprotective drugs, such as cyclosporine A or pitavastatin, has been demonstrated to reduce MI size with lower lowered dose, suggesting that nanoparticle-mediated delivery may increase the potency of the novel cardioprotective therapy [7, 8]. In another study, liposome-based nanoparticles accumulated in and successfully delivered co-enzyme Q10 to the infarcted areas of the myocardium, leading to improved cardiac protection in rabbit models of myocardial infarct [9]. However, it is far to clearly understand the role of nanoparticles in the targeting delivery in the ischemic myocardium and the high efficacy in reducing MI size is still a challenge. Therefore, new nanoparticles with long circulation time in bloodstream and more specific targeting accumulation in infarcted areas are highly desired for delivery of cardioprotective drugs in the model of IR injury as an example of cardiovascular disease.

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Carbon-based Catalytic Materials for Energy Conversion

Jiesheng Chen)

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Abstract

Carbon-based materials have great potential in application for energy storage and conversion because of their low cost, high stability and rich microstructure features. A series of carbon-based materials, represented by g-C_3N_4 and graphene composites, have been prepared and employed as catalysts for hydrogen abstraction from organic molecules and for electrocatalytic splitting of water. We have investigated in detail the microscopic structures, the active sites and the transport efficiencies for matter and electrons of the carbon-based materials [1-6].

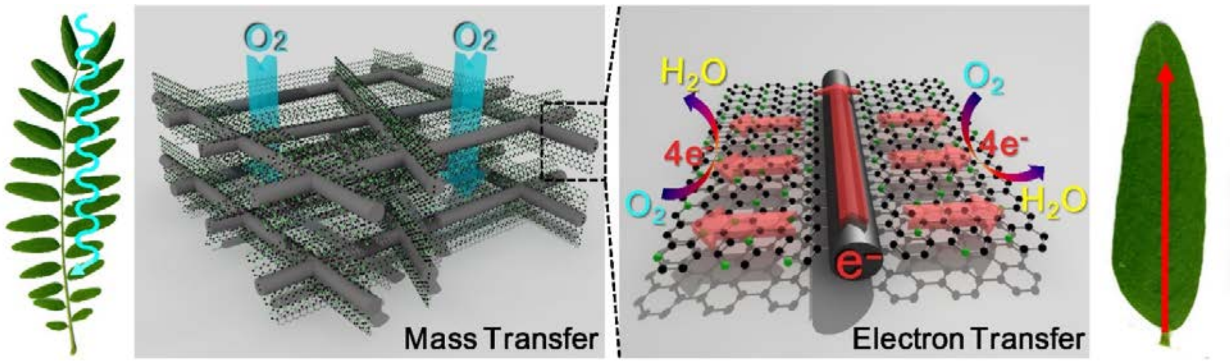

Fig. 1 Nanoporous composite of graphene and carbon nanofibers.

Keywords: Carbon-based materials, carbon nitride, electrocatalysis, energy conversion.

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Controlling the Formation of Perovskite Films by Low-temperature Solution Schemes for High Performance Solar Cells

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chchoy@eee.hku.hk

Abstract- Perovskite solar cells (PVSCs) with PCE of 15-20% have been reported by using one-step and two-step methods in synthesizing perovskites in last few years and the theoretical prediction is about 30% (theory) [2], considering as a strong candidate to offer a breakthrough for the next-generation of solar devices. Low-temperature solution processed planar-heterojunction PVSCs are highly attractive for practical applications (simple structure, low production costs, and capable for large-scale high-throughput manufacture). Therefore, understanding and control of the formation, quality (crystallization and residue), and morphology (e.g., pore, grain boundaries, and roughness) of the perovskite films are the key issues in the field.

In this work, we will propose and demonstrate two novel low-temperature processing schemes for manipulating of perovskite films in the typical one-step and two-step approaches. For the one-step method, our scheme is vacuum assisted low-temperature annealing process. The scheme can control the composition and morphology of triiodide ($CH_3NH_3PbI_3$) film from $3CH_3NH_3I$ (MAI):$PbCl_2$. Moreover, the approach allows us to identify the critical role of the by-produced of ch_3nh_3cl on the film formation and the device performance. as a result, perovskite solar cells (PVSCs) achieve good stability, reproducibility, PCE and no hysteresis [3]. For the two-step method, we demonstrate the formation of PbI_2 nanostructure together with strategically high CH_3NH_3I concentration to (1) form smooth $CH_3NH_3PbI_3$ film on flat substrate without PbI_2 residue at room-temp, and (2) enhance photovoltaic performance and stability of planar-heterojunction PVSCs [4]. As a result, a promising PCE (16.21%) is achieved in planar-heterojunction PSCs. We demonstrate that our facile design of nanostructure for the synthesis of perovskite is a promising route to prepare high-performance solar cells. Furthermore, the PbI_2 residue in perovskite film has been proven to have a negative effect on the stability of devices in ambient air.

[1] see for instance: P.-W. Liang, C.-Y.Liao, C.-C. Chueh, F. Zuo, S. T. Williams, X.-K. Xin, J. Lin, A. K. Y. Jen, Adv. Mater., vol.26, pp.3748-3754. 2014; W.S. Yang, J.H. Noh, N.J. Jeon, Y.C. Kim, S. Ryu, J. Seo, S.I. Seok, Science vol. 348, pp. 1234-1237, 2015.
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NANOPHOTONICS FOR BIOMEDICAL AND OPTOELECTRONICS APPLICATIONS

Elder De La Rosa Cruz*[1]*,

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Optical and electronics properties of semiconductor nanocrystals or quantum dots (QDs) and ceramic nanocrystals can be tuned by controlling the size and composition, such characteristics make them excellent candidate for applications on biomedicine and optoelectronic devices such as displays, solid-state lighting, photodetectors and solar cells devices. Here in this work, it is discussed the luminescence and electronic properties of such functional nanomaterials and proposed some application for imaging and detection of analytes. It is also discussed different architecture to optimize the charge transport and then enhancing the efficiency of LEDs and solar cells based on QDs and ceramic nanocrystals. Hybrid QD-LED and pLED combined with nanocrystals were proposed and analyzed the electro- and photo-luminescence properties in terms of size and composition of nanocrystals, and the appropriate architecture that include organic and inorganic hole and electron transport film to maximize the emission efficiency.

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Oxide Materials for Energy Conversion and Storage

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Oxide materials are of significant interest for both energy conversion and energy storage applications. They have been attracting increasing attention as electron transport layers in perovskite solar cells [1,2] as well as electrodes for lithium ion batteries (LIB) due to their high theoretical capacity [3-7]. Perovskite solar cells are among most promising emerging photovoltaic technologies, with record efficiencies exceeding 20%. Most commonly used oxide in perovskite solar cells is TiO_2, although ZnO has been attracting increasing interest due to potential for low temperature growth [2]. However, these two oxides not only result in significant differences in efficiency, but also large difference in device stability [2]. The influence of the oxide material on the perovskite solar cell stability will be discussed in detail.

Metal oxides have also been attracting increasing attention for LIB anode applications due to their high theoretical capacity, typically several ties higher than that of graphite (372 mAh/g). However, they also commonly exhibit rapid capacity fading with increased cycling. The common culprit for this phenomenon is pulverization, occurring due to large volume changes upon lithium insertion/extraction in these materials. A number of methods has been proposed to address this issue, including optimizing the material morphology, and the preparation of composite materials in an attempt to buffer the volume changes and achieve stable cycling performance. We will discuss the effects of material crystallinity and morphology on its cycling and rate performance as a lithium ion battery anode. Different oxide materials are considered. In addition, we examined the effect of different composites involving carbon nanotubes (CNTs) and graphene oxide (GO) on cycling and rate performance. We found that in general amorphous materials and hollow structures exhibit improved performance compared to solid crystalline materials. Carbon-based composites also provide additional buffering of the volume changes, leading to improved cycling and rate performances. The reasons responsible for the observed improvements are discussed in detail.

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Corrosion control for plasmonic enhanced dye-sensitized solar cells

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One of the methods for enhancing the efficiency of dye-sensitized solar cells (DSSCs) is by plasmonic effect. This can be achieved by the addition of suitable metallic nanostructures. However, they have been found to suffer from corrosion problems, especially when iodine is present in the electrolyte. Although existing encapsulation methods help to protect the metallic nanocores of the plasmonic nanostructure from electrolyte, the nanoshells are always porous and subjected to leakage. In this work, we devised a novel mechanism to alleviate the iodine corrosion attack with a modified liquid electrolyte. Instead of providing surface modification in conventional corrosion mechanism, gold iodide anions i.e. gold(Ⅰ) diiodide (AuI_2^-) and gold(Ⅲ) tetraiodide (AuI_4^-) with optimal concentrations are introduced in the new electrolyte. These anions are simultaneously reduced to metallic gold element during the operation of the plasmonic enhanced DSSC. The regeneration of gold thus effectively compensates the original corrosion effect. Gold attached on the TiO_2 photoanode will form a metal-semiconductor to move the conduction band (CB) of TiO_2 upward to form a Schottky barrier (SB), which effectively inhibits the recombination of electron-hole pair. At a result, the new electrolyte improves the short-circuit current, amplifies the open-circuit voltage, and reduces the impedance of TiO_2/dye interface. The power conversion efficiency of DSSC was increased from 2.1 % to 4.7 %, when compared with that of conventional DSSC. This achievement may pave a way toward the development of plasmonic enhanced DSSCs with the new electrolyte for various applications.

Keywords: dye-sensitized solar cells, corrosion-compensated electrolyte, gold iodide anions, iodide/triiodide redox, Schottky barrier

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The Structure-Symmetry-Properties Relationship at Nanoscale: The Case of Electromagnetic Transduction

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We describe the work of the crystal physics group (CIMAV) linked to the structure → physical properties relationship from the atomic and nanometric scales to the mesoscopic level. Attention is focused on electromagnetic transduction, connected with the conversion into electric or magnetic of some other type of energy. The roles of symmetry and texture in the electrical and magnetic coupling properties are discussed.

A topic of notable interest today is that of lead-free ferropiezoelectrics. The origin of these materials' properties is analyzed under a multiscale approach. At the unit cell level, ferropiezoelectric selection rules are presented on the basis of the irreducible representations (irreps) of the symmetry groups [1]. In the subsequent scale, the existence of polar nanoregions in a paraelectric matrix determines the appearance of relaxor behavior [2]. At the mesoscopic level the influence of structural and electrical textures on the effective properties is characterized. We describe our group's research, based on synchrotron light, to clarify subtle but properties determinant structural details of *state of the art* lead-free electroceramics [3]. The combination of diffraction-diffuse scattering and x-ray absorption spectroscopy has allowed us to solve paradoxes in the literature concerning the local and global ordering of the considered materials [4].

The multiferroic magnetoelectric nature of materials at different scales is another topic of scientific interest and important potentialities in technology and medicine [5]. Fresh ideas about the use of nano-magnetoelectricity in fields such as the fight against cancer are mentioned. The pseudo-vectorial nature of magnetic magnitudes and the peculiar behavior of magnetoelectric systems under time inversion require that the selection rules for magnetoelectric tensors be established by the application of complementary irreducible representations (co-irreps). We present our group´s work on synthesis and characterization of magnetoelectric Aurivillius phases. Multi-scale structural observation by diffraction-scattering methods and synchrotron light absorption spectroscopy is divulged. Magnetoelectric parameters are measured by techniques developed in our laboratories.

The Europe-Mexico scientific collaboration project on the Material Properties Open Database MPOD (http://mpod.cimav.edu.mx) is presented. For the Mexican side, the project is centered at CIMAV, site of the project's main server. European participants groups are from France, Lithuania and Italy. MPOD is freely accessible. The user can consult reports on several materials tensor properties. Mathematical definitions of some tens of properties, the numerical values of the properties matrices of some hundreds of materials and links to the original sources of information are provided. The properties can also be graphically displayed on the screen of the user's computer and "STL" files for 3D prints can be created.

Finally, methods and programs are presented to estimate the effective properties of mesoscopic aggregates of nanometric domains with given texture. Updated methods of texture measurement are mentioned. The advantages and limitations of standard procedures for calculating averages are discussed and novel variants are proposed with their respective application programs [6]. Case studies are shown.

