4th SCIENTIFIC FEDERATION CONFERENCE
Proceedings in
SciFed Nanotech Research Letters

SCIENTIFIC FEDERATION
ABODE FOR RESEARCHERS

Global Nanotechnology
Congress and Expo

April 21-23, 2016 Dubai, UAE

SCIENTIFIC FEDERATION
ABODE FOR RESEARCHERS

ABOUT SCIENTIFIC FEDERATION

The Scientific Federation is expert-driven and initiated to organize and facilitate proficient international scientific conferences worldwide with associating the world class researchers. The Scientific Federation is establishing outstanding, direct communication between the researchers whether they are working in the similar field or in interdisciplinary research activities. The Scientific Federation provides an international forum for the appearance and discussion of cutting edge research in the science, medical, clinical, technology, engineering, life sciences and their related researches. In this regard, meet Inspiring Speakers and Experts at our universal meetings inclusive all scientific conferences, workshops and symposiums annually on Science, Technology, Medical, Pharma, Clinical, Engineering and Business. Scientific Federation is provider of information, solutions to enhance the performance and progress of science, medical, health, clinical, engineering and technology professionals, and is empowering them to make better decisions, deliver better care, and sometimes make groundbreaking discoveries, that advance the boundaries of knowledge and human progress.

WHO WE ARE?

We are exploring the research to the world through the world-class scientists.

"Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world."

- Albert Einstein

Now-a-days, the science and technology is growing in rapid way in all aspects of medical, clinical, physics and pharma. In this regard, we are taking into the step to transform the technology and research through the world class professionals, to get awareness worldwide by organizing the international conferences. Which may also lead to helpful in maintain the peaceful collaboration between the countries.

Our devoted team is very much proficient to organize the international conferences, and they are having much experience and expertise in this aspect.

WHAT WE DO?

The Scientific Federation was established with an aim to organize standard and productive conferences across the globe to bring world class researchers on a unique platform and to explore the interdisciplinary research activities. The Scientific Federation promote discussions and the free exchange of innovative thoughts at the research frontiers of the science, medical, health, clinical, engineering and technology.

We promise that every conference is significant for our partners, the professionals attending, as well as the sponsors and the associations. Scientific Federation collaboration ensures responsibility to the peak standards of service, punctual delivery, reliability and open communication.

The Scientific Federation Conferences provides a valuable means of disseminating information and ideas in a way that cannot be achieved through the usual channels of communication and presentations at large scientific meetings.

Team devoted to Scientific Federation, offers expertise with broad environment familiarity and associations with an array of convention centers, vendors, and hotel chains to contribute to your core. Scientific Federation encourage and promotes organizations of all types and sizes to contact Scientific Federation at (contact@scientificfederation.com)

WHY SCIENTIFIC FEDERATION?

Scientific Federation conferences are covering a broad range of research in the Science, Technology, Medical, Pharma, Clinical and Engineering. Attending a Scientific Federation Conferences are immense access to ground-breaking research presentations and discussions, and the informal atmosphere and smaller size of a conferences provides the best break to *develop collaborations, get innovative ideas and opportunity for your own work - and plan for the subsequent stage of your scientific career.*

All researchers, including post docs and graduate students, are encouraged to attend the Scientific Federation conferences in their respective research field. All conferences offer the opportunity to exploit your knowledge by submitting a poster for the poster sessions.

B2B meetings will be arranged during the conference time and this is the best platform to develop new partnership & collaborations worldwide.

FOR ATTENDEES

Thank you! We are pleased you are joining us at a Scientific Federation Conferences.

Your meeting was planned by devoted volunteers from your obedience and Scientific Federation staff. We have worked hard to make sure it is the most tremendous conference you attend this year! During the time period, you will have lots of time for networking and recreation with members of your Scientific Federation attendees. All sessions are informal and intended to provide abundant time for discussion.

The Scientific Federation meetings are

- *Created by professionally for scientists*
- *Forums to discuss pre-publication research at the forefront of your field*
- *Informal communities of experts in the field*
- *Held in isolated locations to diminish diversions and exploit time for debate and networking*

A detailed program and as well as information about the site, travel, poster guidelines, and other details for your meeting is accessible on our web site. Refer to the respective conference site with your research interests.

For any further queries you can directly contact through email to the respective conference secretary.

SCIENTIFIC FEDERATION MISSION

Our Mission is to bring inspiration and innovation to every researcher in the world. We create a platform to interact and share their research. We will be a destination for researchers and maintain a pleasant relationship.

SCIENTIFIC FEDERATION VISION

Our vision is to create a home environment for researchers across the globe.

ASSOCIATIONS/COLLABORATIONS

- *Exploring and visualize worldwide*
- *A great opportunity to network with your peers*
- *A way to interact with world class professionals*
- *The opportunity to expand collaboration*
- *Amplified trademark awareness through an additional channel*
- *Closer business relationships*
- *Providing advantages to the members through a variety of first-rate organizations to connect to the world*

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Upcoming Conferences

SCIENTIFIC FEDERATION UPCOMING CONFERENCES

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Keynote Forum
Day 1

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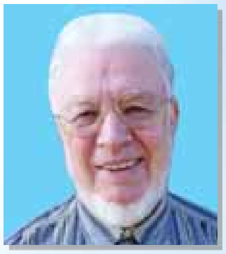
The Physical Foundation of the Exponent 3/2 Instead of 2 on *h* for Conical/Pyramidal Indentation, and Unprecedented Applications

Gerd Kaupp

University of Oldenburg, Germany

Berkovich indentation loading curves are still claimed by legal worldwide ISO standard to follow the Sneddon/Love exponent 2 on the depth h, as in textbooks. However the exponent 3/2 on h has been hundredfold validated with linear correlation coefficients of r >0.999 or often >0.9999 since 2000 from published loading curves for all kinds of indentation techniques, materials, and response mechanisms. Unfortunately, numerous nano and micro mechanical parameters continue to be deduced from the wrong exponent 2, leaving materials' properties incorrect. This includes also legally enforced ISO-hardness and -modulus. The applications of the correct exponent 3/2 to loading curves are highly versatile, including penetration resistance, indentation energy, phase transitions with their transition energy and activation energy. It follows that exactly 80% of the applied work is used for the penetration and 20% for all other far-reaching processes. Apart from empirical and practical wealth the serious liability problems with failing materials require the physical reason for the correct exponent. Fortunately, the deduction of the exponent 3/2 on h for conical/pyramidal indentations can now be deduced on an elementary mathematical basis. The physical foundation for the law FN = k h3/2 (FN = normal force, k = penetration resistance) introduces straightforward new thinking. The new state-of-the-art requires redefinition and recalculation of all mechanical properties from half a century that depend on the wrong exponent 2. Textbooks must be rewritten, liability problems from falsely calculated materials' properties finally avoided. The new parameters for the mechanical properties allow for improvements of materials.

Biography :



Gerd Kaupp reached his PhD in chemistry from the University of Würzburg, Germany in 1964. After postdoctoral years he was appointed associate professor at Freiburg University, Germany, and 1982 full professor at Oldenburg University, Germany. He was visiting professor at various universities and served on the Editorial Board of several scientific journals. His recent research interests concentrate on kinetics, wasteless solid-state chemistry, reactive milling, AFM, SNOM (optical resolution <10 nm, local fluorescence and Raman spectroscopy since 1995), nano-scratching, and quantitative nano-indentation without simulations or data fittings on all types of materials. He authored more than 300 scientific publications.

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Impact of Nanobiotechnology on the Future of Medicine (Nanomedicine): The Road toward Precision Medicine

Shaker A. Mousa
Professor, Vice Provost, Executive Vice President, and Chairman,
The Pharmaceutical research Institute, ACPHS, USA

Over the past few years, evidence from the scientific and medical communities has demonstrated that nanotechnology and nanomedicine have tremendous potential to profoundly impact numerous aspects of cancer and other disorders in term of early diagnosis and targeted therapy. The utilization of nanotechnology for the development of new nano-carrier systems has the potential to offer improved chemotherapeutic delivery through increased solubility and sustained retention. One of the major advantages of this cutting edge technology is its unique multifunctional characteristics. Targeted delivery of drug incorporated nanoparticles, through conjugation of tumor-specific cell surface markers, such as tumor-specific antibodies or ligands, which can enhance the efficacy of the anticancer drug and reduce the side effects. Additionally, multifunctional characteristics of the nano-carrier system would allow for simultaneous imaging of tumor mass, targeted drug delivery and monitoring (Theranostics). A summary of recent progress in nanotechnology as it relates specifically to nanoparticles and anticancer drug delivery will be reviewed. Nano Nutraceuticals using combination of various natural products provide a great potential in diseases prevention. Additionally, various Nanomedicine approaches for the detection and treatment of various types of organ specific delivery, vascular targeting, and vaccine will be briefly discussed.

Biography :

Mousa finished PhD from Ohio State University, College of Medicine, Columbus, OH and Post-doctoral Fellowship, University of Kentucky, Lexington KY. He also received his MBA from Widener University, Chester, PA. Dr. Mousa is currently an endowed tenure Professor and Executive Vice President and Chairman of the Pharmaceutical Research Institute and Vice Provost for Research at ACPHS. Prior to his academic career, Dr. Mousa was a senior Scientist and fellow at The DuPont Pharmaceutical Company for 17 years where he contributed to the discovery and development of several FDA approved and globally marketed diagnostics and Therapeutics.

He holds over 350 US and International Patents discovering novel anti-angiogenesis strategies, antithrombotics, anti-integrins, anti-cancer, and non-invasive diagnostic imaging approaches employing various Nanotechnology platforms. His has published more than 1,000 journal articles, book chapters, published patents, and books as editor and author. He is a member of several NIH study sections, and the editorial board of several high impact Journals. His research has focused on diagnostics and therapeutics of angiogenesis-related disorders, thrombosis, vascular and cardiovascular diseases.

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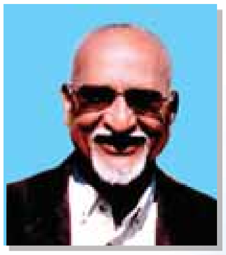
In the Realm of Nanoscience and Nanotechnology: Some Critical Appraisal

Mukunda P Das
The Australian National University, Australia

Nanoscopic science/technology is a very broad area covering physics, chemistry, materials science, biology and several domains of engineering. In all of these disciplines a remarkably intense amount of activity has been taking place. During the past two decades, besides many useful scientific information, a great amount of noise has been created. In this talk first of all I shall present a largely pedagogic overview of nanoscopic systems in the quantum realm, with particular emphasis on the relevant scientific fundamentals. Then I shall cover most of the issues related to the basic understanding of nanoscience, which has a pivotal role to useful applications in nanotechnology. As an example I shall focus on a heavily researched current topic 'quantum electron transport' and discuss some crucial points in our understanding leading to applications.

Biography :



Mukunda P Das completed his PhD from Indian Institute of Technology, Roorkee (formerly known as University of Roorkee) and has postdoctoral experience from many institutes, namely ICTP, Trieste, Max-Planck Institute, Stuttgart, Louisiana State University, Baton Rouge, USA and others.. He has been in the Research School of Physics and Engineering since 1987 and currently a School Professor. He has served as editorial board member of many reputed journals: J. Physics, Condensed Matter, IOP, ANS J. Nanosc. and Nanotech, IOP, to name a few. His area of specialization is in physics of condensed matter with particular emphasis on meso/nanoscience and superconductivity.

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Advanced Functional Polymeric Nanomaterials: Synthesis, Optoelectronic, Highly Selective Dispersion of SWCNTs and Solar Cell Applications

Der-Jang Liaw, Chou-Yi Tsai, Po-I Wang, Qiang Zhang, Ying-Chi Huang, Wei-Ting Wang and Yian Tai
National Taiwan University of Science and Technology, Taiwan

Novel nanomaterials such as polyimides (PIs), polyamides (PAs), conjugated polymers and polynorbornenes (PNBs) were successfully prepared from various polymerization techniques including low temperature polycondensation, Suzuki coupling and ring-opening metathesis polymerization (ROMP). PIs derived from different architecture designs revealed unique physical-mechanical, electrical and chemical properties. Moreover, the PIs films also exhibited high thermal stability (Tg > 300oC), transparency above 90% in visible light region of 400-700 nm and flexibility which are important for optoelectronic applications. PAs with the pyridine moiety displayed good film forming abilities, flexibility, high thermal resistance and protonated emission located on 552 nm due to excimer formation. Conjugated polymers were used for single-walled carbon nanotube (SWCNT) wrapping to separate metallic and semiconducting nanotubes. Their chiralities such as (6,5), (9,5) or (8,7) were characterized by photoluminescence-excitation (PLE) maps as well as UV/vis/NIR absorption spectra. Polytriarylamines- or poly(triarylamine-fluorene)-based conjugated polymers with water/alcohol solubility were applied for the hole-transporting materials of solar cells such as dye-sensitized solar cells (DSSCs) and organic photovoltaics (OPVs). The conjugated polymers and PNBs with hexa-peri-hexabenzocoronene (nanographene) were well dispersed in cyclohexylpyrrolidone (CHP) by bath sonication and possessed exfoliation emission in PLE maps. PNBs synthesized via ROMP showed excellent transparency (90 %) and high thermal stability (Tgs > 160 oC). Triarylamine-containing polymers had electrochromic properties and capacity for multiple colour change reversibilities. The triphenylamine-alt-fluorene conjugated copolymer with hexaphenylbenzene (HPB) and pyrene as asymmetrical pendant groups showed the strong near-infrared (NIR) electrochromic absorbance attributed to intervalence charge transfer by the incorporation of the HPB moiety. These polymeric materials had high organo-solubility in common solvents and as a result can be used to fabricate optoelectronic devices including solar cells, organic field effect transistors, polymer memories, and smart windows.

Biography :

Der-Jang LIAW, Polymer Science Doctor (Ph.D. Polymer), now he is a Chair professor of Chemical Engineering, NTUST. He got Master and Ph.D. degrees in polymer science of Osaka University (Japan). He has published about 360 SCI papers (h-index = 44 from ISI Web of Knowledge), 180 conference papers and 60 patents. In 2009, He was a recipient of the International Award from the Society of Polymer Science, Japan with Prof. J. M. J. Frechet (USA) and Prof. K. Muellen (Germany). He received Outstanding Polymer Academic Research Prize in 2012 and Lifetime Achievement Prize from Polymer Society of Taiwan in 2013. He has been a fellow of The Polymer Society of Taiwan since 2014. He has been Academician of the Russian Academy of Engineering since 2011. He is the Editorial Advisory Board of Polymer (UK), Polymer Journal (Japan), Polymer International (UK), Journal of Polymer Research (1994~2001), High Performance Polymers (UK) (NASA Editor-in-Chief), Materials (Switzerland) and Soft Nanoscience Letters (USA). He is also the International Advisory Board of Polycondensation 2014 (Tokyo) and 2016 (Moscow), IUPAC Macro2008 (Polymer Synthesis, Session Chairman), International Advisory Board of European Polymer Congress 2009 (Graz, Austria), International Advisory Committee of Pacific Polymer Federation (PPF), International Advisory Board of International Symposium on Olefin Metathesis (ISOM 19 [France], ISOM20 [Japan] and ISOM21 [Austria]), honorable guest of Nanotechnology-2015 (Dubai, UAE), Federation of Asian Polymer Societies Polymer Congress, 4FAPS-IPC 2015 (Kuala Lumpur, Malaysia), member of Asia Polymer Association, APA-2015 (India) and Organizing Committee of Nanotechnology and Material Science, Nanotechnology-2016 (Dubai, UAE). Currently, Prof. LIAW's researches including: (1) synthesis of conjugated polymers used for carrier transporting materials of solar cells, (2) nanographenes-containing polymers, (3) Selective dispersion of carbon nanotube by conjugated polymers wrapping and (4) synthesis and characterization of high performance polyimides (PIs) and polyamides (PAs) with organo-solubility, thermal stability and optoelectronic properties. He studies on synthesis of all possible functional polymers via various polymerization techniques including free radical polymerization, ring-opening metathesis polymerization (ROMP), UV curing and moisture curing polymerizations for adhesives and coatings, polycondensation or polymer reaction for optoelectonic devices, biomaterials, next-generation semiconductor materials and solar energy applications.

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New directions in Plasma Nanoscience: From plasma-nano-catalysis and sustainable nanotech to nano-plasmas

Kostya (Ken) Ostrikov

Queensland University of Technology (QUT), CSIRO, Australia

In this talk, I will focus on recent new research directions in the Plasma Nanoscience field, specifically:

1) Plasma-nano-catalysis;

2) Sustainable, green-chemistry based nanotechnology; and

3) Nano-plasmas generated by intense radiation.

In each area, as common to research in the Plasma Nanoscience field, plasma-specific effects and phenomena will be the main points for discussion. For example, in area 1) I will provide some examples of synergistic actions of low-temperature plasmas and nanometer-sized (mostly) inorganic catalysts that lead to value-added products. In area 2), I will introduce the sustainable life-cycles of natural-resource-derived plasma-made nanomaterials, focusing in particular on those effects that help reforming nature-derived precursors into functional nanomaterials. Some of the examples of such nanomaterials include graphenes for energy storage or environmental sensing devices. In area 3), I will pose a fundamental question if it is feasible to reduce the size of plasmas, the fourth state of matter, to the nanoscale and will discuss the physical limitations on the way to achieve nano-plasmas as well as the effective means to overcome such limitations. The mechanisms for the production of transient, highly-non-equilibrium nanoplasmas are introduced. Some of the interesting effects that arise due to the nanoscale plasma-surface interactions and the interesting properties of the nanostructures in relevant cases are discussed. These interactions can be enabled by low-pressure and atmospheric-pressure plasma discharges. Selected recent environmental and energy applications of functional nano-materials produced using plasmas are summarized.

Biography :

Kostya (Ken) Ostrikov is a Science Leader of the Office of Chief Executive with CSIRO, and a Professor with Queensland University of Technology, Australia. His achievements include Pawsey (2008) medal of Australian Academy of Sciences, Walter Boas (2010) medal of Australian Institute of Physics, Building Future Award (2012), NSW Science and Engineering Award (2014), election to the Academy of Europe (2015), 6 prestigious fellowships in 6 countries, several patents, 3 monographs, and 470 journal papers. His research on nanoscale control of energy and matter contributes to the solution of the grand challenge of directing energy and matter at nanoscales, to develop renewable energy and energy-efficient technologies for a sustainable future.

Development of Nanocatalysts for Fuels from Biomass using Microreactors and Tubular Reactors

Debasish Kuila and Vishwanath Deshmane, Richard Abrokwah, Sri Lanka Owen, Shirish Mehta, and Shihuai Zhao
North Carolina A & T State University, USA
Louisiana Tech University, USA
Tianjin Polytechnic University, China

The development, optimization and improvement of catalysts for use in commercially viable processes provide major challenges for scientific research. Thermal conversion of biomass into fuels in the presence of catalysts using microchannel microreactor and tubular reactors is a major focus of research at our NSF-CREST Bioenergy center.

Microreactors provide a relatively simple and quick means for screening catalysts in Fischer-Tropsch (F-T) synthesis. The microchannels of Si-microreactors, fabricated using ICP etching, were coated with sol-gel encapsulated nanocatalysts such as Fe, Co, Ru salts. The F-T studies show that the highest conversion of CO on Ru-Fe-Co/SiO2 reaches ~78% at 220 °C by adding only 0.4 wt.% Ru when the H2:CO (syn-gas) ratio is 3:1. This is much higher than that observed for Fe-Co/SiO2 catalyst (63%) coated in the straight microchannels. The stability studies with each individual catalyst show that Co is more stable than Ru or Fe.

In parallel, we are developing novel steam reforming catalysts for the efficient and economical production of clean hydrogen for PEM fuel cells. To improve the stability and surface area of the catalysts, and their activities, we have developed one-pot synthesis of nanocatalysts in mesoporous titania and silica. Mesoporous TiO2 and SiO2 (MCM-41) containing Cu, Co, Ni, Pd, Sn and Zn catalysts (M-MCM-41 and M-TiO2) were characterized using BET, XRD, TGA-DSC, TEM, SEM-EDX, ICP-OES, and H2-TPR studies. The catalysts exhibited surface area, and pore sizes in the range of 99-1039 m2/g, and 2.63-4.69 nm, respectively, based on the nature of the metal and the support. While the addition of metal to TiO2 (except Pd) led to the formation of M-TiO2 catalysts with much higher surface areas than TiO2 itself, the addition of metal decreased the surface area in M-MCM-41 catalysts. Steam reforming of methanol (SRM) studies showed that Pd, Ni and Zn were more active on TiO2, while Cu-MCM41 and Pd-MCM-41 were reasonably active among others on the MCM-41 support. Based on methanol conversion and CO selectivity, Zn-TiO2 and Cu-MCM-41 showed best SRM results. The remarkable differences in catalytic performances of different M-TiO2 catalysts and the activities of MCM-41 supported catalysts will be presented.