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Environmental Implications of Nanomaterials in the Environment. Effects of Nanoceria on Common bean: An Spectroscopic and Proteomic Analysis

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Comprehensive information on the effects of $nCeO_2$ through the entire life cycle of plants and the nutritional quality of edible tissues is limited. No studies have been reported on the interactions between $nCeO_2$ and common bean (*Phaseolus vulgaris*) plants. This research was performed in four phases. Phase I was focused towards the mechanism of uptake and toxicity. Phase II evaluated soil organic matter (OM) as a factor towards the impact of $nCeO_2$ on plant physiology, metabolism, stress response, productivity, and bean nutritional quality. Phase III involved exploring the molecular mechanisms responsible for modulation of bean nutritional quality by $nCeO_2$ via proteomic analysis performed using LC MS/MS tandem spectrometry. In Phase IV, the possible trophic transfer of $nCeO_2$ from the producer to the primary consumer was examined. In Phase I, plants were exposed to $nCeO_2$ at 0-500 mg/L in hydroponics and analyzed for Ce uptake and translocation, Ce speciation, oxidative stress, antioxidant enzyme activities, soluble protein, and chlorophyll content. These studies were performed by using SEM, synchrotron µ-XRF mapping/µ-XANES and biochemical assays. Synchrotron µ-XRF/µ-XANES showed that Ce enters through the root epidermis as Ce(IV), same oxidation state of $nCeO_2$, and reaches the vascular system through the region of emergence of lateral roots, due to the gaps in Casparian strip. Prolonged exposure to 500 mg $nCeO_2$/L reduced radical scavenging enzymes in roots; whereas, guaiacol peroxidase increased in leaves [1]. In Phase II, the plants were grown in soils with OM at 4% (LOMS) and 10% (OMES). At 500 mg $nCeO_2$/kg, Ce translocation to leaves was significantly higher in plants grown in OMES by 71%, than in LOMS. Photosynthesis and transpiration increased significantly, compared to control, upon $nCeO_2$ exposure at 62.5, 125 and 250 mg $nCeO_2$/kg in OMES. Plant productivity in LOMS was enhanced at 250 and 500 mg $nCeO_2$/kg, but a bell-shaped curve with increasing $nCeO_2$ concentration was noted in the plants grown in OMES. $nCeO_2$ did not affect the macronutrient content in the beans; however, Mo was reduced by 38-61% upon $nCeO_2$ exposure in LOMS. On the other hand, in the seeds from OMES, Na was reduced by 18-31%. FTIR studies showed alteration in carbohydrates, lipids, and amides in beans from OMES amended with $nCeO_2$; however, in beans from LOMS, only the amides were affected at 62.5 mg/kg. In Phase III, proteomic analysis revealed that at 125 and 250 mg/kg, $nCeO_2$ induced defensin and purple acid phosphatase, proteins responsible for stress response and metabolism, respectively. However, the number of downregulated proteins increased, with increasing $nCeO_2$ exposure concentration. At 500 mg $nCeO_2$/kg, eighteen proteins associated with protein storage, carbohydrate metabolism, and ATP/GTP binding activities were downregulated [2]. Phase IV of this dissertation was accomplished by infesting plants exposed to 1000 and 2000 mg/kg nano and bulk CeO_2 with Mexican bean beetles (*Epilachna varivestis*). The beetles were allowed to grow through their entire life cycle, feeding on CeO_2 exposed plants. Then, they were analyzed for Ce accumulation at the various stages of development. Beetles were shown to accumulate Ce in tissues, depending on the exposure concentration, and their food assimilation habits at different developmental stages. Beetles at the pupal stage feeding on 2000 mg/kg $nCeO_2$ accumulated the highest concentration (1300 µg Ce/kg d wt), which decreased to 400 µg Ce/kg d wt in adult tissues [3]. This research has shown that $nCeO_2$ can affect bean quality and also can be biomagnified in the food chain.

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Chirality at the Nanoscale: Geometric Quantification of Chirality in Bare and Ligand-Protected Metal Clusters

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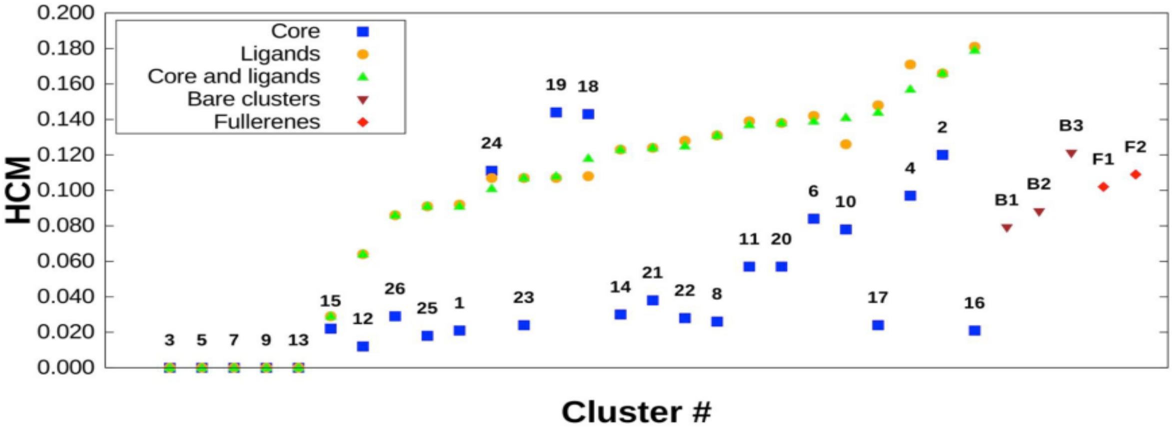
Chirality has been found as a relevant property of nanomaterials, including ligand-protected metal clusters and nanorods [1-4]. This property is not only crucial in nanotechnology developments related with asymmetric catalysis and chiroptical phenomena, but also generates fundamental questions on the existence of chirality at the nanoscale. In fact, x-ray total structure determination, electron diffraction studies, NMR and circular dichroism spectroscopies, as well as theoretical calculations performed on gold clusters protected with thiolate or phosphine ligands have confirmed the existence of chiral structures in the size range of 18-144 Au atoms. In this work [5], we realize a comparative analysis of the degree or amount of chirality existing in chiral ligand-protected gold clusters (LPGC), through a geometric quantification, using the Hausdorff chirality measure (HCM) [6]. The calculated HCM values provide a quantitative framework to compare, classify, and gain insight into the origin of chirality. Interestingly, these values are consistent with the current knowledge on the different sources of chirality: achiral cores and chiral arrangement of ligands in, for example, Au102(SR)44 and Au38 (SR)24, or intrinsically chiral cores, like in Au52(SR)32 and Au20 protected with phosphine ligands. Our calculations are also helpful to assign an index of chirality, and classify as chiral several recently synthesized and structurally solved LPGC that, in first instance, were not identified as such. The calculated HCM values are used to extract trends on how chirality is spatially distributed in LPGC, and correlate them with optical activity measurements. The main trend indicates that the Au-S interface has the dominant role in the chirality of LPGC [5].



1	$Au_{18}(SR)_{14}$	9	$[Au_{25}(SR)_{18}]^-$	17	$Au_{40}(oMBT)_{24}$	25	$Au_{144}(SR)_{60}$
2	$Au_{20}(PP_3)_4Cl_4$	10	$Au_{28}(SR)_{20}$	18	$Au_{44}(SR)_{28}$	26	$Au_{144}(Cl)_{60}$
3	$[Au_{20}(PR)_{10}Cl_4]Cl_2$	11	$Au_{30}S(SR)_{18}$	19	$Au_{52}(SR)_{32}$	B1	Au_{72}
4	$Au_{20}(SR)_{16}$	12	$Au_{36}(SR)_{24}$	20	$Au_{68}(SR)_{32}$	B2	Au_{55}
5	$[Au_{23}(SR)_{16}]^-$	13	$Au_{36}(SR)_8Cl_{20}$	21	$Au_{68}(SR)_{34}$	B3	Au_{34}
6	$Au_{24}(SR)_{16}$	14	$Au_{38}(SR)_{24}$	22	$Au_{102}(SR)_{44}$	F1	C_{84}
7	$Au_{24}(SR)_{20}$	15	$Au_{38}(SR)_{24}^T$	23	$Au_{130}(SR)_{50}$	F2	C_{76}
8	$Au_{24}(SeR)_{20}$	16	$Au_{40}(SR)_{24}$	24	$Au_{133}(SR)_{52}$		

Fig. 1 Geometric chirality (HCM) values for 26 ligand-protected gold clusters. The numbers in black above the blue squares denote the cluster number (index).

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Aerosol Assisted Surface Enhanced Raman Spectroscopy for Characterizing Organic Thin Films

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Surface-enhanced Raman spectroscopy (SERS) is an ultrasensitive analytical technique with sensitivity up to the single-molecule level[1,2]. SERS requires plasmonic nanoparticles (typically gold or silver nanoparticles) in contact with analyte molecules (i.e. hotspots) to amplify Raman signals of the analytes. The necessary transport of the analyte molecules (typically in the liquid form) onto nanoparticle surface is one of the most important aspects for practical applications. Recent study[3] has extended the SERS technique to surface analysis by reversely transferring "plasmonic nanoparticles" onto fixed analyte molecules instead of the typical transfer method. However, the nanoparticles were still in the liquid form (i.e. colloidal suspension) such that relocation of analyte molecules can take place by dissolving them in the liquid and the distribution of hotspots can be inhomogeneous.

In the current study, we present a development of surface analysis based on SERS. We produce silver (Ag) nanoparticles in the dry form suspended in the gas phase (i.e. aerosols) using electrospray technique[4] and the aerosol nanoparticles are thereafter deposited onto a surface containing analyte molecules. A clothianidin (pesticide) was selected as a model sample to be detected and a silicon wafer was dip-coated with the sample solution, followed by deposition of the aerosol nanoparticles. The mass concentration of the model sample was controlled with the dip-coating speed. The dip-coated surfaces in the absence and presence of Ag nanoparticles were scanned by Raman spectroscope with a laser of 532 nm.

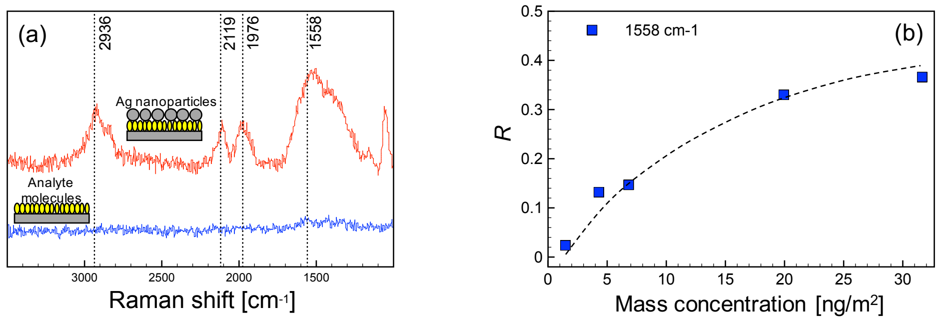

Fig. 1 (a) Raman spectra of clothianidin in the absence (lower) and presence (upper) of Ag nanoparticles. (b) Plot of occurrence of enhancement event, *R* against mass concentration of analyte molecules for enhanced peak of 1558 cm^{-1}.

Figure 1a shows Raman spectra with (upper) and without (lower) deposition of aerosol nanoparticles. The result clearly shows enhancement of Raman peaks in the presence of Ag nanoparticles: 1558, 1976, 2116 and 2936 cm^{-1}. Occurrence of the enhancement is analyzed in terms of the ratio of the number of enhancement events to the total number of spectrum acquisition, R for a representative peak of 1558 cm^{-1}. Figure 1b describes the occurrence (R) *versus* the mass concentration of analyte molecules. This plot undoubtedly has a positive correlation between R and the mass concentration. These findings demonstrate that the newly developed aerosol-assisted SERS technique have the potential to directly and quantitatively analyze any surface regardless its material and morphology.

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Analysis of nanoparticles with ICP-MS

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Engineered nanoparticles (ENPs) have received significant attention in recent years for the increased production and ubiquitous application in various fields worldwide [1]. Concerns about the safety and potential risks of AgNPs to human health and environment have also been raised. Hence, the characterization and analysis of nanoparticles in different biological and environmental samples is of great importance and have received much research attention recently. Recently, the inductively coupled plasma mass spectrometry (ICP-MS) has been recognized as a convenient and sensitive technique for the analysis of nanoparticles. A variety of methods have been developed for the determination of nanoparticles based on different separation techniques, such as liquid chromatography (LC), capillary electrophoresis (CE) and field- flow fractionation (FFF), coupled with ICP-MS detection [2-3]. Nanoparticles with different sizes were separated based on their different mobilities and then quantified by ICP-MS. The hyphenated methods allowed both size and distribution characterization and chemical composition analysis of nanoparticles comprehensively. Moreover, the strategies could be used not only to characterize size and distribution of nanoparticles, but also to separate and analyze the ionic species of the related elements in the same run. Besides, the single particle ICP-MS (SP-ICP-MS) was an alternative and fast method for the analysis of nanoparticles [4]. It could provide the particle number concentration and size distribution of nanoparticles at very low concentration (ng/kg level). The SP-ICP-MS method did not require any separation technique and has minimal potential artifacts from the particle surface coatings. These above methods have been successfully applied in vaious environmental and biological matrices. In brief, the ICP-MS has become a powerful tool for the analysis of nanoparticles and has great potential for the "nano" research.

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Water Resistant $CsPbX_3$ Nanocrysals Coated by Polyhedral Oligomeric Silsesquioxane and Their Use in Light-emitting Devices

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Last few years have seen a burst of publications on the perovskites in the form of colloidal nanocrystals (NCs). All-inorganic $CsPbX_3$ NCs, which exhibit both compositional and size variability of their bandgaps over the whole visible spectral range have been reported [1].

We demonstrate advantageous properties of $CsPbX_3$ (X=Br or I) perovskite NCs coated by Polyhedral Oligomeric Silsesquioxane (POSS): a high resistivity to water and the prevention of mixed perovskite NC powders of different halide composition from anion exchange both in water and in solid state [2]. The strong emission and the spectral shape of the POSS-coated perovskite NCs were fully preserved in powdered state, which allowed us to use them as solid state luminophores for fabrication of all-perovskite down-conversion white light-emitting devices (LEDs) [2]. In order to fabricate all-perovskite based white LEDs, green emissive $CsPbBr_3$ and red emissive $CsPb(Br/I)_3$ NCs were dispersed in a silicone resin, following by deposition onto a blue-emitting LED chip.

The beneficial role of the insulating material POSS as a solution additive or an additional hole-blocking layer to enhance the performance of electroluminescent green LEDs based on $CsPbBr_3$ perovskite nanocrystals is also demonstrated [3]. POSS improves the surface coverage and the morphological features of the films deposited either from supernatant or suspension of perovskite nanocrystals. The POSS acts as a hole-blocking layer between the perovskite nanocrystals and TPBi, keeping both electrons and holes located within the active layer for an efficient recombination.

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3D Integrated CMOS-Memristor Hybrid Circuits: Devices, Integration, Architecture, and Applications

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The *memristor* passed from being a mathematical curiosity predicted by Leon Chua in 1971 [1], to a real device, when the HP Labs linked Chua's predicted memristive behavior to the resistive switching characteristics they were observing in TiO_2 thin-film devices in 2008 [2]. This discovery led to a resurgence in the research on these devices and their use as a resistive random-access memory (ReRAM). In our group we have been working on various aspects of memristive memories under our HyNANO project, sponsored by the United States Air Force Office of Scientific Research (AFOSR) through the Multidisciplinary Research Program of the University Research Initiative (MURI) program [3]. Our objective is to develop fundamentally new ways of advanced information processing based on monolithically 3D-integrated, hybrid CMOS/nanoelectronic circuits.

As a central part of our project, we have developed several versions of a highly configurable CMOS interface chip (Fig. 1(a)) that enables the 3D monolithic integration of CMOS and memristive (ReRAM) crossbars, and well as the characterization of these 3D-integrated ReRAM crossbars, for various memory applications. The chip design allows for post-CMOS fabrication of ReRAM cells, and the interface between the ReRAM cells and the CMOS circuitry was provided via a top metal contact (Fig. 1(b)). The chip was designed to support an area-distributed interface decoupling the CMOS pitch and ReRAM pitch, enabling high-density ReRAM integration. This CMOS platform is the base of a flexible testbed for exploring various aspects of ReRAM applications. In particular we recently demonstrated and experimentally validated *3D-DPE*, a general-purpose Dot-Product Engine for two high-dimensional vectors [4], which is ideal for accelerating artificial neural networks (ANNs). 3D-DPE is based on a monolithically integrated 3D CMOS-memristor hybrid circuit and performs a high-dimensional dot-product operation (a recurrent and computationally expensive operation in ANNs) within a single step, using current-based computing in the analog domain. Compared to the traditional interface of a 2D system or a 3D system integrated using through silicon vias (TSVs), 3D-DPE's high-density area-distributed interface results in much higher connectivity between the two subsystems. As a result, 3D-DPE's single-step dot-product operation is no longer limited by the memory bandwidth, and the input dimension of the operations scales well with the capacity of the 3D ReRAM arrays.

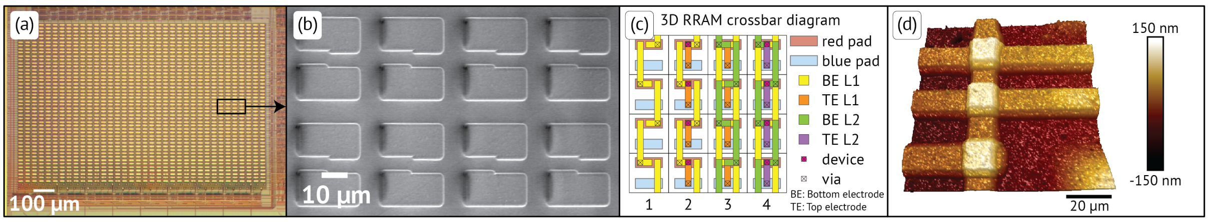

Fig. 1 (a) Optical micrograph of the area-distributed interface of the CMOS memory controller. (b) SEM image detailing the interconnection pads at the top metal layer. (c) Steps to fabricate two layers of the 3D RRAM crossbar. An arbitrary number of layers can be fabricated repeating these steps. (d) AFM image of three integrated RRAM cells in the first layer.

To demonstrate the feasibility of 3D-DPE, we fabricated 2 layers of TiO_2 ReRAM crossbars (Fig. 1(c-d)) on top of the CMOS memory controller, then we performed the analog dot-product operation under different input conditions in two scenarios: (1) with devices within the same crossbar layer (called the intralayer dot-product) and (2) with devices from different layers (called the interlayer dot-product). In both cases, the devices exhibited low voltage operation and analog switching behavior with high tuning accuracy.

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News about Technology Innovation & Incubation in China

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Technology innovation and incubation has recently been set as a national strategy for developing a sustainable knowledge-based-economy in China. All research subjects in the NANOMXCN community do bear relevance and impact in such a strategic plan, and international collaboration is a key to the success of this plan. An overview of this plan will be given in this talk to facilitate the alignment of future collaboration in the NANOMXCN community with China's newest strategy of development. Although raising a nation's manufacturing productivity and competitiveness by promoting technology innovation and business-incubation has already been adopted in many developed countries with various degrees of success, China's new strategy in developing its knowledge-based-economy via technology innovation and incubation is still globally influential because of the size and growth of China's GDP. Currently, the State Council of China aims at finding the best ways of implementing its strategy by experimenting with 28 exemplary cases of technology innovation and incubation (referred as I-I therein): 17 of them to be developed by regional governments in reference to their own core competence and competitive advantages in I-I, 4 of them to be led by four top universities in China, and 7 of them to be spearheaded in seven giant-corporations in different sectors. The first group of cases is supposed to chart efficient and effective policies and regulations for promoting I-I, the second group focuses on linking education/research to I-I and facilitating students to engage themselves in I-I, and the third group takes the responsibilities of setting practical models and protocols for developing knowledge-based industry/economy with I-I. Clearly China is taking an open-minded approach in this aggressive strategy, and eager to engage national and international change-agents, including those in the NANOMXCN community, in developing and implementing such strategy.

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(Electrospun nano-fibers as platform technology for product sustainability)

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Electrospun nanofibre applications for many bio-sourced and bio-compatible materials, with and without surface functionalization (chemical and biological), have been extensively reported in literature [1]. However, the investment on scalability required to process such innovative nano-materials, often is too prohibited for the materials synthesis costs, to bear a revenue on the operations and business development stages of the incubation process. Hence, R&D innovation on nanomaterials (IP), usually does not reach the markets due to the financial limitations of manufacturability at large scale, especially when investing on a green approach to the life cycle of the product (Reduce, Reuse, Recycle).

Bio-sourced materials, either by biotechnology or sustainable green processes, do have a point of differentiation on many markets, such as air filtration. Compostable filters with chemical functionality (CO_2, NO_x capture) and biological properties (anti-microbial/-viral), are increasing in demand; as consumers become aware of the environmental benefits of nanotechnology. Bio-sourced, marine collagen nanofibers, containing natural ingredients with antimicrobial functionality, and other bio-polymers (Zein, PLA, PLGA, PCL, Cellulose, Gelatin, Sugars, Lignin, etc.) containing a wide range of bio-materials (enzymes, oils, microorganisms, etc.), have been electro spun on industrial scale. Several business models have been explored and compare against circular economy models and real life commercialization examples.

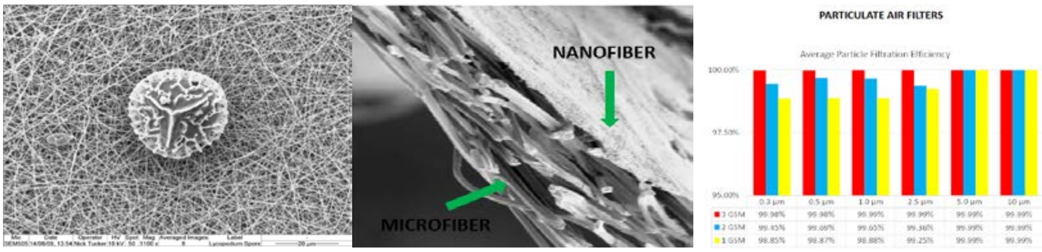

Fig. 1 Lycopodium spore on nanofibre media (left), Pollution Facemask media (middle), and air filtration efficiency (PM 2.5 -> 99.9% at > 2.5 ΔP), (right).

In contrast, the business potential for many other inorganic nano-materials, i.e., MOFs, MIPs, Graphene, CNT's, nano-particles, and so on, as membranes for air filtration; relies not on the bio-eco integration to a circular economy model (RRR), but on the long term financial and health impacts of introducing new materials and their corresponding application techniques into current manufacturing processes in existing markets. Electrospun nanofiber media offers a wide range of product alternatives, to suit a wide range of markets (even within air filtration) with completely different drives (Facemasks, HVAC, transportation, industrial, military, etc.). As most of the nanotechnology investment worldwide comes from public government funds, implementing a path to market strategy in all scientific endeavors, is a critical requirement from the tax payer. Understanding such requirements and engaging early with commercial nanofibre manufactures, benefits both industry and academics to accelerate the accessibility of nanomaterials for greener applications.

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Single-Atom Catalysis (SAC): Bridging Heterogeneous and Homogenous Catalysis

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Catalysis science is essential for biological transformation, chemical industries, atmospheric processes, environment restoration, energy resource, and human health. In the recent years, single-atom catalysis (SAC) has aroused significant interest in the catalysis community [1-4]. Extensive high-performance computation has been used in elucidating the reactivities and fundamental mechanisms of various SAC catalytic processes. Based on recent ab initio molecular dynamics (AIMD) simulations we have revealed that the microscopic mechanisms of a series of nano-scale catalytic reactions involve dynamic single-atom catalysis (DSAC) [5-7]. In this talk, we will provide an overview of the computational studies relevant to DSAC using density functional theory (DFT) and AIMD simulations.

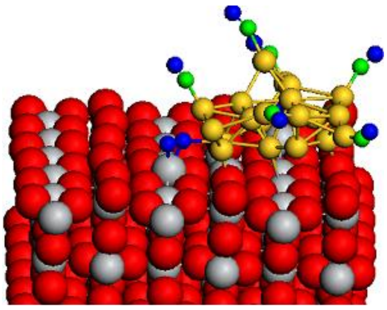

Fig. 1 Dynamic Formation of Single-Atoms in CO Oxidation on Gold Nanoparticles

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Rethinking the Safety of Sulfidation: Case of CuO Nanoparticles

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Metallic nanoparticles (NPs) readily undergo transformations in the natural environment, which dramatically affects their toxicity as well as ecological risks in return[1,2]. Among transformations, sulfidation as a natural antidote to metallic NPs toxicity has drawn much attention over the past years[3]. The detoxification contribution from sulfidation, however, may vary depending on sulfidation mechanisms.

Here we presented the dissolution-precipitation instead of direct solid-state-shell mechanism to illustrate the process of CuONPs conversion to CuSNPs in aqueous solutions. Accordingly, the CuSNPs at environmentally relevant concentrations showed far stronger interference on Japanese medaka (*Oryzias latipes*) embryo hatching than CuONPs, which was probably due to elevated free copper ions released from CuSNPs, leading to significant increase in oxidative stress and causing toxicity in embryos. The larval length was significantly reduced by CuSNPs, however, no other obviously abnormal morphological features were identified in the hatched larvae. Co-introduction of a metal ion chelator [ethylene diamine tetraacetic acid (EDTA)] could abolish the hatching inhibition induced by CuSNPs, indicating free copper ions released from CuSNPs play an important role in hatching interference.

This work documents for the first time that sulfidation as a natural antidote to metallic NPs is being overestimated, which has far reaching implications for risk assessment of metallic NPs in aquatic environment.

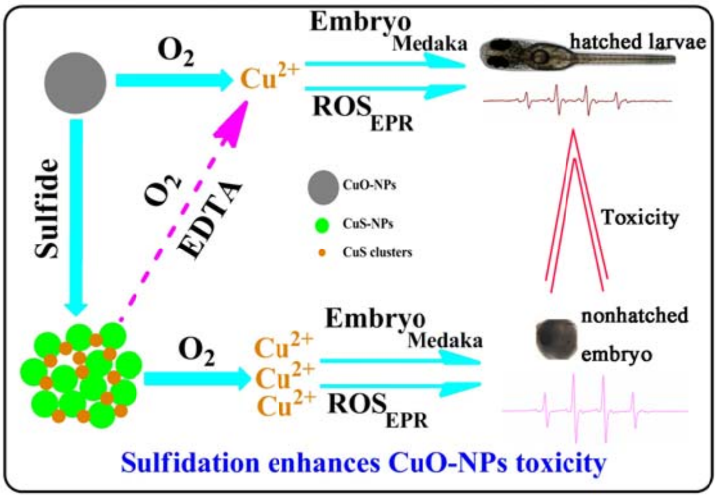

Fig. 1 The diagram to show the increasing toxicity of CuONPs to Japanese medaka embryo hatching due to sulfidation.

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Antibiotics and Antibiotic Resistance Genes (ARGs) in Water Environments of China

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Abstract
Antibiotics and their resistance genes in the water environment have raised global health concerns. China is the largest producer and user of antibiotics in the world. Due to limited regulation on both antibiotic use and their release, the water environments in China have been severely contaminated with antibiotics and ARGs. This study summarizes the current research progresses on the occurrence and characteristics of antibiotics and ARGs in the Chinese aquatic environments. There are large variations in the occurrence and levels of antibiotics and ARGs among different regions of China, which are closely associated with antibiotic usage, economic development status and governmental regulations. Metagenomic profiles of ARGs in the relatively pristine and highly-impacted environments demonstrated that ARGs naturally exist in water environments while the wide use of anthropogenic antibiotics significantly enriches the profiles and transfer pathways of ARGs. A single-point source always lead to an unequivocal gradient for both antibiotic and ARGs in the nearby water environment whereas the spatial patterns are featured with distinct hotspots as multiple sources occur. Significant relationships are often found between ARGs and antibiotics in the aquatic environment of China. Molecular signature of ARGs suggests that the elevated levels of ARGs in the aquatic environment are mainly originated from representative anthropogenic sources, instead of being produced *in situ* at far below sub-inhibitory concentrations of antibiotics. Antibiotic resistant bacteria (ARB) developed in the aquatic environment may potentially reach humans. However, there are still significant research gaps to accurately estimate the health risks of ARGs and ARB in the aquatic environment.