Biography :

Debasish Kuila is currently the Research Director of NSF-CREST Bioenergy Center and a professor of Chemistry at North Carolina A & T State University where he joined as Chair of the Chemistry Department in Fall 2006. He is an affiliate of the Joint School of Nanoscience and Nanoengineering with UNC-Greensboro. He is also an adjunct professor of Wake Forest School of Medicine. He received his B.Sc. (Honours) in Chemistry from the University of Calcutta, M. Sc. from Indian Institute of Technology, Madras, and Ph.D. in Chemistry from The City University of New York in 1984. He did his postdoctoral work at The University of Michigan/Los Alamos National Laboratory and Northwestern University. After over eight years at Hoechst Celanese and Great Lakes Chemical Corporations as a senior research chemist/project leader of exploratory research, he moved to Purdue University in 2000 as a principal research scientist to do Nanoscience, and taught chemistry at Indiana U-Purdue U, Indianapolis. In 2002, Dr. Kuila joined Louisiana Tech as an associate professor of Chemistry and an affiliate of the Institute for Micromanufacturing. He teaches general chemistry, and graduate level biochemistry (lab) and materials/analytical/bionanoscience courses. His research interests are interdisciplinary: from materials/biomaterials to drug delivery to catalysis/biocatalysis to surface modification for in vitro cell biology applications. His research and educational activities have been supported by grants from Louisiana Board of Regents, Pfizer Corporation, NSF and DOE. He was the co-chairperson of the PhD Nanoscience Establishment Committee at JSNN (Joint School of Nanoscience and Nanoengineering with UNCG) and played a significant role in its planning and the preparation of the documents for UNC General Administration He has 12 U.S. Patent/Patent applications and has published five book chapters and over 50 journal articles. He is a peer reviewer of Nanotechnology, Nanomedicine, Langmuir, J. Phys. Chem., J. Catal., and other ACS journals.

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Controlled growth of graphene, carbon nanotubes and transition metal dichalcogenides

Eui-Hyeok Yang
Stevens Institute of Technology, USA

Initially motivated by work with graphene, the broad class of two dimensional (2D) materials has generated enormous interest in the research community because of its potential for use in electronics, photonic devices, and other applications. Semiconducting transition metal dichalcogenides (TMDs) have found been researched for fundamentals as well as applications including optoelectronics. This is due to their direct bandgaps in the visible, high absorption relative to their thicknesses, ultrafast carrier separation with other 2D materials, and the new fields of spintronics and valleytronics. For these applications, TMDs are frequently patterned post-growth or post-exfoliation even though this is known to compromise device performance. In order to avoid contamination, various techniques such as "all-dry" material transfer and Cu and BN encapsulation have been developed which are time consuming manual processes. Here we develop a direct growth process to enable localized, patterned, single crystalline or large-scale polycrystalline monolayers of MoS2, WS2, WSe2 and MoSe2 along with their heterostructures by the chemical vapor deposition method. Our new growth method permits the growth of TMDs on the 'contacted' areas only, enabling fabrication of 2D layers in controlled shapes without lithography at desired locations on the substrate. Our growth-patterning techniques are a possible route towards realizing devices with fewer processing steps without introducing device-degrading levels of contamination. If the technique could be developed to be highly reliable and high fidelity it could have a large impact on the future research and commercializability of TMD-based devices. We also demonstrate an approach toward controlled growth of carbon nanotubes (CNTs) atop graphene substrates, where the reaction equilibrium between the source hydrocarbon decomposition and carbon saturation into/precipitation from the catalyst nanoparticles shifts toward CNT growth, rather than graphene consumption.

Biography :

E. H. Yang is a Professor of the Mechanical Engineering Department at Stevens Institute of Technology. Dr. Yang was a Senior Member of the Engineering Staff at NASA's Jet Propulsion Laboratory. He received a number of awards, including the prestigious Lew Allen Award for Excellence at JPL in 2003, in recognition of his excellence in advancing the use of MEMS-based actuators for NASA's space applications. He is an Associate Editor and Editorial Board of several journals, including the IEEE Sensors Journal. As Principal Investigator, he has been responsible for obtaining extremely competitive research funding from several federal agencies including NSF, AFOSR, US Army, NRO, NASA and DARPA (including 6 NSF and 3 AFOSR grants, and 5 NASA and 3 NRO contracts) with the total amount exceeding $7M.

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Scientific Sessions
Day 1

Session 1

Nanomaterials
Synthesis of Nanomaterials and Nanoparticles
Recent trends in nanotechnology
Emerging areas of materials science

Title:	Evaporation Kinetics of Sessile Droplets of Aqueous Suspensions of Inorganic Nanoparticles **Victor Starov**, Loughborough University, UK
Title:	Clay particles, their properties in aqueous solutions and their use in applications **Debbabi Mongi**, University of Monastir, Tunisia
Title:	Nanocrystalline Hydroxyapatite-Phosphonate Composites **Heinz Hoffmann,** University of Bayreuth, Germany
Title:	InAs HEMTs for High Frequency and High Speed Applications **Edward Yi Chang**, National Chiao Tung University, Taiwan
Title:	Multi-functionality of Moth-eye Film **Yoshihiro UOZU**, Mitsubishi Rayon Co., Ltd., Japan
Title:	Beneficial Modification of Heterogeneous Catalysts Using Microwave Radiation or Cold Plasmas **Mike S Scurrell**, University of South Africa, South Africa
Title:	Synthesis and characterization of aqueous only medium gold nanoparticles using hydrogen gas as a reducing agent **Getahun Merga**, Andrews University, USA
Title:	Semiconductor Materials: Delivery, Assembly and Potential Applications **Neerish Revaprasadu,** University of Zululand, South Africa
Title:	Photocatalytic reduction of Chromium(VI) by In2S3 microspheres present in water and wastewater under visible light illumination **Rengaraj Selvaraj**, Sultan Qaboos University, Oman
Title:	ZnO Nanocomposites for Thermoelectrics **Devendraprakash Gautam**, University College Cork, Ireland
Title:	Morphology as an essential parameter in designing efficient photocatalysts **Lucian Baia**, Babes-Bolyai University, Romania
Title:	Increased 3HV Concentration in the Bacterial Production of 3-Hydroxybutyrate (3HB) and 3-Hydroxyvalerate (3HV) Copolymer with Acid-digested Rice Straw Waste **Kyoungphile Nam,** Seoul National University, Korea
Title:	Nanoscale and Multiscale Approaches to the Design of Building Materials **Hendrik Heinz**, University of Colorado-Boulder, USA
Title:	Protein Corona Breakdown in Reactive Metal Nanoparticle Systems **Matthew N. Martin**, Khalifa University, UAE
Title:	Controlled Nano Trapping and Concentration by Ultrasound **Junhui Hu**, Nanjing University of Aeronautics and Astronautics, China

Evaporation Kinetics of Sessile Droplets of Aqueous Suspensions of Inorganic Nanoparticles

Victor Starov

Loughborough University, UK

Nanosuspensions comprise solid nanoparticles with a typical size of 1–100 nm suspended in a liquid. Nanofluids have been found to possess enhanced thermophysical properties such as thermal conductivity, thermal diffusivity, viscosity and convective heat transfer coefficients as compared to those of base fluids like oil or water. As a result, nanosuspensions have found applications in wide technological areas, for example, industrial cooling application (automotive industry and microchips), smart fluids, extraction of geothermal power and other energy sources, as well as in nuclear reactors. The application of nanosuspensions and nanoemulsions has drawn attention in a broad array of fields. Evaporation kinetics of sessile droplets of aqueous suspension of inorganic nanoparticles on solid substrates of various wettabilities is investigated from both experimental and theoretical points of view. Experimental results on evaporation of various kinds of inorganic nanosuspensions on solid surfaces of different hydrophobicities/hydrophilicities are compared with our theoretical predictions of diffusion limited evaporation of sessile droplets in the presence of contact angle hysteresis. The theory describes two main stages of evaporation process: (I) evaporation with a constant radius of the droplet base when the contact angle decreases from static advancing contact angle down to static receding contact angle and (II) evaporation with constant contact angle equal to the static receding contact angle when the radius of the droplet base decreases. Theoretically predicted universal dependences for both evaporation stages are compared with experimental data, and a very good agreement is found.

Biography :

Victor Starov has completed his PhD from Russian Academy of Sciences, DSc from Sant Petersburg University, Russia. Was a Visiting Professor at University of Texas at Austin, USA, Instituto Pluridisciplinar, Madrid, Spain, Toulouse University, France and so on. Since 1999 he is a Professor at the Department of Chemical Engineering, Loughborough University, UK. He has published more than 274 papers in reputed journals and has been serving as an editorial board member of Advances in Colloid and Interface Science, Desalination, Colloid and Interface Science Communications and others. Fellow of the Royal Society of Chemistry.

Nanocrystalline Hydroxyapatite-Phosphonate Composites

Debbabi Mongi

University of Monastir, Tunisia

Two new hybrid compounds apatite-phosphonate are prepared by hydrothermal method. For that, a vinyl or methyl phosphonic acid variable quantity is added during apatite synthesis. X-rays diagrams confirmed the apatite structure conservation and permitted to evaluate crystallite sizes. The values are in nanometric range (25-2.5 nm).IR and Raman spectra show apatite characteristic bands and also phosphonate bands.^{31}P MAS-NMR spectra present the apatite isotropic signal and new signals attributed to phosphonate organic phosphor. ^{13}C MAS-NMR reveals vinyl or methyl characteristic signals. Thermo gravimetric analysis shows a weight loss between 200 and 600 °C attributed to the organic moiety decomposition. DTA analysis confirms the exothermic effect. The value of this loss increases with the increase of grafting, in good agreement with the results of the ^{13}C chemical analysis.Specific area measurements show obtaining porous hybrid apatite-phosphonate compounds whose porosity is controlled by the rate and the nature of the graft. The observation by TEM and AFM powders of these new materials shows that the crystallite size is in the nanometer scale and decreases with the amount of graft added during synthesis.