Enhanced graphene-based NO sensing under electric field

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Nitric oxide (NO), a common toxic gas, mainly comes from industrial processes. It has been reported that NO can cause several diseases to human. Recently, graphene and doped graphene have drawn more and more attention for application in gas sensing due to their unique properties. Moreover, it is perceived that electric field can tune the properties of two-dimensional materials. In this work, we studied the interaction of NO with doped graphene to explore the feasibility of graphene based sensor for NO using density functional theory and *ab intio* molecular dynamics calculations. The temperature and electric field dependent adsorption process and electronic properties were analyzed and discussed. The results predicted that doped graphene could be used for NO detection and showed that electric field can significantly affect the adsorption process.

Keywords: doped graphene, NO detection, electric field

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Recent development of metallic nanomaterials for structural applications

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We summarize our recent works on the advanced metallic nanomaterials with exceptional dual mechanical properties using multiscale metallurgical structure-driven design combined with advanced mechanical simulation. The effect of nanostructured materials on the mechanical behavior and the failure mechanism of metallic material show the possibility to develop different new nanomaterials with extraordinary mechanical properties. The computational models and experimental results successfully provide valuable information about the nanomaterials properties as a function nanostructure gradient configuration (nanograins, nanotwins, new nanoglasses). The processing of nanomaterials using mechanical processing and heat treatment has been studied at nanoscale and atomic scale. The material studies using nanomechanics based experimental investigations (nanoindentation and nano-pillar tests) can reveal the effects of the atomic structure and nanostructure gradient on the mechanical behaviors. The failure mechanisms study at atomic, nano-, micro- and macroscopic scale can provide efficient ways to enhance the ductility of materials using the general approach of strain non localization. We shall specially introduce the progress on the development of the high strength and high ductility industrial alloys with high density nano twinned stainless steels, hierarchical nanotwinned TWIP steels, nanotwinned gold and new Mg based metallic glasses. The potential applications in lightweight car, bio-implant, energy and aerospace sectors will be presented. The integration of nanomaterials using advanced design tools with associated processing development will be introduced.

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Synthesis, Characterization, Photocatalytic and Toxicological Evaluation of M-TiO_2 (M = Ag, Cu^{2+}) materials

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Environmental pollution is nowadays a growing concern due to deterioration of the environment and deleterious effects caused in living organisms, thus, sustainable technologies for environmental remediation should be developed. In response to this societal need, Advanced Oxidation Processes (AOPs) have demonstrated to be a suitable technology for water, air and/or soil remediation [1]. Among the AOPs, heterogeneous photocatalysis mediated by TiO_2 has been the most extensively studied for the past few years due to its strong oxidizing power, abundance and biocompatibility [2]. Despite the numerous advantages on the use of TiO_2 materials for environmental remediation, practical applications of this technology are limited due to the need of UV light for activation of the material. In our research group we have been working on the development of visible light active metal doped TiO_2 materials. Silver and copper have been explored as dopants for the development of visible light active TiO_2 material due to their antibacterial activity, since pathogenic microorganisms are also present in diverse contaminated sites. A robust, green and reproducible route for the synthesis of Ag@TiO_2 and TiO_2-Cu^{2+} materials was developed [3, 4]. The materials were fully characterized using several spectroscopic and microscopic techniques. The materials are active under visible light and show enhanced bactericidal activity. Silver doped materials exhibit better performance for inhibition of bacterial growth in comparison to copper doped materials. Silver doped materials exhibit excellent performance for disinfection of water, air, surfaces and inhibiting the growth of multi-resistant food-borne pathogenic bacteria. For instance, water treated industrial effluents were disinfected with the use of these materials after 6 hours of photocatalytic treatment under visible light. Copper doped materials also exhibit good performance for disinfection of water effluents and air. Indoor air (from a dental clinic of school of dentistry at UAA) was treated using supported TiO_2-Cu^{2+} materials under visible light radiation. Disinfection efficiencies up to 90% were achieved within 5 hours. In view of the excellent bactericidal activity of the materials, large scale implementation is being developed. Previous to implementation, toxicological potential of the materials was evaluated in mammals and plants. Silver doped materials exhibit hemolytic activity against human red blood cells at low doses, but do not exert toxicity against plants (*A. thaliana*). On the other hand, copper doped materials are not hemolytic to human red blood cells but inhibit plant growth at low doses. The microbicidal and toxicological mechanisms of these materials is mainly due to the lixiviation of metal ions.

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Nanoparticles and nanocomposite thin films prepared using a toroidal planar hollow cathode

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Hollow cathodes are widely used for a variety of applications from intense light source to for thin film deposition. The particularity of the hollow cathode is that the geometry reduces the loss of electrons to the anode or ground electrodes and doubly ionized ions generate many more secondary electrons from the cathode. Such an increase in the electrons production results in an in the number of ions and hence the plasma density. Another aspect of the cathode geometry is that almost all of the material that is sputtered from the cathode is re-deposited on the opposite cathode wall. We have developed a new hollow cathode design based on the planar geometry, similar to a combination of a toroidal electrode and the GHFC; Toroidal Planar Hollow Cathode (TPHC). Here the "hollow cathode" discharge occurs between the upper and lower electrode surfaces and the only way that electrons can leave the discharge is via the upper or lower aperture in these electrodes. We have studied the plasma density as a function of the applied electrical power and the gas pressure and we have used the system to deposit bismuth and aluminium based thin films and nanoparticles as a function of the experimental parameters. The cathode can be operated from 1 few millitorr up to >5 torr. The deposition rate mainly is dependent on the plasma power and gas pressure but can be easily controlled by the gas flow. The size of the nanoparticles mainly depends on the gas pressure and plasma power. Nanocomposite coatings have been made by using the plasma plume at the exit of the TPHC to remotely decompose acetylene or methane and deposit a combination of the nanoparticles and an a-C:H film.

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One-Step Synthesis of Hierarchical Metal-Gallic Acid Frameworks for Fast and Efficient Wastewater Treatment

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The removal of heavy metals from both natural water supplies and industrial wastewater streams is becoming increasingly important as awareness of the environmental impact of such pollutants is fully realized. In particular, environmental contamination by chromium and lead is a major problem in industrialized areas. The development of technologies to prevent further chromium discharge and remediate Cr(VI) contamination are of great importance. At present, extensive methods have been employed to remedy heavy metal polluted wastewater, including chemical precipitation, ion-exchange, membrane separation, and adsorption. Among them, adsorption is considered as one of the most attractive ways due to its easy processability and high efficiency [1,2]. Metal-organic frameworks (MOFs) have drawn special interest in organic and inorganic pollutants from water samples due to their extremely higher surface areas and porous volumes [3,4]. However, the pore size of MOFs generally is no larger than 2 nm, and inner adsorptive sites are inavailable for most targets in aqueous solution. In the present study, we have prepared several MOFs with hierarchical structures and pore sizes by using gallic acid as organic ligand and DMF as solvents.

We found that the reduction ability of the gallic acid ligand still remains in MOFs. All these materials show very potent reduction ability to Cr(VI). The resulting Cr(III) are precipitated directly from water or exchange with the metal nodes of (Fe, Co or Zn-) MOFs. As the initial concentration of Cr(VI) ranged in 100-2000 mg/L, the removal efficiency of Cr(VI) and total Cr ranged in 85-100% and 82-97% respectively in the presence of 1 g/L of Fe-GA. Besides, these frameworks can selectively remove Pb^{2+} and Cr(III). Among which, the adsorption capacities of Zn-GA to Cr(III) and Pb^{2+} reach to 1500 and 2000 mg/g, respectively, which are higher than those obtained on some metal oxides adsorbents [1,2]. The adsorption of Cr(III) and Pb^{2+} are mainly driven by sediment in the form of $Cr(OH)_3$ or $Pb(OH)_2$ and exchengment with the metal nodes of MOF. However, these cations can not exchange with Zr cations on Zr-GA, which also exhibits strong adsorption ability and fast adsorptive kinetic on the removal of Cr(VI), Cr(III) and Pb^{2+}. XPS results indicate that Cr(III) and Pb^{2+} can chelate the oxygen atoms connected to Zr on MOF. Finally, these materials keep high elimination ability to Cr(VI), Cr(III) and Pb^{2+} from several environmental water samples, indicating the application potentials of these hierarchical metal-gallic acid frameworks for wastewater treatment.

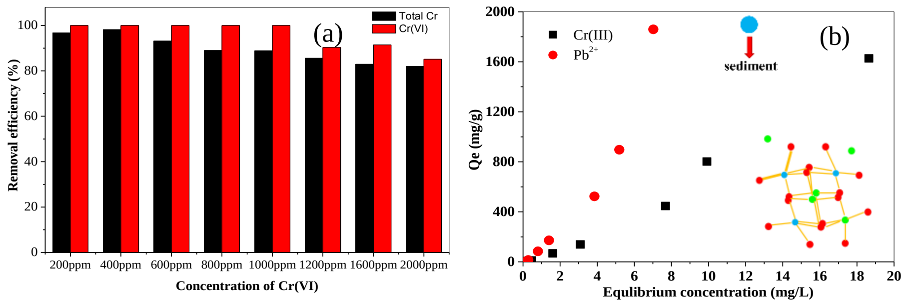

Fig. 1 Removal efficiency of Cr(VI) by Fe-GA (a) and Cr(III) and Pb^{2+} by Zn-GA and the corresponding interaction mechanism (b)

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Nanomaterials for Solar Energy Conversion Systems

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In this presentation, an overview will be given of the research in our group in the Department of Applied Physics at CINVESTAV-Mérida (Yucatán, México) on the application of nanomaterials in a variety of solar energy systems, including photovoltaics, solar fuels, and solar-to-thermal energy conversion.

In photovoltaics, the efforts in our group are focused on the dye-sensitized solar cell (DSC), which is based on a mesoporous, nanostructured metal oxide substrate. We have investigated the influence of the nanomaterials properties on the performance of the solar cells, using TiO2 in both the anatase and brookite form, and ZnO prepared by a variety of methods and with a range of morphologies. One of the most important subjects of research is on the charge transport and recombination processes and kinetics, applying small-signal modulation techniques such as electrochemical impedance spectroscopy (EIS), and intensity-modulated photocurrent and photovoltage spectroscopy (IMPS and IMVS). We also are making progress in the scale-up of the technology fabricating mini-modules of 24 cm2, reaching an efficiency of 4.8% for the DSCs based on anatase (in active area). We have recently started working on the hybrid perovskite solar cell, with particular focus on the physicochemical properties of hybrid perovskite materials both in the solar cell and in templates of different materials.

In the solar fuels research project, we use a combinatorial technique to look for new metal oxide nanomaterials for solar water splitting. In addition, we use advanced (photo)electrochemical methods in order to study the fundamental processes taking place in promising nanomaterials. Recent work has shown interesting results for the p-type semiconductor CuBi2O4, and we have analyzed the hole transport and recombination properties using IMPS and EIS. In addition, we are investigating water oxidation on WO3 electrodes, using the same techniques for electron transport measurements.

In the solar-to-thermal energy conversion project, we focus on selective coatings that efficiently absorb sunlight but with a low thermal emittance, thus optimizing the conversion efficiency and minimizing loss processes. We use both electrodeposition and sputtering to prepare selective coatings, using cermet and multilayer stack approaches in order to tailor the optical properties of the thin films. Specific examples for Ni and Co black, and Al2O3-MoOx-Al2O3 systems will be presented.

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Nanoscale Atomic Ordering for Enhanced Electromechanical Properties in Lead-free Ferroelectrics

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Ferroelectric materials are of great importance in many modern technologies due to their interesting electromechanical properties, including precision electromechanical actuators, impact and load sensors, sonar, medical diagnostic imaging and energy harvesting. Due to adverse environmental effects of the current lead-based ferroelectrics, there are on-going efforts to develop lead-free alternatives. Engineering of atomic scale structural disorder is a promising way to obtain highly enhanced electromechanical properties in Pb-free ferroelectrics. In many of the lead-free ferroelectric oxides, the local atomic displacements from high-symmetry lattice positions are correlated over nanometer lengthscales, while the bulk electrical polarization emerges as an ensemble average over all atomic displacements within a given material volume. In this talk, I will present our recent findings on the nanoscale orderings of local atomic displacements in some prototypical lead-free ferroelectrics and how they evolve under the application of electric fields and temperature changes, which were measured using advanced in situ X-ray and neutron scattering techniques. It will be shown that nanoscale atomic orderings can have significant effects on the lattice instability and phase transition behaviors of lead-free ferroelectric oxides, an understanding of which therefore provide opportunities for enhancing their electromechanical functionalities.

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Robust Self-cleaning Coating Made of Surface-molded Teflon Thin Film

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Superhydrophobicity is an amazing feature organisms developed to repel water and stains [1]. Such ability may enable many new functions , e.g., equipment (like umbrellas) that dry instantly; outdoor constructions much easier to maintain; more efficient chemical production; many other functions are proposed, such as anti-icing, anti-biofouling, and surface-assisted extraction, which may bring significant influences into energy, transportation and human health fields. Prior reports demonstrated various strategies to generate superhyodrphobic surface, but their products were not resistant to mechanical, thermal, chemical and/or irradiant stresses, making them impractical for real-world applications. [2]

We have developed a new strategy to generate superhydrophobic coating, which we believe effectively solves the problem in stability of the surface. Different from previous strategies, we generate the coating in one-continuous-piece using extremely inert material (Teflons), making it inherently free of the aforementioned stability problems. Among all the commercial polymers, a most inert group is perfluorinated polymers, often referred to as Teflons. Teflons are resistant to almost all chemicals, stable from -200 °C to over 250 °C, with outstanding mechanical robustness and low stickiness. However, a major problem is that inert materials are difficult to microfabricate, e.g., it has been a decades-long challenge for affordable microfabrication of Teflons.

We have addressed the need of effective and affordable microfabrication of Teflons and thus are able to fabricate superhydrophobic coating using Teflons. Recently we developed a high-temperature (up to 350 °C) thermomolding method to microfabricate Teflons with nanometer resolution. Our first report in *PNAS* demonstrated microfluidic chips fabricated entirely in Teflon [3. In current work, we fabricated microstructures on Teflon surface, and realized superhydrophobicity and anti-icing characters. While previous methods often generate brittle or chemically unstable structures, our superhydrophobic surface is in a continuous piece of Teflon, exhibiting extreme stability against chemical-, thermal-, mechanical- and photochemical-attacks. Also, we managed to firmly attach such Teflon coating to substrates such as glass, metals, and glass fiber mesh. We believe it is promising to meet the demanded reliability of superhydrophobic coating and thereby with a chance to be implemented in large scale.

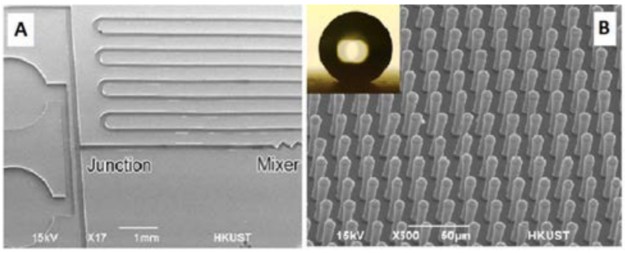

Figure 1: (A)microchannels on a Teflon surface [3) (B)microstructures on Teflon PFA surface. Inset: a water droplet on the textured Teflon surface (unpublished).

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Photocatalytic Properties of Bismuth-Based Coatings

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During the last decades, there has been an exponential growth of studies related to the use of bismuth-based semiconductors as photocatalytic materials. Such reports include the oxidation of organic compounds in residual water or the H_2 production by the water-splitting method.

In the case of water purification, the semiconductor photocatalytic materials are usually used as slurry mixing the nano/micro powders with the contaminated water. Thus, a secondary process of filtration or separation has to be implemented, making the process costly and slow. An alternative approach is to deposit the semiconductor photocatalytic material as a coating on a substrate or directly in the water container with the disadvantage that flat surfaces have lower active areas compared to the powders and therefore the photocatalytic efficiency is reduced. Therefore, for such alternative procedure the use of more efficient photocatalytic materials is a critical issue.

Among the photocatalytic semiconductor materials as powders or thin films, the titanium dioxide (TiO_2) has been the most studied due to its large efficiency, chemical stability and low cost. Nevertheless, there are still plenty of possibilities for improvement of TiO_2 through increasing its light absorption in the visible range, so that a larger percentage of the sunlight could be used to activate the photocatalytic activity. In parallel, there is also a constant activity for the development of other semiconductor photocatalytic materials that present larger absorption in the visible range, as well as the chemical stability, efficiency and cost. Among the different materials that have been proposed, bismuth (Bi) compounds appears as a common element in the whole list for either binary, ternary and quaternary oxides or oxyhalides. The reason is that the photocatalytic activity of Bi-based materials is related to the specific density of states produced by the hybridization of the 6s2 electrons of Bismuth with the 2p states of oxygen. Following these ideas we have evaluated the photocatalytic degradation of dye solutions using different bismuth oxide phases produced as coatings using magnetron sputtering. Moreover, because the Bi_2O_3 phases showed a good efficiency for discoloration using visible light but not for complete mineralization, we decided to produced ternary bismuth oxides, such as Bi_2WO_6, $Bi_5Nb_3O_{15}$, Bi_2CuO_4 and $BiVO_4$. Thin films of the latter compound were also tested for water splitting, demonstrating that after post-deposition treatments, either using a chemical solution or an electrochemical process, the photocurrent produced could be enhanced above 1.2 mA/cm_2 at 1.23 V vs RHE.

The mechanisms that lead to strong discoloration without mineralization has been throughly studied and a new strategy proposing thin film heterojunctions is currently under evaluation.

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Decontamination and desinfection of domestic wastewater by sequential biological- Nano-TiO_2/O_2/UV photocatalysis treatment

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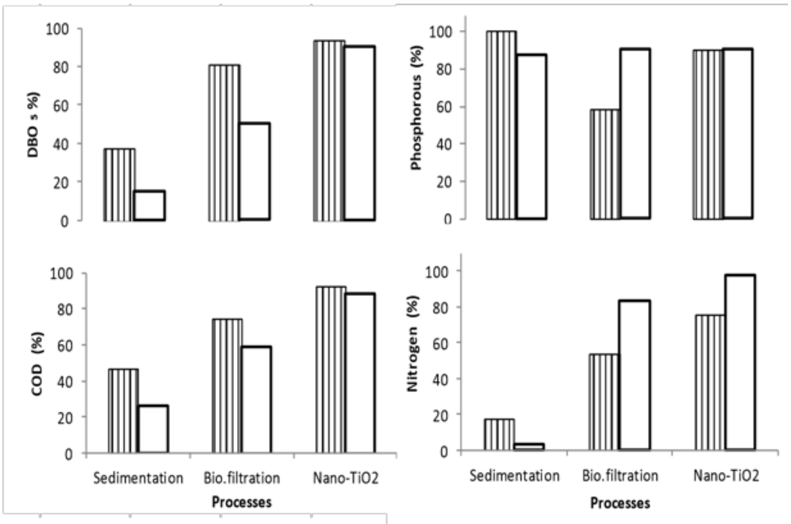
Water reuse is a sustainable solution to today's rising urban water demand, to achieve a reuse quality, wastewater treatment (WWT) systems need to effectively reduce the organic loading, decontaminate and disinfect wastewaters. However, current municipal WWTs are not specialized in the degradation of persistent organic pollutants (POPs), and are ineffective in fully mineralizing recalcitrant chemicals such as harmaceutically active compounds (PhACs). For water reuse to be sustainable, current secondary and tertiary WWTs need to be further developed to effectively decontaminate and disinfect pretreated wastewater, reduce their byproducts (i.e. wastewater sludge, brines with PhACs and metabolites) and associated handling costs, and be less chemical and energy intensive. In this work, a novel sequential treatment system is being developed for domestic/commercial wastewater applications. This system includes a secondary processes (sedimentation-biofiltration) that reduces the organic loading and decontaminates, while tertiary process includes a nanoTiO_2 heterogeneous photocatalytic reactor of 60, 000 L/day (Fig. 1), to decontaminate and disinfect the pretreated waste water. The results performed at laboratory (LS) and Pilot Plant Scale (PPS) (Fig. 2), show a removal of Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Color Units (CU), Nitrogen (N) and Phosphorous (P), in LS, 94%, 92%, 93%, 76% and 90%, respectively and at PPS, 90%, 88%, 91%, 98% and 91%, respectively. Metals, Cu and Pb showed a removal of 88% and 76%, respectively; Fe and Zn of 100%. Total bacteria and fungi, as well as for fecal coliform and *Escherichia coli* were detected. The treated water reached the quality water suitable for irrigation use.

Fig. 1. Photoreactor of NanoTiO_2/UV air For 60,00 L of water/day



F ig. 2 Contaminants removal. ▥ Laboratory scale (800 mL); ☐ Pilot plant

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Colloidal Nanostructures for Light Harvesting and Light Generation

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I provide an overview of light-harvesting and light-emitting colloidal nanostructures synthesized in our labs, which include semiconductor quantum dots and rods emitting over the broad visible and near-infrared spectral range [1,2]; carbon dots [3]; perovskite nanocrystals [4]; and copper clusters [5]. I highlight their photophysical properties studied by advanced optical spectroscopy techniques, and demonstrate their emerging applications ranging from water-splitting materials [6] to light-emitting diodes [7] and displays [2].

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Patterned Photo-Alignment of Fluorescent Semiconductor Nanorods

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Photo-alignment technique provides high alignment quality with exceptional control over the local director of liquid crystals. Based on the reorientation mechanism of sulfonic azo dye molecules, the method offers high anchoring energies for the alignment of liquid crystals and liquid crystal composites [1]. We explore the advantages of the photo-alignment method towards fabrication of precise micro-patterns of light-emitting CdSe/CdS semiconductor nanorods, dispersed in liquid crystal polymer. After unidirectional alignment of thin composite films, we obtain one- and two-dimensional fluorescent gratings by a second irradiation with UV light, and the employment of a photomask. We are able to obtain domain sizes down to 2 µm, which is confirmed by fluorescent microscopy. Apart from addressing the fundamental interest to precisely control the orientation of nano-sized objects, we introduce the concept of semiconductor nanorod-based fluorescent gratings, which can find multiple applications in optoelectronic devices.

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Two-dimension nanoscale minerals as adsorbent in water treatment

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Rapid industrialization has led to an increased worldwide water contamination, which has become one of the key environmental problems facing humanity. Many industries such as metallurgical, mining, chemical manufacturing, battery manufacturing, textile, cosmetic, and leather industries can release organic or inorganic wastewater, both of them can cause severe health problems in animals and human beings [1,2]. Thus, the removal of these contaminants from natural water has become a crucial issue. Adsorption is regarded as one of the most promising technologies in terms of simple operation, cost-effective, no chemical addition and regeneration capability among all the wastewater technologies [3]. In recent years, the developments of nanoscience and nanotechnology have shown remarkable potential for the remediation of environmental problems. Compared with traditional materials, nanoscale adsorbents, especially those with two-dimension (2D) structure, have exhibited much higher efficiency and faster rate on water treatment owing to their higher surface areas and much more surface active sites than bulk materials [4,5].

This presentation summarized our recent works on the removal of water contaminants with two-dimension nanoscale minerals (graphene oxide, 2D molybdenite, 2D montmorillonite hydrogel) as adsorbents. It was found that graphene oxide (GO) is a superior adsorbent for the removal of methylene blue, Pb2+, AsO43-, Cd2+ from aqueous solutions. 2D molybdenite is a new 2D material and possesses a similar structure with GO. Furthermore, it has remarkable advantage that lots of S atoms are exposed on its surface. Therefore, 2D molybdenite might be an efficient adsorbent in the removal of the heavy metals from contaminants because of the fact that S atoms could strongly react with heavy metals. The possibility of using 2D molybdenite as an adsorbent and its adsorption property for heavy metal removal from water are presented. The negatively charge surface of 2D montmorillonite makes it an efficient adsorbent for the removal of positively charged heavy metal ions. Hydrogel has been paid much attention recently due to its easy recovery. We will present the preparation of hydrogel with 2D montmorillonite and its adsorption of heavy metals.

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Investigation of High Efficiency Perovskite-based Solar Cells

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The perovskite-based solar cells (PSCs) have taken the world of PV research by storm due to the dramatic enhancement of the power conversion efficiency (PCE) of this class of devices within just a short period of time (~22.1%). In this paper, we present an overview of different approaches to accomplish high PCE in PSCs including: i.) improvement of the absorber layer; ii.) enhancement in the device structure; and iii.) incorporation of the light trapping structures.

Methylammonium lead tri-iodide (MAPI) is commonly used absorber layer in PSCs. Different growth techniques have been reported for the growth of high quality MAPI films including: i.) solvent engineering; ii.) vapor assisted process (VASP); and iii.) hybrid chemical vapor depositions (HCVD) technique[1]. Sunlight absorption in the perovskite layer can also be improved by using new perovskite materials with smaller bandgaps. It was shown that using a mixed perovskite consisting of formamidinium methylammonium lead tri-iodide (FA/MAPI). The bandgap of this material can be tuned by varying the ratio between FA and MA and an ideal bandgap size of 1.48eV can be achieved using this technique. A record PCE of 22.1% was reported utilizing FA/MAPI absorber layer. Our group had reported wide range of investigations for the enhancement of PCE in MAPI-based PSCs. It was shown that significant improvement in the PCE by dry O_2 treatment of the MAPI layer. Experimental results on photothermal deflection spectroscopy (PDS) show that O_2 annealing leads to significant reduction in the localized states in the MAPI layer, which is shown to be the key factor underlying the observed enhancement in the PCE. We will present a detailed discussion on the HCVD growth process that utilizes a N_2/O_2 carrier gas resulting in significant enhancement in the PCE.

We have investigated light trapping effects utilizing a unique structure which replicates nanometer-scale biological surface texture and behaves as an effective light scattering layer. The structure exhibits ultrahigh transmission haze of 75% and high diffusion transmittance of 97% and thus can be placed on the surface of the perovskite top cell to scatter the incident solar light and enhance the light harvesting power of the tandem structure. Our results demonstrate 7% to 10% improvement in the PCE using the biomimicking haze film.

The collection efficiency of the photo-carriers in the absorber layer can be substantially improved by incorporating crystalline TiO_2 nanorods in the absorber layer. Vertically oriented TiO_2 nanorods, of length ~0.4 to 0.5 μm, were grown directly on FTO/glass substrates by solvothermal technique as shown in Fig. 1. The *I-V* characteristics of the champion device with TiO_2 nanorods is shown in Fig. 2. The results demonstrate excellent fill factor and negligible hysteresis.

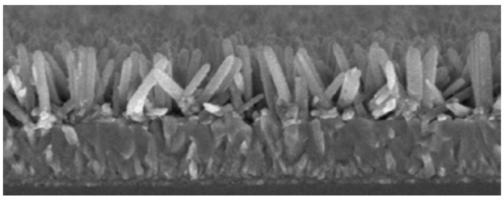

Fig. 1 SEM picture of TiO_2 nanorods grown by solvothermal technique.

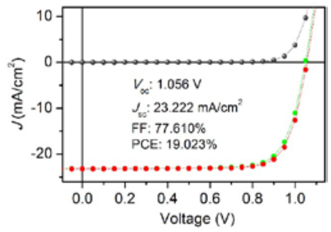

Fig. 2 *I-V* characteristics of a PSC with .