Biography :

Mongi Debbabi has completed his PhD from University of Bologna, Italy and postdoctoral studies from Université P.et M.Curie, Paris, France. He is Professor Emeritus at the University of Monastir, Tunisia. He has published more than 40 papers in reputed journals and has been serving as an editorial board member of reputed journals.

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Clay particles, their properties in aqueous solutions and their use in applications

H. Hoffmann

University of Bayreuth, Germany

Clay particles from Laponite and Hetorite are nanoparticles with a thickness of one nm and a width of 20 to 50 nm, depending on their preparation. They are ionically charged stiff monolayers. The particles can be characterized with electric birefringence measurements and by rheological properties in solutions. Solutions of the particles show a sol-gel transition and at concentration above this transition, show stationary birefringence.

Clays are usually used as thickeners in various formulations. Clays bind many amphiphilic molecules like surfactants, dyes, amphiphilic polymers and polyelectrolytes and proteins. The hybrid particles from clays and adsorbed molecules can be used for dye pigments and as emulsifiers for the preparation of emulsions with fascinating properties.

Biography :

Heinz Hoffmann received his PhD in 1962 from University in Würzburg, TH Karlsruhe. He worked as a full Professor at University Bayreuth 1975 – 2003. He is serving as a director of BayColl from 2003 – 2015. He is currently working as emeritus professor at Univ. of Bayreuth. He was honoured with many awards and honorary positions. He has more than 370 publications. He was received 'Nernst' award of the 'Deutsche Bunsengesellschaft' in 1976, Wolfgang-Ostwald-Award of the 'Kolloidgesellschaft' in 1995, Lecture-ship Award from the Chemical Society of Japan in 1998, Lecture-ship Award from the Chemical Society of India, Bombay in 1998 and Overbeek Gold Medal from the European Colloid and Interface Society, Berlin in 2011.

InAs HEMTs for High Frequency and High Speed Applications

Edward Yi Chang
National Chiao Tung University, Taiwan

Outstanding carrier transport properties of III-V compound semiconductors have shown excellent potential for high frequency characteristics. Among them, III-V HEMTs on various material systems like InGaAs/InAlAs, InAs/InP have emerged promising for millimeter wave and terahertz applications.

Many previous reports of record high frequency characteristics have shown InGaAs/InAlAs HEMTs with very high cut off frequency(f_t) and maximum oscillation frequency (f_{max}) . With increase in Indium concentration higher electron mobility can be achieved which can lead to higher operating frequency. Among them InAs HEMTs have shown record high frequency of 710GHz for 60nm gate length. These HEMT structures can be fabricated for high frequency applications using Molecular Beam Epitaxy (MBE) and Metal Organic Chemical Vapor Deposition (MOCVD) techniques. Small gate length devices have shown excellent RF performances over past two decades. Besdies, due to high electron mobility, saturation velocity and large conduction band offset in InAs, InAs-channel HEMTs are also promising for high speed and low power applications. InAs Pseudomorphic HEMTs on InP substrate have been reported to have less short channel effects(SCE) through cap recess engineering and demonstrated low gate delay time when biased at 0.5V.

In conclusion, InAs devices are promising for high frequency applications upto sub terahertz range and high speed low power logic application for post Si CMOS application. The outstanding performances of the device will be presented in this talk.

Biography :

Edward Yi Chang has completed his PhD from University of Minnesota , USA. He is the VP of Research and Development and Dean of International College of Semiconductor Technology, NCTU, Taiwan . He has published more than 100 papers in reputed journals and is an IEEE Fellow and Distinguished Lecturer.

Multi-functionality of Moth-eye Film

Yoshihiro UOZU

Mitsubishi Rayon Co., Ltd., Japan

The living body surface develops many functions with one structure. It is hoped that the structure formed by technique of biomimetics also develops many functions.

Moth-eye is one of the most famous biomimetic materials. Moth-eyes have periodic nanostructures that show absolutely low reflection. The effect of these structures is due to a continuous change of refractive index between air and substrates. We developed a continuous manufacturing process of a moth-eye structure on a polymer film with the porous alumia roll mold. Recently, we have verified the multi-functionality of the moth-eye structure.

As for the moth-eye surface consisting of a hydrophobic polymer, the contact angle of the water is around 140 degrees. On the contrary, the value for a hydrophilic polymer is around 20 degrees. These phenomena reflect characteristics of polymers.

Next, we have researched insect-slipping phenomena on the moth-eye structure. We put an insect on the plastic plate and turned the plastic plate 180 degrees. When the surface was smooth, the insect was getting on the plastic board. In contrast, on the moth-eye surface, the insect slipped down from a plastic board for 90 degrees. Most insects slipped down on moth-eye surfaces.

We continue to investigate other characteristics of a moth-eye structure.

It is hoped that the structure formed by technique of biomimetics develops many functions.

Biography :

Yoshihiro Uozu, Engineering Doctor of Polymer Science, now is a “Fellow” of Mitsubishi Rayon. He received his master degree of Engineering in 1986 from Kyoto University. He joined Mitsubishi Rayon Co., Ltd. in 1986. He received the Engineering Doctor’s degree in 2004. He got the award of the society of polymer science, Japan “Development of new graded-index plastic rod-lenses and their linear arrays” by these activities in 2000. He also got the Monodzukuri Nippon Grand Award from the Ministry of Economy, Trade and Industry Japan in 2012. He has been the senior member of the Optical Society since 2012.

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Beneficial Modification of Heterogeneous Catalysts Using Microwave Radiation or Cold Plasmas

Mike S Scurrell

University of South Africa, South Africa

Increasing demands are being placed on heterogeneous catalysts, particularly in the growing areas of cleaner energy conversion and environmental processes. Increased activity, higher selectivity, increased longevity and reduced costs are all being sought. This presents very severe challenges to catalyst design.

We have experienced some success at improving conventional catalysts through the use of microwave radiation, carried out as a pretreatment of the solids involved, before the actual reaction itself. In other work, the use of plasmas has been demonstrated to affect catalytic performance of solid materials, again used as a pretreatment step.

Considerations based on the physical chemistry of nanosystems imply that nanomaterials are more susceptible to building up localized temperature gradients due to surface effects, poorer thermal conductivity and lower heat capacities. In alkalized iron-based catalysts for Fischer-Tropsch synthesis increases in the mobility of potassium during microwave radiation, as evidenced by secondary ion-mass spectrometry, appear to be associated with increases in activity and an increase in selectivity to olefins and longer-chain hydrocarbons. Temperature programmed surface reaction between pre-adsorbed CO and hydrogen gas show distinct differences in the forms of CO chemisorbed on irradiated and untreated samples.

This paper serves to provide an update on the behavior of heterogeneous catalysts pretreated using these methods, and to model the thermal effects involved. In this way it is expected that we can start to establish the the "selection rules" for using microwave radiation or cold plasma methods in heterogeneous catalysis synthesis and manufacture.

Biography :

Mike Scurrell has worked extensively in catalysis for over 40 years and has published some 170 papers in various areas. He is Emeritus Professor of Chemistry at the University of the Witwatersrand in Johannesburg and is also Research Professor at the University of South Africa in Johannesburg in South Africa. He held previous positions at the University of Edinburgh, Scotland, the Technical University of Denmark, the CSIR, South Africa and at Anglo American Research Laboratories. His current interests are in improving heterogeneous catalysts through the use of innovative approaches in nanosynthesis.

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Synthesis and characterization of aqueous only medium gold nanoparticles using hydrogen gas as a reducing agent

Getahun Merga, [1,2] Nuvia Saucedo, [1,2] Laura C. Cass, [1] James Puthussery,[1] Noah Chan,[2] and Dan Meisel [1]

[1]University of Notre Dame, USA

[2]Andrews University, USA

Synthesis and characterization of noble metal, especially silver and gold, nanoparticles are of current interest. These nanoparticles have novel optical, electrical, and thermal properties, which are different from the properties of the bulk metals. The properties of these colloids can be changed by controlling the size, shape and medium of the nanoparticles. We describe simple, environmentally benign medium, and quite efficient synthesis of gold nanoparticles upon reduction of Au_2O_3 by molecular hydrogen. The reaction generates particles that contain no foreign stabilizer other than gold or water species. The reaction readily proceeds at slightly moderate temperatures and somewhat higher than atmospheric pressure of H_2 and these two parameters control the size of the particles produced. The suspensions of particles were analyzed for particle size, size distribution, residual ions and metal-atom concentrations using, TEM, dynamic light scattering, electrophoretic mobility, pH, conductivity, ICP-OES, and UV-Visible spectra. Their redox catalytic activities were investigated by monitoring the production of hydrogen gas form water by employing strongly reducing radicals. Surface enhanced Raman scattering (SERS) spectra of a probe molecule, *p*-aminothiphenol, adsorbed on the gold particles surface was also determined.

Biography :

Getahun Merga is a professor of chemistry on the campus of Andrews University, Berrien Springs, Michigan, USA since 2002 to present. He graduated from Addis Ababa University, Ethiopia, in 1984 with a BS in chemistry. He then went on to the University of Pune, India. In 1991, he earned a master's of science and in 1995 he received his PhD. While working towards his doctorate degrees, Merga received the DAAD Fellowship for about two years and worked at Max-Planck-Institute for Strahlenchemie, Mulheim under Ruhr, Germany. He was also the recipient of the Indian Young Scientist Award and he conducted research works at the Bhabha Atomic Research Centre (BARC), and at Tata Institute of Fundamental Research, School of Natural Sciences – Centers, Mumbai, India.

Prior to assuming his position at Andrews, Merga was the department head and professor of chemistry at Solusi University, Bulawayo, Zimbabwe, for five years. Served as Senior Research Associate /Visiting Scholar at University of Notre Dame, 2003 – 2014, Indiana, USA.

Research Interest: We focus on processes that involve nanoparticles and nanostructures and the effect of the interfaces of these structures on reactions of short-lived intermediates.

Semiconductor Materials: Delivery, Assembly and Potential Applications

Neerish Revaprasadu

University of Zululand, South Africa

Metal chalcogenide semiconductor nanocrystals have been identified as an important class of materials due to their applications in emerging technologies. A key objective of many research groups is the fabrication of nanostructures with controlled diameters, aspect ratios and morphologies, which are essential for their applications in electronic devices. The use of metal complexes to prepare metal chalcogenide materials at the nanoscale is a well-established route. The lecture will focus on recent work done in my laboratory on the synthesis of semiconductor nanomaterials. The first part of the lecture will describe the synthesis of some heterocyclic dithiocarbamate complexes of cadmium and lead for the synthesis of CdS and PbS nanoparticles in various coordinating solvents. Our recent work on FeS, Bi_2S_3 and SnS nanostructured materials will be highlighted.