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How to promote Innovation in the Energy Sector by regulating the Nano-, Bio-, Info- technologies and Cognitive Science (NBICs) to foster a Sustainable Development.

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Nanotechnology,[1] Biotechnology,[2] Information technology[3] and Cognitive science[4] (NBICs)[5] are the subjects of a converging process that offers both challenges and opportunities for the development of our societies.[6] They are changing the paradigm in scientific research towards an interdisciplinary-holistic approach to the design, production, utilization and confinement of goods & services. By taking advantage of NBICs, certain societies are fostering a tendency towards an innovation oriented economy to such an extent that every input could become the subject matter of legal controversy.

An innovation economy is based on the ability to attract or retain investments through a solid structure that encompasses all the social, economic, and legal conditions sought by investors. A responsible innovation based economy should promote every possible mechanism to enhance our capacity to diminish the human impact on the environment while promoting sustainable development throughout the economy.

The increasing demand for energy puts our societies in such a vulnerable situation that we must pursue research to foster innovation in the production, transformation, distribution, and/or storage of energy to achieve regional energy stability.

Law has provided us with structures that facilitate human activities. In a system based on the rule of law, institutions and prevailing regulations interact to coordinate society so as to achieve certain common goals that are usually oriented towards the pursuit of sustainable development. Due to the intrinsic complexity of each technological area in NBICs and the nature of the energy sector, law may have too broad and imprecise repercussions in particular when not taking into account the following criteria:

- the nanoscale,
- the blurred boundary between these technologies, and
- the properties and characteristics of new materials and their applications in the energy production process.

This could — and in all probability will — generate uncertainty for investors by increasing the risk of litigation which will slow down or restrict the development of the convergent process of these technologies and the investments of private capital.

Our goal is to discuss how law and technology could intersect to conduct our societies towards sustainable development. Specifically, we are going to talk about the regulation of the energy sector and how NBICs technologies should be implemented and regulated, looking for the best method to promote innovation while keeping the inner consistency of the energy system.

Against this background, the main question to be examined hereafter is twofold: Does a regulatory model or legal instrument that could foster innovation in the energy sector exist? We have to look at the current regulation of the energy sector and analyse the perspectives of evolution in the light of the new challenges posed by NBICs, for a better understanding of the legal instruments of control and management of energy.

Acknowledgements. To the Sectorial Fund of the National Council for Science and Technology and the Energy Minister of Mexico for the scholarship, to the Institute for Mexicans Abroad (IME) for the financial support to attend, to Professor Hubert DELZANGLES for directing the research and to the Mexicans Abroad Global Network.

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[1] "Nanotechnologies are the design, characterisation, production and application of structures, devices and systems by controlling shape and size at nanometre scale." Royal Society & Royal Academy of Engineering. 2004. Nanoscience and nanotechnologies: opportunities and uncertainties. London: The Royal Society 2004. http://www.nanotec.org.uk/report/Nano%20report%202004%20fin.pdf

[2] "Biotechnology, a word that arouses hopes and concerns! But what does it cover? - Simply, all industrial processes that involve the use and implementation of living organisms, bacteria, yeast, animal or plant cells, etc. - Above all, a knowledge base, tools, techniques that can be applied to many industries, including pharmaceuticals, food processing, environmental protection, eventually to all industrial sectors associated with quality of life" HACHE, J., Les enjeux des biotechnologies : Complexité et interactions, Editions EMS Management et Société. Collection « pratiques d'entreprises », dirigée par BOYER, L., Colombelles, France, 2005, p. 11.

[3] "From an economic perspective, technology consists in the application of information either tacit (know-how, skills) or coded (drawings, models, chemical formulas) in the design, production, and utilization of goods and services. In contrast with science, the creation of new technology is primarily a business matter. As an illustration, the share of climate-related patents – protecting technologies aiming at reducing greenhouse gas emissions – filed by public bodies is in average less than ten percent in most countries. 2 Contrary to standard tangible goods, technology and knowledge production and dissemination inevitably involves a public policy dimension." OECD Green Growth Papers 2013-05 GREENING GLOBAL VALUE CHAINS INNOVATION AND THE INTERNATIONAL DIFFUSION OF TECHNOLOGIES AND KNOWLEDGE.

[4] "We call cognitive sciences all scientific disciplines dedicated to the study and understanding of the mechanisms of thought, whether human, animal or artificial, so anything that relates to knowledge." SECROUN, C., 2011. Informatique. Paris: Éd. J.P. BAYOL. p. 50.

[5] It is also called the Modern Technology Converging Process (MTCP).

[6] *See* ROCO, C.M.; BAINBRIDGE, W., ed. Converging technologies for improving human performance nanotechnology, biotechnology, information technology and cognitive science: NSF/DOC-sponsored report [Internet]. Arlington, Va.: National Science Foundation : Dept. of Commerce; 2002. Meanwhile Marie-Hélène Parizeau refers to a feature of the convergence process is manifested through the convergence of diverse scientific disciplines: -biology, chemistry, computer science, engineering, which converge under the auspices of quantum physics and makes scientific explanatory paradigm in nanoscale. PARIZEAU, M.H., Biotechnologie, nanotechnologie, écologie, entre science et idéologie, 2010, p. 57.

Photovoltage Loss in Excitonic Solar cells

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Polymer solar cells with power conversion efficiencies (PCEs) over 8% have been demonstrated in laboratories with advances of novel materials, device processing, and device architectures. However, some critical physical properties of the polymer:fullerene bulk heterojunctions (BHJs) such as the donor-acceptor interface energetics which controls the charge transfer process are not well understood. In a BHJ photovoltaic cell, the open-circuit voltage (V_{OC}) is determined by the energy level difference of the highest-occupied-molecular-orbital (HOMO) of the donor and the lowest-unoccupied-molecular orbital (LUMO) of the acceptor. However, there is lack of experimental approach to directly probe such alignment in a working device.

In this presentation, we will demonstrate a technique—charge modulated electroabsorption spectroscopy (CMEAS) to directly determine the effective bandgap and the interface effective force in a polymer:fullerene BHJ system.[1] By measuring the electroabsorption (EA) signal due to charge-modulation (CM) in the polymer, we are able to observe a clear sub-bandgap signal through direct excitation of excitons to the charge transfer states. Such a differential spectrum measured by CMEAS has a much higher signal-to-noise ratio than that measured by linear optical absorption techniques. Compared to the conventional electrochemical method, CMEAS can probe the energy level alignment at the electron donor-acceptor interface in a working BHJ photovltaic cell. Using CMEAS, for the first time we are able to directly probe the effective bandgap in polymer:fullerene systems. The results also bring insight into the details of the charge transfer states and the origin of V_{OC} in polymer photovoltaic cells.

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Energy sources for molecular machines

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Molecular machines are gaining increasing interest from biological to energetic perspectives. They promise to convert energy, including renewable energy, and control mechanical motion at length scales down to the nanometer.

Some molecular machines cause reciprocal motion, as in muscles and switches, while others cause rotational motion, as in flagellae: we discuss theoretical models of both, in particular a diversity of possible energy sources. Nature developed a variety of molecular machines to convert energy and control motion. These natural machines tend to be complex and robust.

In the last few decades, scientists have synthesized a wide range of new, relatively simpler molecular machines and learned to control and observe some of their important motions, mostly in solution. Increasingly, molecular motors have also been investigated at solid surfaces, allowing the use of surface science techniques for studying monolayers of well-oriented molecules. Nanoscience techniques have added further possibilities.

We shall discuss basic issues of the operation of molecular motors, including energy conversion steps, continuous energy supply, the role of thermal energy, intentional start and stop of motion, and unidirectionality of motion. Without intentional control of these aspects, motors create random motion and are largely useless.
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Low Cost HeteroNanostructures for Efficient Solar Water Splitting

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The scientific community has witnessed a considerable renewed interest in the field of artificial photosynthesis for solar water splitting[1] within the last decade to address global climate change seriously compromising our environment and the concomitant exponential increase in energy demand from emerging countries. Large bandgap transition metal oxide semiconductors offer a wide range of applications for solar energy conversion and renewable energy systems[2]. Most are stable, non toxic, earth-abundant, easy to prepare on a large scale as powders, thin films, and ordered anisotropic arrays at various dimensional scales. They do exhibit the widest range of optical and electronic properties suitable for low cost solar water splitting applications. Our approach is to develop novel purpose-built oxide heteronanostructures consisting of oriented arrays of quantum rods and dots of high purity entirely produced from aqueous chemical growth at low temperature[3] without surfactant nor template and with precise controlled size and water-interfacial chemistry[4] with intermediate bands for high visible-light energy conversion, highly quantized band structure for bandgap and optimized band edge[5] for stability against photocorrosion and operation conditions in aqueous solutions at neutral pH without sacrificial agent. Such unique characteristics, combined with the in-depth investigation of their size-dependent[6] and interfacial[7] electronic structure[8], optical, structural and conductivity[9] properties do provide a substantial advance in fundamental understanding as well as novel structure-efficiency relationships for a cost effective, efficient and sustainable generation of hydrogen from the two most abundant and geographically-balanced free resources, i.e. the sun and seawater. All of the aforementioned will be demonstrated along with a new design strategy to combine molecular and inorganic catalysts[10] as well as the latest development in heteronanostructured devices for low cost solar hydrogen generation[11] and atomic scale fundamental understanding of performance and stability of nitride photoelectrodes capable of overall water splitting in pure water without bias[12].

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Renewable Energy Storage: High-Performance Supercapacitors

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To fulfill the global demand for sustainable and renewable energy as well as clean environment, it is important to develop high-performance energy devices. Supercapacitors with high power density and long-term cyclability are emerging as promising candidates for energy storage in hybrid electric vehicles, back-up power systems, etc. However, current supercapacitors suffer from relevant low energy density, which may hinder the practical applications.

Supercapacitors can be classified into two categories according to the different working principles, i.e., electric double layer capacitors (EDLCs) and pseudocapacitors. In this talk, I will mainly talk about the efforts in my research group to achieve high-performance supercapacitors: from carbon-based EDLCs to metal oxide or sulfide based pseudocapacitors. Particularly, a graphene/porous Fe_2O_3 nanocomposite anode we developed shows outstanding electrochemical properties, which can deliver a high specific capacitance of 1095 F g^{-1} at a current density of 3 A g^{-1}, outperforming nearly all the reported Fe-based anode materials at that time. Along with the high specific capacitance, the nanocomposite exhibits great rate capability and good cycling stability. Asymmetric supercapacitors are fabricated by assembling the graphene/porous Fe_2O_3 nanocomposite (as the anode material) with a CoNi-layered double hydroxide/carbon nanotube composite (as the cathode material). The devices exhibit high energy and power densities of 98.0 W h kg^{-1} and 22,826 W kg^{-1}, which are among the best performances reported to date for asymmetric supercapacitors.

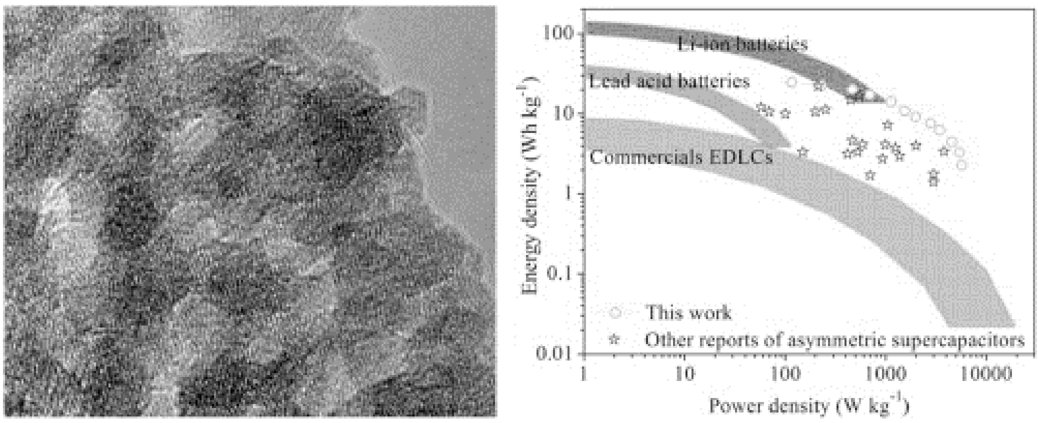

Fig. 1 Graphene/porous Fe_2O_3 nanocomposite for high-performance pseudocapaictors.

Besides the graphene/Fe2O3 nanocomposites, I will also discuss in detail about the material design and device performance of the high-performance supercapacitors we developed.

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Adsorption of Biotin on Titanium Nitride Thinfilm for Label-Free Surface Plasmon Resonance Biosensing

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State-of-the-art label-free biosensors employing surface plasmon resonance (SPR) technology are governed by two critical components, namely, 1) the plasmonic material responding to refractive index alteration on the sensing surface, and 2) surface functionalization by specific antibody so that the corresponding antigen can be captured and detected accordingly. While gold is the dominating plasmonic material, it is also expensive, fragile and incompatible with existing complementary metal-oxide-semiconductor (CMOS) fabrication technology. Thus, the scope to miniaturize chip-scale gold-based SPR devices is rather limited. Recently, we observed the renaissance of novel titanium nitride (TiN) plasmonic material, which is durable and CMOS compatible. It is thought that TiN may address some of the above-mentioned limitations. In this presentation, we fabricated TiN thinfilm of various thicknesses on glass (TiNG) by magnetron sputtering. It was found that with nominal TiN thickness of 30 nm, the refractive index resolution attains approximately 1.9 × 10^{-7} RIU, which is comparable to the performance of gold film. We have also attempted direct detection of biotin with the TiNG biosensor and monitored the sub-sequential biotin-streptavidin conjugation. As it was found that the biotin-TiN affinity is one order of magnitude better than that of biotin-gold, we were able to detect biotin directly to 1.2 $\mu g \cdot ml^{-1}$ (4.9 µM) at flow rate of 5 $\mu l \cdot min^{-1}$ in label-free manner. Thus, the detection limit of biotin is two orders of magnitude better than existing SPR devices. We have also explored the biotin-TiN interaction with periodic density functional theory via computational simulation and found that the exceptional biotin-TiN affinity may be due to the formation of both S-Ti and O-Ti bonds, whereas only S-Au bonds were formed on gold. In conclusion, we have proved that TiNG is a convincing alternative to existing gold-based SPR biosensors by both experimental and theoretical investigations.

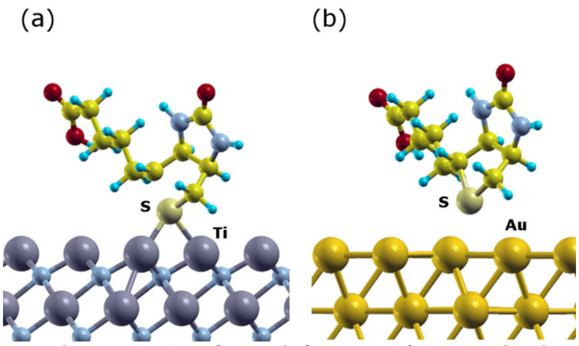

Fig. 1 a) Adsorption of biotin to the TiN (200) surface with formation of two S-Ti bonds and the adsorption energy is estimated to be -3.2 eV using DFT geometrical optimization, b) the absorption of biotin to the Au (111) surface is also calculated and it is found to be -0.8 eV which is much weaker and no S-Au chemical bond is formed.

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Revealing Nanostructure-Toxicity Relationship Using Nanoparticle Library Approach

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Nanomaterials are widely used in various industrial sectors, biomedicine, and many consumer products. However, their potential toxicity is still a major concern. Nanoparticles enter human cells, perturb cellular signaling pathways, affect various cell functions, and cause malfunctions in animals. Because a large portion of atoms in nanoparticles are on the surface, chemistry modification on their surface may change their biological properties significantly. We modified nanoparticle's surface using nano-combinatorial chemistry library approach. Novel nanoparticles were discovered to exhibit reduced toxicity or re-program cellular signaling machineries. Exploring large sets of bio-assay data with chemoinformatics and computational chemistry, quantitative nanostructure-activity relationship has been established and predictive models built to predict biocompatible nanoparticles.

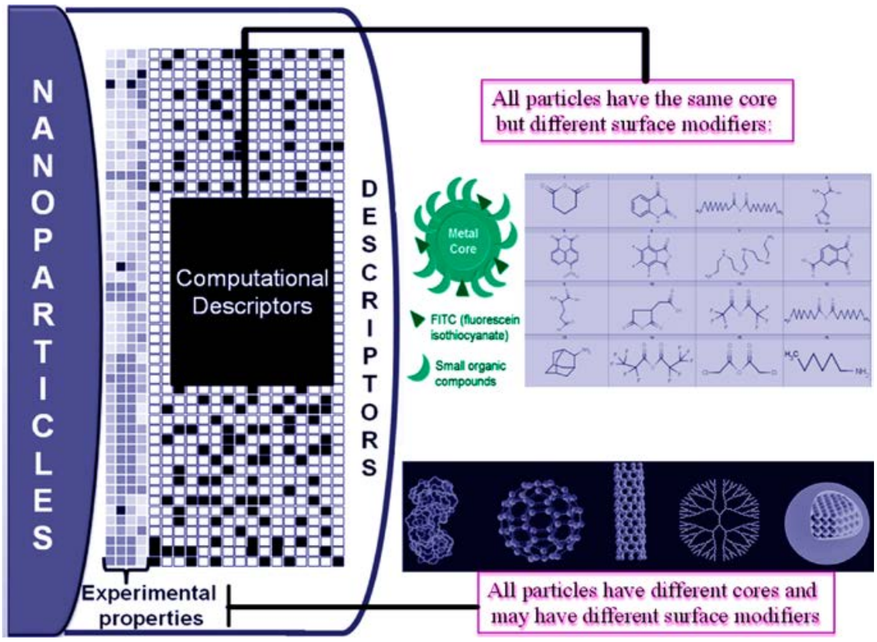

Figure 1. Applications of QNAR methods to nanomaterials with either diverse cores (characterized by experimental properties) or similar cores but diverse surface modifiers (characterized by computed chemical descriptors of modifying organic molecules). Adapted with permission from ref 31. Copyright 2010 American Chemical Society

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Novel III-V and II-VI Semiconductors for Intermediate Band Solar Cells

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Efficient utilization of the full solar spectrum is one of the primary challenges for solar power conversion technologies. The intermediate band solar cell (IBSC) is an attractive concept to achieve photovoltaic conversion efficiencies exceeding the Shockley-Queissar efficiency limit for a single junction cell by harvesting a large fraction of the solar spectrum [1,2]. In the simplest form of an IBSC the absorber is a semiconductor with a narrow, intermediate band (IB) of states in the band gap. When partially occupied, the IB serves as a stepping stone to transfer electrons from the valence to the conduction band through the absorption of two below bandgap photons. In theory, the addition of this "intermediate band" would provide a high photocurrent while maintaining a high output voltage and thus has a theoretical maximum efficiency limit of 63%. In contrast to multijunction cells, the device requires only a single p/n junction and therefore is a simple approach to achieve high efficiency.

Highly mismatched alloys (HMAs) are a broad class of materials that were proposed to be used for IBSCs [3,4]. The energy band structure of HMAs is determined by the interaction between localized states of the minority element and extended states of the host. Thus, substitution of highly electronegative minority atoms in majority atom sites, e.g. N substituting As in GaAs, leads to an anticrossing interaction between localized level of N and the conduction band of the GaAs host matrix. On the other hand, metallic minority atoms substituting more electronegative majority atoms, e. g. Se substituting O in ZnO, results in an anticrossing interaction between localized Se level and the valence band of ZnO. Cases of both types of band anticrossing (BAC), in the conduction band (CBAC) and the valence band (VBAC) were demonstrated for a variety of group III-V and II-VI compound semiconductors. We have fabricated a fully operational IBSC using GaNAs HMA in which CBAC splits the conduction band into two subbands with a lower subband playing the role of an intermediate band [4]. The key requirement for proper operation of an IBSC is a strong optical coupling between different bands of the light absorber. Here we present direct observation of these optical transitions in several HMAs. We use electroluminescence to demonstrate optical transitions involving intermediate band in a GaNAs IBSC structure (Fig. 1) [5] and photoluminescence to show optical transitions between conduction band and different valence subbands split by VBAC in ZnOSe alloy (Fig. 2). Recent results on a promising HMA candidate for IBSC, the GaNAsP dilute nitride alloy system [6] will also be discussed.

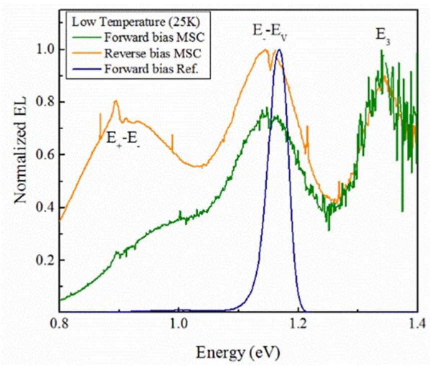

Figure 1 Low temperature electroluminescence in blocked and unblocked GaNAs intermediate band solar cell structures showing transitions from the various bands.

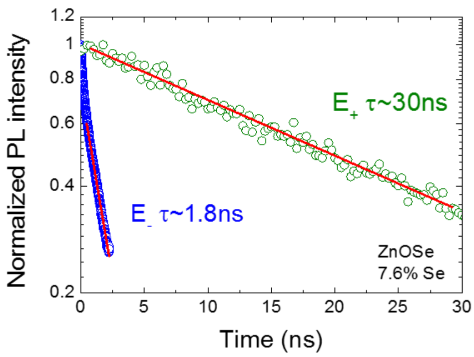

Fig. 2 PL decay curves from TRPL measurements corresponding to the E_+ (green open circles) and E_- (blue open circles) transitions for a ZnOSe HMA. The red curves indicate the exponential fitting lines.

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Bimetallic Au-M/TiO_2 catalysts for the oxidation of CO and propene

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Since the report by Haruta *et al*. in 1987 of high catalytic activity of supported nanocrystalline Au catalysts in CO oxidation at low temperature [1], Au catalysts have attracted significant amount of interest from researchers because they are active in various reactions of environmental importance. Despite the remarkable activity of Au catalysts in various oxidation processes, a wide range of uses of Au catalysts in industry is limited due to the lack of stability against sintering. In this regard, stabilization of supported Au nanoparticles (NPs) is of utmost importance in the field of Au catalysis. Besides fundamental studies on the dynamic behavior of Au NPs representing the sintering mechanism, various methods for increasing the stability have been developed. One of the successful methods for increasing the stability is through adding a second metal into Au NPs. Specifically, we have reported that AuIr, Au-Ag and Au-Cu bimetallic NPs on TiO_2 support show enhanced stability and activity compared to Au on TiO_2 [2-5]. Considering many reports of the improved catalytic activity as well as on the improved stability of supported Au-based bimetallic catalysts, it can be expected that Au catalysts for industrial applications will be comprise bimetallic NPs rather than pure Au.

Bimetallic catalysts were prepared by deposition-precipitation with urea by sequential deposition, iridium, silver or copper first, followed by gold deposition [2-5]. The effect of the addition of M to Au/TiO_2 with varying Au/M ratio was investigated in the reactions of CO oxidation and propene oxidation. This last reaction was performed in conditions close to those used in the studies of decomposition of volatile organic compounds (1200 ppm propene and 9 vol.% O_2 in He) [6]. The effect of the activation conditions (hydrogen or air) was investigated. The samples were investigated by HRTEM, HAADF, EDS, TPR, UV-Visible, XPS, DRIFTS coupled to CO adsorption and c-MES.

Improved catalytic activity and stability of Au-Ag, Au-Cu and Au-Ir supported on TiO_2 catalysts in the reaction of CO oxidation at room temperature was observed. In the case of Au-Ir system, the study of the optimization of the activation conditions the catalyst showed that activation under hydrogen generated a catalyst more active than the monometallic ones in propene total oxidation (Figure 1A), while Ir-Au/TiO_2 activated in air remained as poorly active as Au/TiO_2 (Figure 1B). Hence, the Ir-Au/TiO_2 catalyst activated under H_2 is more active in both CO and propene oxidation reactions than the one activated in air [6]. The presence of the hump in the conversion curve of Figure 1A will be discussed. Characterizations techniques revealed the formation of metallic particles of close size (2 nm) in both monometallic Au/TiO_2 and bimetallic Ir-Au/TiO_2 and the existence of different types of Ir-Au interaction, IrO_2-Au^0 interaction when the sample was calcined and Ir^0-Au^0 interaction when it was reduced, i.e., the formation of bimetallic particles. The enhanced catalytic activity or better said the synergetic effect of the reduced Ir-Au/TiO_2 catalyst was therefore attributed to the formation of bimetallic Au-Ir particles.

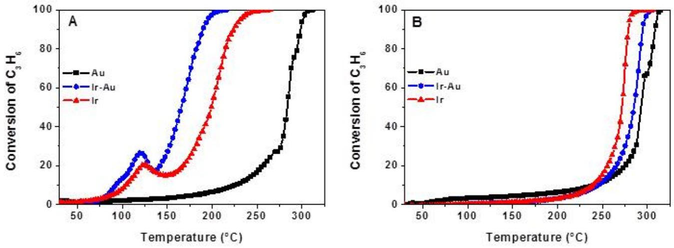

Fig. 1. Propene oxidation light-off curves of tested catalysts activated at 400 °C (A) under H_2, (B) under air

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Quantitative optical characterization for nano-photonic and nano-plasmonic applications in sensing, energy conversion and light emission and extraction

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We have recently established the use of the finite difference time domain (FDTD) method as a highly accurate computation technique to calculate the spectroscopic ellipsometry (SE) response of thin films and complex, 1D gratings. This cements the use of FDTD method as the only alternative numerical computation option to the long-established Rigorous Coupled-Wave Analysis (RCWA) technique. RCWA has been the method of choice for 1D structures, providing exquisite resolution with sub-wavelength and indeed sub-nm size resolution, in optical Critical Dimension (OCD) characterization based on SE and scatterometry data. However, it is well know that the complexity of RCWA results in excessive computational costs in the simulation of 2D gratings or metallic structures making FDTD a suitable complimentary tool to for optical data analysis of complex samples. Furthermore, FDTD method is well suited to model non-linear effects and/or non-periodic morphologies. To advance these goals, however, it is imperative to advance our understanding and to design strategies to improve the computational time of FDTD method calculations. Previously we showed that FDTD can simulate the SE response of prototypical samples based on far-field projections of near-field simulation based on the FDTD method with accuracy equivalent to ~0.5 monolayer precision in film thickness up to 70° angle of incidence (AoI). More recently, we provided an improved strategy that results in up to 1000 x improvement, respect to the standard solution, in the SE data calculation as estimated by the figure of merit χ^2 at angles of incidence of up to 80°. Significantly, the increase in accuracy results with simultaneous improvement in the computation time speeds by ~4x at 70° AoI and as large as ~20x for 40° AoI. We will revise the expected applications of the proposed SE-FDTD approach and our initial calculations for complex 2D grating.