The talk will also describe our use of 'green' capping groups in nanomaterials synthesis. Finally an application of biocompatible gold-semiconductor core-shell system for potential in drug delivery will be described.

Biography :

Revaprasadu is the South African Research Chair Initiative (SARChI) Chair in Nanotechnology and Professor of Chemistry. He holds a BSc Honours from University of Natal and joined UNIZULU as a Senior Laboratory Assistant in 1996. In 1997 he was granted an NRF/Royal Society (UK) scholarship to complete his PhD in the area of nanomaterials synthesis at Imperial College, London. In 2000 he completed his PhD, upon his return to UNIZULU he established a research group with a focus on the synthesis of semiconductor nanoparticles using facile non-organametallic routes. In 2007, he was awarded the SARChI Chair in Nanotechnology. Prof Revaprasadu has done extensive work on the synthesis of CdS, CdSe, CdTe, PbS PbSe and PbTe nanoparticles using a new route two step hybrid high temperature solution based route developed in his group. He has also as developed a novel route to water soluble selenium and tellurium based nanomaterials. This route has led to work on the toxicity and study of nanomaterials in biological systems. His current research involves synthesis of earth abundant materials for solar cell applications. Prof Revaprasadu has published 125 articles in peer-reviewed journals and has presented his work at more than 60 international conferences. His publications have been cited more than 1800 times and he has an H-index of 23.

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Photocatalytic reduction of Chromium(VI) by In_2S_3 microspheres present in water and wastewater under visible light illumination

Rengaraj Selvaraj, Bushra Al Wahaibi and Salma M. Z. Al-Kindy

Sultan Qaboos University, Oman

Novel hierarchical-like In_2S_3 hollow microsphere were synthesized using thiosemicarbazide ($NH_2NHCSNH_2$) both as a sulfur source and as a capping ligand in a ethanol/water system and used for the photocatalytic reduction of Cr(VI) under visible light illumination, in order to determine its photocatalytic properties. We demonstrate that several process parameters such as the reaction time and precursor ratio strongly influence the morphology of the final product. The $In(NO_3)_3$/thiosemicarbazide ratios were found to effectively play crucial roles in the morphologies of hierarchical-like In_2S_3 hollow microspheres nanostructure. With the ratios increasing from two to four, the In_2S_3 crystals exhibited almost spherical morphologies. The synthesized products have been characterized by a variety of methods, including X-ray powder diffraction (XRD), field emission scanning electron microscopy (FE-SEM), energy-dispersive X-ray (EDX) analysis, X-ray photoelectron spectroscopy (XPS), and UV-visible diffused reflectance spectroscopy (UV-DRS). XRD analysis confirmed the tetragonal structure of the In_2S_3 hollow microspheres. The products show complex hierarchical structures assembled from nanoscaled building blocks. The morphology evolution can be realized on both outside (surface) and inside (hollow cavity) of the microsphere. The optical properties of In_2S_3 were also investigated by UV – vis DRS spectroscopy, which indicated that our In_2S_3 microsphere samples possess a band gap of ~1.96 eV. Furthermore, the experiments demonstrated that Cr(VI) was efficiently reduced in aqueous In_2S_3 suspension by more than 98% within 10 minutes, while the pH of the solution was increased from 1.7 to 1.9 due to the consumption of formic acid. It was also found that the optimal dosage of 100 mg of In_2S_3 achieved the fastest reaction of Cr(VI) reduction under the experimental conditions. The improved separation of electrons and holes on the In_2S_3 surface allows more efficient channelling of the charge carriers into useful reduction and oxidation reactions rather than recombination reactions. The presence of sacrificial electron donors such as formic acid enhances the photocatalytic reduction of Cr(VI). The Cr(VI) adsorbed on the surface of the In_2S_3 particles was observed to be almost completely photoreduced to Cr(III).

Biography :

RENGARAJ Selvaraj is the Assistant Professor at Sultan Qaboos University, Muscat, Oman with responsibility for teaching, research and consultancy in the field of Analytical and Applied Environmental Chemistry particularly in the area of water and wastewater treatment. He is graduated from Anna University, Madras, India with a Ph.D in Chemistry in 1999. He has 20 years of research experience in Environmental Science and Engineering, particularly in the area of Environmental Nanotechnology, wastewater treatment, water quality analysis, and solid waste management. Recently Dr. Rengaraj has been elected as one of the board of directors for Pacific Basin Consortium for Environment and Health, USA. He has published more than 60 papers in reputed National and International Journals and Proceedings. He has participated and presented his research papers in several National and International conferences. He is having more than 12 years post Ph.D experience as Marie Curie Experienced Research Fellow, Visiting Professor, Brain Pool Scientist, Post-Doctoral Fellow, Contract Professor, and Visiting Scientist at different International Universities, United Nation University pilot program and Research Institutes at Finland, France, Oman, South Korea and Hong Kong. At present he is actively involving in the area of synthesis, characterization and application of nano structured photocatalysts for the removal of endocrine disruptor chemicals, toxic organics, NOx and heavy metals from water and wastewater. Also he is Editorial board member and peer reviewer for several International Journals.

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ZnO Nanocomposites for Thermoelectrics

D. Gautam[1, 2], M. Engenhorst[1], C. Schilling[1], G. Schierning[1], R. Schmechel[1] and M. Winterer[1]

[1]University of Duisburg-Essen, Germany

[2]University College Cork, Ireland

Currently, oxide-based thermoelectric materials are investigated for high temperature energy conversion because of their advantages, such as thermally stable, non-toxic and oxidation resistant compared to Si-Ge alloys thermoelectric materials. In this talk, we report the bottom-up approach to create bulk Al-doped ZnO nanocomposites from nanopowders, which are prepared by chemical vapour synthesis. Using our synthesis approach we are able to design Al-containing ZnO nanocomposites having various kinds of microstructures exhibiting bulk like electrical conductivity. Concurrently, the impact of microstructure of nanocomposites on their thermal conductivity is enormous. In the light of the obtained data the impact of the microstructure of the starting powder, doping strategy and sintering temperature on the thermoelectric properties is discussed.

Biography :

Devendraprakash Gautam obtained his doctoral degree from Max-Planck Institute for Metals Research affiliated to the University of Stuttgart, Stuttgart, Germany, in 2006. In 2007, he joined Kobe University, Kobe, Japan as a Post-doctoral Researcher working on functional materials for optical/thermal applications. In 2009, he joined Nano-Energy Technology Centre, University of Duisburg-Essen, Duisburg, Germany as a Senior Post-doctoral Researcher. Currently, he is a Research Scientist at Tyndall National Institute, Cork, Ireland working on CMOS compatible thermoelectric materials and devices. In his professional career, Dr. Gautam has worked on functional materials in particular related to nanostructured thermoelectric. He has published about 20 papers in reputed peer review journals.

Morphology as an essential parameter in designing efficient photocatalysts

Lucian Baia

Babes-Bolyai University, Romania

The manipulation of the nanostructures morphology represents one of the most important challenge in the nanotechnology development. Thus, the control of the morphological characteristics of porous materials, like pore volume, pore size distribution and connectivity, can significantly improve the photocatalytic performances. On the other hand, the shape control of the nanostructures involved in the photocatalytic process, which is one of the hot topics in current material science, can lead to a great enhancement of the photodegradation rate of the pollutant. Our research activity in the last period was focused on both aspects of controlling the morphology of such photocatalysts. The first approach consists in designing materials based on TiO_2 aerogel and Au/Ag nanoparticles for improving the photocatalytical performances. Aerogels are highly porous materials with a low density, large open pores, and a high inner surface area produced *via* sol-gel process followed by supercritical drying. A large variety of porous composites were obtained and tested and it was concluded that the best apparent photodegradation rate constants were achieved for the porous composites prepared by impregnating the titania gel with Au/Ag nanoparticles followed by supercritical drying. The second approach was directed towards understanding the role played by the Au nanoparticle's shape on the photocatalytical properties, when they are in contact with commercially available Evonik Aeroxide P25. By the variation of specific synthesis parameters, three differently shaped Au nanoparticles, i.e. nanospheres, nanowires and nanotriangles, were synthesized and deposited on the surface of the chosen commercial titania, and the photodegradation rate and hydrogen production of the composites were evaluated. It was concluded that the shape of the deposited nanoparticles can highly influence the efficiency of the composites, making possible a shape defined application tuning.

Acknowledgments*:* This work was supported by the grants of the Romanian National Authority for Scientific Research MNT ERA_NET nr.7-065/26.09.2012 and PN-II-ID-PCE-2011-3-0442.

Biography :

Lucian Baia earned his Ph.D. degree in 2003 at the University of Würzburg, Germany. Since 2008, he works as Associate Professor at the Department of Condensed Matter Physics and Advanced Technologies at the Faculty of Physics of the Babes-Bolyai University. His current research focuses on the obtaining and characterization of porous and highly porous nanoarchitectures with controllable morphology and structure for environmental and biomedical applications. He is author or coauthor of more than 100 peer-reviewed publications (h-index: 19), three books, and three book chapters, 3 patent applications and is serving as editorial board member for several scientific journals.