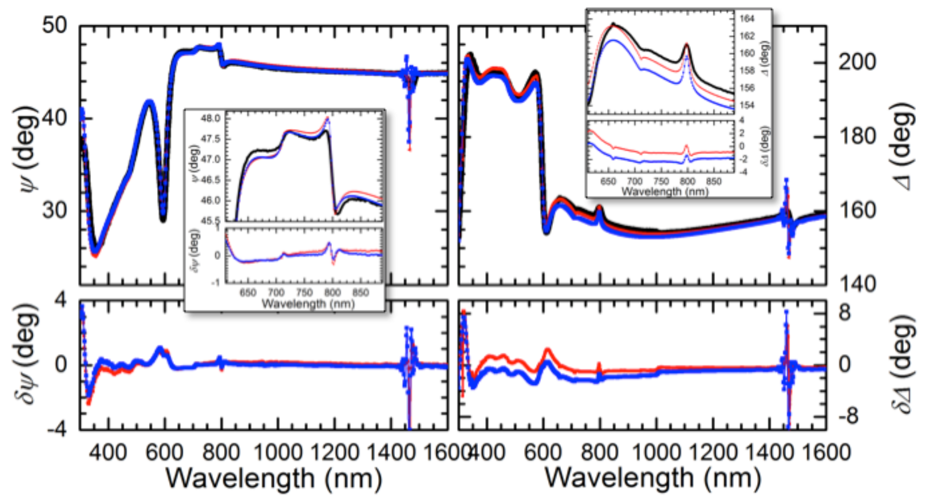

Fig. 1. Measurements and modeling @ 70° AoI for 1D PMMA grating, The measurements (black lines) are compared against RCWA (red liens) and FDTD (blue lines) modeling results. The insets (650 to 850 nm) exemplify the high level of detail obtained with both methods. The lower panels show the residuals (Exp-Model). Unpublished work presented at the ICSE7 conference, Berlin, Jun 2016, manuscript in preparation.

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Distribution and biological effects of CeO_2 nanoparticles in a simulated aquatic ecosystem --- a pilot study of a food web

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Considering the rapid development of nanotechnology, nanosafety has become a notable topic and been widely discussed in recent years. The environmental behavior of nanomaterials is still rarely studied due to their complexity in the real environment [1-2]. A fresh water ecosystem was accordingly constructed in the lab to study the distribution, bioaccumulation and biomagnification of CeO_2 nanoparticles (CeO_2 NPs) via long-term exposure. The results demonstrated most of the CeO_2 NPs administered in the aquatic system (88.66 ± 9.53%) deposited in the sediment when the partition equilibrium was reached 30 days later (Fig. 1A). The bioaccumulated Ce in each tested species was negatively correlated with its trophic level, showing no biomagnification of CeO_2 NPs through this food web in the simulated microcosm (Fig. 1B). CeO_2 NP exposure induced visual abnormalities in hydrophytes including chlorophyll loss in water silk and water lettuce, decreased pyrenoids in water silk and root elongation in water lettuce. The generation of hydroxyl radical (·OH) and cell wall loosening induced by CeO_2 NP exposure might mediate the increased root growth in water lettuce. Overall, environmentally relevant concentrations of CeO_2 NPs negatively affect certain plants in the freshwater aquatic ecosystem. As aquatic organisms are important for human consumption, nanomaterials may find their way from lower organisms to human beings through food chains, our findings clarify the potential risks and have implications for their safe use.

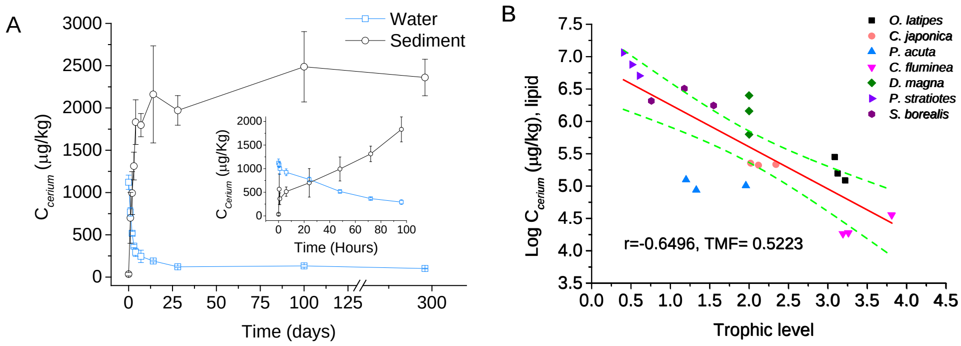

Fig. 1 (A) Time-dependent cerium concentration variations in water and sediment of the simulated microcosm after the initial spike. (B) Relationship between Ce concentration normalized by lipid content and the trophic level of each species. Each dot stands for the mean value of three samples from one tank. Green dashed lines stand for 95% confidence intervals. r is the correlation coefficient and TMF is the biomagnification factor.

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Flexible multifunctional supercapacitor devices

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Wearable electronic textiles that store capacitive energy are a next frontier in personalized electronics [1-3]. However, the lack of industrially weavable and knittable conductive yarns in conjunction with high capacitance, limits the wide-scale application of such textiles. Here pristine soft conductive yarns are continuously produced by a scalable method with the use of twist-bundle-drawing technique, and are mechanically robust enough to be knitted to a cloth by a commercial cloth knitting machine. Subsequently, we demonstrate a combination of textile industry available conductive yarn and conducting polymers can form a great basement for wearable energy storage devices. For example, a combination of metal oxide and conductive polymer can great enhanced tolerance of stretch-induced performance degradation of stretchable supercapacitors [2-6]. In case of self-healable PU sheel applied, a yarn supercapacitor can be self-healable. In addition, we demonstrate a new electrolyte comprising polyacrylic acid dual cross-linked by hydrogen bonding and vinyl hybrid silica nanoparticles (VSNPs-PAA) that addresses all the superior functions and provide an ultimate solution to the intrinsic self-healability and high stretchability of a supercapacitor. Supercapacitors with VSNPs-PAA as the electrolyte are self-healed, achieving an excellent healing efficiency of ~100% even after 20 cycles of breaking/healing. By a designed facile electrode fabrication procedure, they are stretched up to 600% strain with performance enhanced. Our research represents a solid progress in portable and wearable multifunctional devices with extreme self-healability and stretchability [1].

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Well-defined Graphene-based Hybrids for Energy Storage Applications

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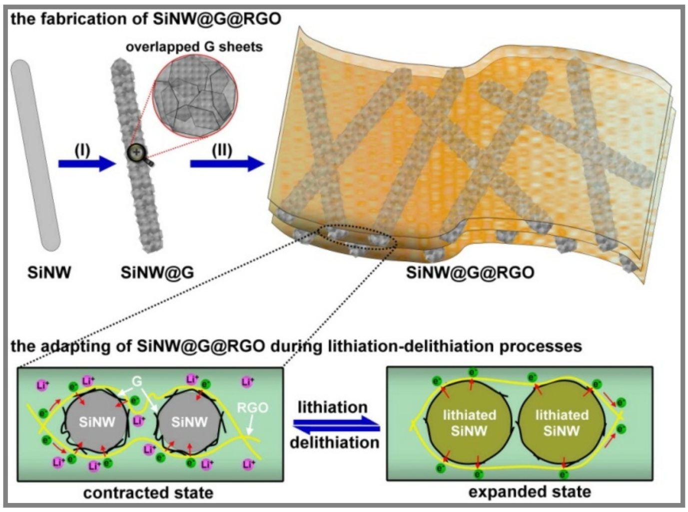
The preparation of high performance electrode materials is critically important for the development of powerful batteries. Graphene-based materials have attracted great attention recently as electrode in various energy storage devices, including lithium ion batteries and supercapacitors. However, the rational design and constructionl of the structures and functions of the material is always a big challenge. In this work, graphene-based materials with well-defined structures and functions, such as the graphene/SnXn nanocomposites with rationallly desinged interfaces, the graphene/Si nanocomposites with systematic structure control, have been developed by the rational design of various chemical approaches. Interestingly, the rational design of structures and functions of the electrode material provides efficient strategies for the development of high performance materials in lithium ion batteries.



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Design and synthesis of n-type photovoltaic polymers and small molecules

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Organic solar cells (OSCs) have emerged as a promising alternative technology for producing clean and renewable energy due to their potential of low cost, light weight and large area devices facilitated by scalable solution processes. Many works have demonstrated that alternating electron-rich (donor) and electron-deficient (acceptor) units in the polymer chain is an effective strategy to improve the absorption of p-type photovoltaic polymers [1-6]. We used DTP-based low band gap polymer, TTV2, and highest Jsc of 22.6 mA/cm^2 was achieved. On the other hand, all-polymer solar cells (all-PSCs) have been developed, where an n-type semiconducting polymer is used as the electron acceptor instead of a fullerene derivative blended with a p-type polymer [7-13]. The selection of p-type polymers with suitable energy levels, complementary absorption spectra, and appropriate miscibility with n-type polymers is also important to improve the power conversion efficiency of all-PSCs. In our group, all-PSCs based on PDI, NDI and NDTI-containing polymers were investigated systematically.

Non-fullerene small molecule acceptors have been intensively investigated and some exciting success has been realized in recent three years, due to their adjustable absorption spectra and energy levels. We designed and synthesized a BTA-based small molecule acceptor, which demonstrates high-lying LUMO energy level of -3.55 eV, and fullerene-free polymer solar cell based on P3HT: BTA1 realized the higher Voc of 1.02V and PCE of 5.24%, which is one of the highest value of P3HT:non-fullerene system [14].

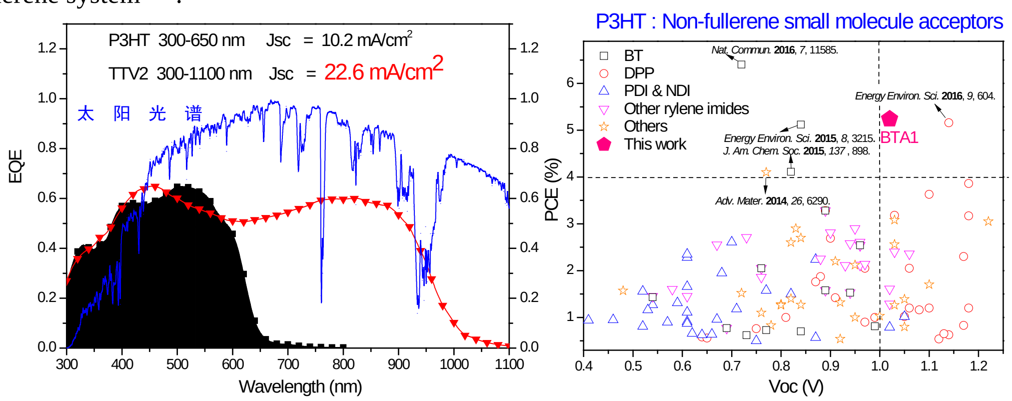

Figure 1. a) EQE of low band gap polymer of TTV2 ; b) summary of P3HT : non-fullerene acceptors.

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The Toxicological Effects of Nanosilver and the Influencing Factors

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Silver nanoparticles (AgNPs) have been extensively used as an antibacterial component in numerous healthcare, biomedical, and consumer products. Among the nanomaterial-based products, the application of nanosilver ranks first. Due to diverse usages, the environmental expsoure of nanosilver has become inevitable. Therefore, the adverse effects of this kind of nanomaterial on biological systems have become a major concern.

The aquatic toxicicological studies showed that AgNPs had higher toxicity than silver ions. Although the bioaccumulation of nanosilver was low with BCF less than 1, the ultrastructural alterations in fish target tissues, such as fall-off of the flat epithelial cell, disappearance of the surface microridges, and distorted taste buds in gill tissues, were observed under exposure [1]. The developmental toxicity study based on Medaka embryo revealed that nanosilver exposure induced all sorts of morphological changes (Fig.1), including spinal deformity, delayed absorption of yolk sac, abnormal eye development etc [2]. In addition, the inhibition of fish optic tectum width in exposure groups confirmed that AgNPs hindered the fish neurological development. Animal studies showed that long-term nasal instillation of AgNPs caused neurological behavior changes, like reduced locomotor activities, impaired motor coordination. Histological examination revealed nanosilver-induced cellular impairment in rat brains. *In-vitro* experiments using primary cerebellum granule cells indicated that AgNP exposure caused oxidative damge through excessive ROS generation, and decreased calcium channel protein expression [3]. This finding well explained the molecular mechanism for *in-vivo* neurotoxicities of AgNPs. The penatration of nanosilver through BBB barrier was explored by studying the interaction between the nanoparticles and the plasma Kallikrein-kinin system (KKS). The results showed that nanosilver could increase vascular permeability by inducing dysfunction in the adherent junction of endothelial cells through the cascade activation of the KKS [4]. The factors, including particle size, surface charges, ion release and coating ligands etc. were found to influence the biological effects of nanosilver [5,6]. These toxicological data of nanosilver provided substatial evidences on the potential risks from its unintentional exposure.

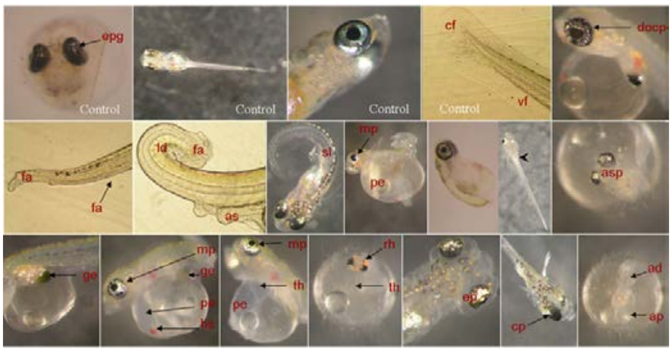

Fig. 1 Nanosilver exposure induced morphological changes in the development of Medaka embryos

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