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Increased 3HV Concentration in the Bacterial Production of 3-Hydroxybutyrate (3HB) and 3-Hydroxyvalerate (3HV) Copolymer with Acid-digested Rice Straw Waste

Kyoungphile Nam, Moon Kyung Kim and Byungchul Kim

Seoul National University, Korea

Production of P(3hydroxybutyrate-co-3hydroxyvalerate) copolymer with rice straw waste by bacteria was investigated. The effect of treatment conditions, mainly heat and acid, on the composition and yield of rice straw hydrolysates was studied with an emphasis on increased levulinic acid production. The bacterial accumulation of P(3HB-co-3HV) copolymers and their 3HV mole fractions were determined. Bacterial synthesis of 3-hydroxybutyrate (3HB) and 3-hydroxyvalerate (3HV) copolymer (P(3HB-co-3HV)) using the hydrolysate of rice straw waste as a carbon source was affected by the composition of the hydrolysate, which depends highly on the rice straw pretreatment condition. Acid digestion with 2% sulfuric acid generated larger production of P(3HB-co-3HV) than 6% sulfuric acid, but 3HV concentration in the copolymer produced with 2% acid hydrolysate was only 8.8% compared to 18.1% with 6% acid hydrolysate. To obtain a higher 3HV mole fraction for enhanced flexibility of the copolymer, an additional heating was conducted with the 2% acid hydrolysate after removal of residual rice straw. As the additional heating time increased a higher concentration of levulinic acid was generated, and consequently, the mole fraction of 3HV in P(3HB-co-3HV) increased. Among the conditions tested (i.e., 20, 40, 60 min), 60-min additional heating following 2% sulfuric acid digestion achieved the highest 3HV mole fraction of 22.9%. However, a longer heating time decreased the P(3HB-co-3HV) productivity, probably due to the increased intermediates concentrations acting as inhibitors in the hydrolysates. Therefore, the use of additional heating needs to consider both the increases in the 3HV mole fraction and the decreases in the P(3HB-co-3HV) productivity.

Biography :

Kyoungphile Nam has completed his PhD from Cornell University in 1998. Currently, he is Professor at Dept. of Civil and Environmental Engineering, Seoul National University, Korea, and he also serves as the director of Remediation Technology and Risk Assessment Center. Recently, he initated a research project about production of bio-based plastics from agricultural and industrial wastes. He has published more than 70 papers in peer-reviewed journals and has been serving as an editor for Clean-Soil Air Water since 2006.

Nanoscale and Multiscale Approaches to the Design of Building Materials

Hendrik Heinz[1], Tariq Jamil,[1] Martin Weibel,[2] Ratan K. Mishra,[3] Robert J. Flatt[3]

[1] University of Colorado-Boulder, USA

[2] Sika Technology AG, Switzerland

[3] ETH Zurich, Switzerland

We present a multimodel approach targeted at understanding the behaviour of comminution, the effect of grinding aids in industrial cement mills, and understanding of cement hydration from the nanometer scale. On the atomic scale, we use molecular dynamics (MD) simulations with validated force field models to quantify elastic and structural properties, cleavage energies as well as the organic interactions with mineral surfaces. Simulation explain the role of organic modifiers, which are industrially used as grinding aids, by reduction of electrostatic aggregation forces between the particle at a very short timescale of nanoseconds that is slower than surface diffusion on the order of microseconds. Further, the interaction of polymeric superplasticizers with initially hydrated calcium silicate surfaces similar to CSH gels has been analyzed quantitatively to derive first correlations with rheological and setting performance of cement. Realistic surface models as a function of composition and pH will be discussed. At the larger scale, simulations based on the discrete element method (DEM) are explained to integrate the information gained from MD simulations at the nanometer scale into the clinker particle behaviour at larger scales. Computed impact energy distributions from DEM mill simulations serve as a link between laboratory sized mills and large scale industrial mills, and provide the required input for particle impact fragmentation models. Such a multiscale, multimodel methodology paves the way for a structured approach to the design of chemical additives aimed at improving the performance of compositionally diverse Portland cements and achieve energy savings in the initial milling process.

Biography :

Hendrik Heinz is an associate professor at the University of Colorado-Boulder. He received his PhD degree from ETH Zurich in 2003 and carried out postdoctoral work at the Air Force Research Laboratory in Dayton, Ohio. His research interests include the simulation of biological and nanostructured materials, metals, minerals, polymers, inorganic-organic interfaces, and multiscale computational methods. Recent honors include the Sandmeyer award of the Swiss Chemical Society, the Max Hey Medal of the Mineralogical Society, an NSF Career Award, as well as guest professorships at ETH Zurich and at the National Institute for Materials Science (NIMS) in Tsukuba, Japan.

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Protein Corona Breakdown in Reactive Metal Nanoparticle Systems

Matthew N. Martin

Khalifa University, UAE

Serum proteins are predominant in mammalian blood, and form a protective corona around nanoparticle surfaces due to electrostatic, depletion, or thermodynamic interactions. This has recently led researchers to use common blood plasma proteins to stabilize the surface of nanoparticles, to ensure colloidal stability in physiological or harsh conditions, or protect biological systems from nanoparticle core surface reactions. However, it has become clear that even these protein coatings can become destabilized in extreme ionic or acidic conditions. Despite this, the mechanisms of coating breakdown and ensuing reactions remain elusive, because it is technically challenging to simultaneously measure the dissolution, aggregation, and sedimentation of a destabilized colloidal suspension.

Here we present *in situ* ultrasmall-angle X-ray scattering (USAXS) results, simultaneously quantifying dissolution, agglomeration, and stability limits of a model system: highly reactive silver nanoparticles (AgNPs), coated by a standard blood protein: bovine serum albumin (BSA). We push the protein past its stability limits to discover the mechanisms of coating breakdown and ensuing reactions. We found that competing aggregation and dissolution phenomena can be deconvoluted to make quantitative measurements on the mechanisms of nanoparticle loss. Interestingly, single particles dissolve rapidly from a single exposed spot in the corona, rather than undergo slow dissolution from the aqueous interface inward. We rationalize this by the globular nature of the BSA coating, and its structural changes due to acid. Further applications and generalizations to other highly relevant nanoparticle cores and coating materials will be discussed.

Biography :

Matthew Martin is currently an Assistant Professor of Physics at Khalifa University, UAE. He was previously a postdoctoral fellow at the National Institute of Standards and Technology, MD, USA. Before joining NIST, he received his PhD degree in Physics from Rensselaer Polytechnic Institute, NY, USA.

Controlled Nano Trapping and Concentration by Ultrasound

Junhui Hu

Nanjing University of Aeronautics and Astronautics, China

Nano trapping and concentration have potential applications in the test and assembly of nano objects, fabrication of nano sensors, etc. Our recent work shows that ultrasound can be used in the controlled trapping and concentration of nano objects in DI water. Here, we report the ultrasound based strategies for the trapping and concentration of nano objects in DI water, proposed and developed by our team. They can be used to trap single nanowires and concentrate nano objects in the DI droplet on a substrate. All of them utilize the acoustic streaming eddies in the droplet which is in proper ultrasonic vibration. In this report, the details of experimental setups, device structures, working principles and manipulation characteristics of these methods are given.

Biography :

Junhui Hu is a Chang-Jiang Distinguished Professor, China, the director of Precision Driving Lab at Nanjing University of Aeronautics and Astronautics, and deputy director of State Key Laboratory of Mechanics and Control of Mechanical Structures, China. He received his Ph.D. Degree from Tokyo Institute of Technology, Tokyo, Japan, in 1997, and B. E. and M. E. degrees in electrical engineering from Zhejiang University, Hangzhou, China, in 1986 and 1989, respectively. He was an assistant and associate professor at Nanyang Technological University, Singapore, from 2001 to 2010. His research interest is in piezoelectric/ultrasonic actuating technology. He is the author and co-author of about 250 papers and disclosed patents, including more than 80 full SCI journal papers and 1 editorial review in an international journal. He is also the sole author of monograph book “Ultrasonic Micro/Nano Manipulations” (2014, World Scientific, Singapore). Dr. Hu won the Paper Prize from the Institute of Electronics, Information and Communication Engineers (Japan) as the first author in 1998, and his research work has been highlighted by 7 international scientific media. He is a senior member of IEEE, and the editorial board member of three international journals. He was once awarded the title of valued reviewer by Sensors and Actuators A: Physical and Ultrasonics. He has given more than ten invited talks/invited plenary lecture/keynote lecture at international/domestic conferences, and is the honorary chairman of IWPMA 2011, held in USA.

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Biosynthesis of ZnO Nanoparticles Using Alkaloidal Fraction of *Murraya Koenigii* Roots and Their Antimicrobial Potential

Rakesh K Sindhu, Inderbir Singh, Sandeep Arora and Mansi Chitkara

Chitkara University, India

In the present study, Biosynthesis of ZnO nanoparticles by precipitation method using alkaloidal fraction of *Murraya Koenigii* roots and nanoparticles evaluated for antimicrobial activity. Zinc oxide has its unique physical and chemical properties i.e. High chemical stability, broad range of radiation absorption, high electrochemical coupling coefficient and high photostability, is a multifunctional material. The precipitated ZnO nanoparticles were characterized by UV visible spectroscopy, SEM (Scanning Electron Microscopy), XRD (X Ray Diffraction) and DLS (Dynamic Light Scattering) techniques.

Biography :

Rakesh K Sindhu, Ph.D. (Pharmaceutical Sciences) Associate Professor and Training Placement Officer at Chitkara College of Pharmacy, Chitkara University, Punjab, India.

He has experience of Eight years in Research and academics. His area of interest is Standardization and Phytochemical evaluation of herbal drugs, Pharmacological evaluation of herbal drugs, Green nanotechnology, Development of herbal formulations and Standardization. Engaged with various projects on phytochemical and pharmacological standardization of crude drugs. I have 20 research and review publications in peer reviewed journals and Book Chapter in "Recent Progress in Medicinal Plants Vol-36".

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Fly Ash: Ferro-Alumino- Silicates Separation and Characterization as Resource Minerals using Nano-based Approaches

M.H. Fulekar, Virendra Kumar Yadav and Jyoti Fulekar

Central University of Gujarat, India

In India, the Thermal Power Stations generates 60 to 70%of Energy using Coal as Fuel. Fly ash is a combustion material of the coal, when burnt in thermal power station for generation of electricity.. At present, out of 66.49 million tonnes of fly ash generated, in India, 50 % of fly ash is used for making bricks, cements, tiles, construction industries and micronutrients in agriculture. The rest of the fly ash is dumped either in dry disposal or in wet disposal method which causes soil and water pollution. Fly ash is a ferro-alumino-silicate mineral, comprises the 50-60% silica, 20-30% alumina and 10-20% ferrous materials including traces of elements. If Ferrous, Alumina and Silicates are separated, and trace elements are leached out, the Fly ash could be considered as one of the Resources.

In the present research study the nano based approaches has been emphasized for separation of ferrous, alumina and silicate minerals from fly ash, so as to use as a raw material; if toxic metals can be leached out from the fly ash minerals (ferrous, alumina and silicate). The technology has been developed for the separation of ferrous by external magnetic force, alumina by dissolving the remaining fly ash minerals in acidic condition and the residual contains the silicate. And, fly ash minerals constituent are separated as ferrous, alumina and silicate nanomaterials. Nanomaterials: ferrous, alumina, silicate are developed using bottom up methods that will make fly ash- minerals more functional for variety of uses; after leaching the toxicants from the separated minerals. Fly ash – Minerals: Ferro-Alumina-Silicates were characterized by XRD,TEM, SEM, AFM, NMR. Further, Membrane based filtration techniques are being employed for separation of clay from the silicate nanomaterials whereas; ferrous nanomaterials will be treated chemical/biological, for removal of trace elements (toxic) to purify ferrous minerals. Similarly, alumina nanomaterial will be treated chemically, biologically to remove toxicants. The leached out toxicants can be further phytoremediated for remediation of toxic metals for the fly ash management as resource materials. Fly-ash –Minerals: Ferro-Alumina –Silicates will be used as generated Resources for varieties of Benefits / Uses, out of the Disposal fly ash from dumping ground to solve Environmental Fly ash disposal problem and convert Waste into Wealth.

Biography :

M. H. Fulekar is a Professor and Dean at School of Environment and Sustainable Development, and Coordinator of Special Centre for Nano Sciences, Central University of Gujarat. He was also professor and Head, University Department of Life Sciences, University of Mumbai. He has in his credit 250 numbers of research papers and articles published in international and national journals of repute. He is also author of 12 books. He has guided 15 Ph.D. and 10 MPhil students. As a Principal Investigator, he has completed Research Project: UGC, CSIR, BRNS, DBT R&D and Industrial projects. He has achieved "Who's Who" in Science and Engineering USA in 1998; "Outstanding Scientist of the 20th Century" in 2000, from International Biographical Centre, Cambridge, England; Education Leadership award and International Award for Environmental Biotechnology. He is also a member of New York Academy of Sciences, USA and Indian Science Congress Association.

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Catalytic removal of phenol from wastewater

Mohammad Abu Haija

The Petroleum Institute, UAE

In this study, copper ferrite $CuFe_2O_4$ nanopowders were prepared by sol-gel and co-precipitation methods. The prepared ferrites were characterized for their morphology, crystallinity, purity, and stability using various techniques such as X-ray diffraction (XRD), infra-red spectroscopy (IR), scanning electron microscopy (SEM), transmission electron microscopy (TEM), thermogravimetric analysis (TGA), and BET surface area analysis. These techniques revealed that the sol-gel derived $CuFe_2O_4$ samples exhibited spinel ferrite phases of higher crystallinity and purity than the co-precipitation derived samples. The catalytic activity of $CuFe_2O_4$ was investigated for the degradation of phenol using high performance liquid chromatography (HPLC). The experimental results suggested that $CuFe_2O_4$ is an effective catalyst for the removal of phenol from wastewater. Several parameters were studied such as the catalyst loading, H_2O_2 concentration, pH, reaction temperature, UV and sunlight radiations. A comparison in catalytic activity between $CuFe_2O_4$ and other catalysts such as ferrites ($ZnFe_2O_4$ and $MgFe_2O_4$) and TiO_2 was conducted. The successful regeneration and reusability of $CuFe_2O_4$ catalyst for phenol removal were also studied.

Biography :

Mohammad Abu Haija completed his PhD from the Technical University of Berlin in cooperation with the Fritz-Haber Institute of the Max Planck Society, Germany. Then he worked as a Postdoctoral Fellow at the X-ray Science Division at Advanced Photon Source, Argonne National Laboratory, USA. Then he worked as an Assistant Professor in the Department of Chemistry at King Khalid University, Saudi Arabia. Currently he is an Assistant Professor in the Department of Chemistry, the Petroleum Institute, UAE.

Al Habari

Carbon Nanomaterials
Graphene Technologies
Carbon based devices and Nanocomposites

Title:	Laser Raman Micro-Spectroscopy as an Effective Non-Destructive Method of Identification and Investigation of Various Carbon Modifications **Sergey S. Bukalov**, Russian Academy of Sciences, Russia
Title:	Carbon Nanotube Assemblies and their Composites: Mechanical Properties **Alan Windle**, Cambridge University, UK
Title:	Architectural design of porous carbon nanocomposites for energy storage applications **Ruey-an Doong**, National Chiao Tung University, Taiwan
Title:	Quick and Normal X-ray Absorption Spectroscopy and its Application in Nanotechnology **Syed Khalid**, Brookhaven National Laboratory, USA
Title:	Non-disruptive Oxygen Annealing of Graphene **Peter K Petrov**, Imperial College London, UK
Title:	Thin polycrystalline diamond films protecting Zirconium alloys surfaces: from technology to layer analysis and application in nuclear facilities **Irena Kratochvilova**, The Academy of Sciences of the Czech Republic, Czech Republic
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Title:	Graphene and its functionalization: developing a platform for flexible and transparent optoelectronics **Monica Craciun,** University of Exeter, UK

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Laser Raman Micro-Spectroscopy as an Effective Non-Destructive Method of Identification and Investigation of Various Carbon Modifications

Sergey S. Bukalov

Russian Academy of Sciences, Russia

Graphite and various carbonaceous compounds are widely used in industry and nanotechnology as modern high-tech constructural materials. These comprise graphene layers forming bundles and crystallites, whose size and packing are of great importance for macroscopic properties. That is why non-destructive structural methods allowing determination of crystallite size and their ordering.are of major interest. Laser Raman micro-spectroscopy which uses modern laser Raman spectrometers of last generation, such as T64000, LabRAM HR Horiba-Jobin Yvon equipped by high-sensitive CCD detectors and microscopes, allow one to identify various carbon modifications, because each of the latter exhibits its own specific Raman spectrum, characterized by a given number of Raman lines with their particular parameters (frequency, intensity, half-width, contour). Besides, this non-destructive method gives a unique possibility of Raman micro-mapping of the samples, that is, obtaining information about sample heterogeneity. In this study the method was applied to many samples of various types. These are carbonaceous materials of natural origin (graphites of various genesis, shungites, meteorites, living matter), as well as industrial origin, such as glassy carbon, diamond-like carbon, nanotubes, fibers, graphen, etc).

Biography :

S.S. Bukalov has got his Ph.D in physics from the Physical Department of St.Petersburg University, his Dr.Sci in chemistry from the Institute of Organoelement Compounds, Moscow. In 1989 he has founded the Scientific and Technical Center on Raman Spectroscopy of the Russian Academy of Sciences and is the Head of this Center. He has published more than 200 papers in reputed journals and was the member of the Organizing Committee of International Conferences on Raman Spectroscopy. His main research activity is application of Raman spectroscopy on its modern level to various fields of chemistry (molecularl structure of carbon modifications, organometallics, polymers, industrial materials) and physics (molecular dynamics, phase transitions).

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Carbon Nanotube Assemblies and their Composites: Mechanical Properties

Alan Windle, Thurid Gspann and Anastasiia Mikhalchan

Cambridge University, UK

There is no doubt about the strength of the carbon-carbon covalent bond, which coupled with the lightness of the atom, makes it a perfect subject for high strength materials. The initial strength hype over carbon nanotubes, now being repeated in some circles with graphene, arose from measurements of the strength of individual graphene layers, and while the scientists were professionally explicit as to what they had measured, the publicity machines assumed that these figures could also be readily realized in materials made from these components. It is against a background of this overselling that we have watched the gradual improvement in strength of useful materials, especially yarn-like fibres made of carbon nanotubes.

Fibres made by the direct spinning process have been used as the subject of this study. There have been occasional observations of strengths greater than 5GPa/SG (N/tex), and where these have been verifiable, they have served to maintain enthusiasm for on-going developments.

If carbon nanotube fibres are to displace carbon fibre on a world scale, it will be firstly on the basis of cost, as the direct spinning process for nanotube fibre is eminently scaleable. Secondly, it is the toughness of the fibre which is likely to be one of its major selling points, so while matching existing fibres in tensile properties, it promises to be much more resilient to damage and very much tougher in any case of non-axial loading. The paper will explore the issues of strength of nanotube yarn-like carbon fibres, where the advantages of low shear strength between neighbouring nanotube bundles are offset against the disadvantages. Strategies for further development are outlined, as will be the prospects for tuning properties for particular applications.

In composites, the fracture mechanism appears very different from that associated with conventional composites such as those based on carbon fibre, where fibre pull-out is a major contributor to toughness. Here we have evidence for nanotube pull out on an altogether much finer scale, so that the toughening mechanism appears to have features as much akin to the multiple crazing in polymers as it does to that in conventional fibre composites.

Biography :

Alan Windle's research career has spanned Metallurgy, Polymers and Nanotechnology. He is Emertitus Professor of Materials Science at Cambridge University, and is driving forward research into materials based on carbon nanotubes. He was awarded the Bessemer Medal and the Royal Society of Arts Silver Medal in 1963, the Rosenhain Medal in 1987, the Swinburne Medal and Prize in 1992 and the Founder's Medal and Prize of the Polymer Physics Group of the Insitute of Physics in 2007. He was elected to the Royal Society in 1997. He was a founder of Cambridge Molecular Design, a materials software company, and of the Melville Laboratory for Polymer Synthesis at Cambridge. He was Executive Director of the Cambridge-MIT Institute during its formative years, and has been a Commissioner for the Royal Commission for the 1851 Exhibition, the Director of the Pfizer Institute for Pharmaceutical Materials Science at Cambridge and the Chairman of the Board of Q-Flo, a company designed to exploit innovations in materials nanotechnology.

His more recent research exploits involve the creation of a new type of carbon fibre based on carbon nanotubes. A prototype production process is running in Cambridge, which promises fibre with much the same strength and stiffness of conventional carbon fibre but with increased toughness. As a commercial product, it should also be significantly cheaper. The process is now being scaled up internationally, and products ranging from replacements for carbon fibre to replacements for metals as electrical conductors and a new generation of sensors are all part of future planning. This radically different type of carbon fibre also opens up new processing concepts in composite technology.

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Architectural design of porous carbon nanocomposites for energy storage applications

Ruey-an Doong[1, 2], Pei-Yi Chang[2] and Tsu-chin Chou[2]

[1]National Chiao Tung University, Taiwan

[2]National Tsing Hua University, Taiwan

Porous carbon-based nanomaterials and composites are attractive electrode active materials for energy storage devices such as lithium ion batteries (LIBs) and high power density electrochemical double layer capacitors (EDLCs). However, the electrochemical performance of porous carbon materials is highly dependent on the electrolyte/accessible surface area and the power capability capacity is limited by the electrode kinetic constrains such as inner-pore ion transport. The hierarchically ordered porous carbon (HOPC) materials exhibit uniformly distributed mesopores inside the spheres and the existence of macropores between the spheres, which could serve as a buffer for volume change and provide available channels for electrolyte. In this presentation, the fabrication and characterization of metal- and metal oxide-based HOPC composites for high-rate LIB and EDLC applications will be introduced. The HOPC-based nanocomposites were fabricated by using dual templates and evaporation induced self-assembly process. The hierarchical structures generate the highly ordered porous carbons with high specific surface area of higher than 1000 $m^2 g^{-1}$. The specific capacitance of HOPC electrodes can be up to 300 F g^{-1}, and retain over 70% capacitance at a high scan rate of 1000 mV s^{-1}. Addition of MnO_2 and CoO significantly enhances electrochemical performance. In addition, the embedment of Sn nanoparticles or TiO_2 also improves the stability of HOPC and retains high capacity because of the interaction of mesopores and macropores to serves as an effective buffer to prevent the volume expansion during the insertion and removal of Li ions. An extremely high coulomb efficiency of 99% with the stable specific capacity at around 300-600 mAh g^{-1} after 80 cycles was obtained, clearly showing the excellent of HOPC composites for next generation of energy storage devices.

Biography :

Ruey-an Doong has completed his PhD in Environmental Engineering at National Taiwan University, Taiwan in 1992. He joined National Tsing Hua University in 194 and was the Dean of Nuclear Science during 2011-2015. Currently, he is working as full professor in the Institute of Environmental Engineering, National Chiao Tung University. He is serving as an editorial member of several reputed journals like Journal of Environmental Engineering and Management and Global Journal of Environmental Science and Technology. He has authored more than 100 research articles/books. He has honored as fellow of Alexander von Humboldt Foundation, Germany.

Quick and Normal X-ray Absorption Spectroscopy and its Application in Nanotechnology

Syed Khalid

Brookhaven National Laboratory, USA

X-ray absorption spectroscopy (XAS) is now an established technique for probing short range order surroundings of an element with mostly amorphous substance. The information we get out of this is the distance of atoms sitting around the absorbing atom, their co-ordination numbers and type of atoms. At the National Synchrotron Light Source-I (NSLS-I), we developed two beamlines, X18B and X19A, for X-ray spectroscopy to study elements with their K and L edges in the energy range from 2.1 KeV to 40 KeV. That covers elements from phosphorus to K edges of Ba, and L edges of all other elements >2.1 KeV. In addition the X18A and X18B beamlines were developed to do Quick X-ray spectroscopy, with a time scale of 100 ms for the whole spectrum, and 10 ms to study the features of X-ray Absorption Near Edge Spectroscopy (XANES), which has additional information about the chemical composition and oxidation state of the element under investigation. We are developing the same technique at now the world's brightest synchrotron NSLS-II. In Quick-XAS we can study the dynamic function of some reactions, oxidation reduction, laser treatment etc. At Stanford Synchrotron Radiation Laboratory (SSRL) we applied this technique to study acid treated carbon nanotube (CNT) supported ruthenium nanoparticles prepared by aqueous incipient wetness impregnation (IWI) and chemical vapor deposition (CVD) methods. Of particular interest is FT synthesis derived diesel . Various metal catalysts have been investigated for use in FT synthesis, and it is well known that Fe, Co, and Ru are active.

Biography :

Syed Khalid has completed my PhD and Diploma of Imperial College (DIC) from Imperial College, University of London, UK, and postdoctoral studies from University of Delaware, USA. I was a research associate and Adjunct Professor at the University of Pennsylvania, USA. At present I am working as beamline scientist at Stanford Synchrotron Research Facility, Stanford University, USA, and at the National Synchrotron Light Source-II, USA. I have 78 publications and 30 reports and conference presentations. Two book chapters. Gold medal, scholarships and grants also to my credit.

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Non-disruptive Oxygen Annealing of Graphene

Peter K Petrov

Imperial College London, UK

Graphene is a two-dimensional crystal consisting of a single layer of carbon atoms with hexagonal symmetry. Owing to its high electrical conductivity, it can be widely utilised as a conductive electrode for modern electronic devices. Development of technology for fabrication of graphene-oxide structures is essential for realisation of industry attractive graphene based devices. Therefore it is vital to develop a method for non-disruptive Oxygen annealing of Graphene, which parameters could be used for deposition of oxide layers without damaging the underlying graphene or creating high interface defect density between the graphene and oxide materials.

This paper presents the results of an investigation of the process of oxygen annealing of single layer CVD graphene transferred on various substrates. It was found that graphene can endure a temperature up to 600oC at 100 mTorr Oxygen partial pressure. (Results were confirmed by optical microscopy, Raman spectroscopy and electrical measurements.) With increase of the temperature and the Oxygen partial pressure, graphene was destroyed and became discontinuous with pits stochastically distributed on the surface of substrate.

This study demonstrates that the crystalline nature of the graphene could be preserved during an oxygen treatment and identifies the technological parameters for successful growth of oxide layers on graphene. Also, it offers new directions to exploit the development of oxide/graphene multilayer structures and devices.

Biography :

Peter K Petrov has completed his PhD from St Petersburg Electrotechnical University, Russia and postdoctoral studies from Chalmers University, Sweden. He is the Head of the Thin Film Technology Laboratory at Imperial College London. He has published more than 70 papers in reputed journals. Also he is inventor of five patents (two transferred to Ericsson AB, Sweden).

Dr. Petrov is known for his research into functional oxide thin films. Currently he leads and is involved as co-PI in several other research projects aimed to develop nano-scale thin films and structures for energy harvesting and active plasmonic devices.

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Thin polycrystalline diamond films protecting Zirconium alloys surfaces: from technology to layer analysis and application in nuclear facilities

I. Kratochvílová[1,2], P. Ashcheulov[1], R. Škoda[2], J. Škarohlíd[2], A. Taylor[1], L. Fekete[1], F. Fendrych[1], R. Vega[3], L. Shao[3], L. Kalvoda[2], S. Vratislav[2], V. Cháb[1], K. Horáková[1], K. Kůsová[1], L. Klimša[1], J. Kopeček[1], P. Sajdl[4] and J. Macák[4], S. Johnson[5]

[1]Academy of Sciences Czech Republic v.v.i, Czech Republic
[2]Czech Technical University in Prague, Czech Republic
[3]Texas A&M University, U.S.A
[4]University of Chemistry and Technology, Czech Republic
[5]Westinghouse Electric Company, USA

Zirconium alloys can be effectively protected against corrosion by polycrystalline diamond (PCD) layers grown in microwave plasma enhanced linear antenna chemical vapor deposition apparatus. Standard and hot steam oxidized PCD layers grown on Zircaloy2 surfaces were examined and the specific impact of polycrystalline Zr substrate surface on PCD layer properties was investigated. It was found that the presence of the PCD coating blocks hydrogen diffusion into the Zircaloy2 surface and protects Zircaloy2 material from degradation. PCD anticorrosion protection of Zircaloy2 can significantly prolong life of Zircaloy2 material in nuclear reactors even at temperatures above Zr phase transition temperatures.

Biography :

Irena Kratochvílova received her Ph.D. from Czech Technical University in 1998. She is currently serving as an As. Prof with Institute of Physics. Her Research Areas and Interests are Organic materials for electronic applications, MFI zeolites, ferroelectric materials, nanodiamonds, DNA, bioactive and biocompatible materials for medical applications, preparation and characterization of drug delivery systems. She is supervising Master theses defended 4, PhD thesis 8. And she holds patents in *Polyepitope recombinat vaccines for protection against Lyme borreliosis in human and veterinary medicine,* Layer protecting the surface of zirconium alloys used in nuclear reactors and Layer for protecting surface of zirconium alloys. She is honoured with many awards.

Super-Low Friction Mechanism of Diamond-Like Carbon Thin Films: Tight-Binding Quantum Chemical Molecular Dynamics Simulations

Momoji Kubo

Tohoku University, Japan

Super-low friction properties of materials are strongly desired for automotive engines and equipment in the sight of energy saving and efficiency. Recently, diamond-like carbon (DLC) thin films have gained much attention as super-low friction materials. Experimentally, it is pointed out that tribochemical reactions of the DLC thin films are key for their super-low friction properties. However, the super-low friction mechanism in detail has not been clarified yet. Nowadays classical molecular dynamics simulation is employed to investigate the super-low friction properties of the DLC thin films. However the classical molecular dynamics method cannot simulate the chemical reaction dynamics and then the super-low friction properties due to the tribochemical reactions cannot be investigated. Therefore, we developed our original tight-binding quantum chemical molecular dynamics simulator "Colors" for the elucidation of the tribochemical reaction dynamics.

In this conference, we introduce the successful applications of our tight-binding quantum chemical molecular dynamics simulator to the super-low friction properties of the DLC thin films. Especially, the effects of the sp2/sp3 ratio, H- and OH-termination, Si-doping, N-doping, Mo-DTC, etc. on the friction properties of the DLC thin films were investigated and discussed. Those investigations suggest design principles for more effective super-low friction materials.

Biography :

Momoji Kubo is a full professor of Institute for Materials Research, Tohoku University, Japan. He received Bachelor degree in 1990 and Master degree in 1992 from Kyoto University. From 1992, he was a research associate, Department of Molecular Chemistry & Engineering, Tohoku University. In 1999, he received Ph. D degree from Tohoku University. In 2001, he was promoted to an associate professor, Department of Materials Chemistry, Tohoku University and in 2008 he was promoted to a full professor, Fracture and Reliability Research Institute, Tohoku University. In 2015, he moved to Institute for Materials Research, Tohoku University.

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Hydrogen sensing of nano-coronal grapheme/zinc oxide compound

Chen Hsu and Li-ang Hsu

Lunghwa University of Science and Technology, Taiwan

A new kind of materials which is graphene mixed in zinc oxide have been successfully developed for sensing hydrogen at room temperature. Unlike the traditional hydrogen sensors, the new sensing material can detect especially at room temperature and a good selection of hydrogen. The materials were prepared by two-precursor sol-gel method, because the method can easily control micro particle size and composition. Subsequently the powder was treated with the micro-beam laser and re-grew into nano-coronal at graphene addition status. The characteristics were examined by a field-emission electron scanning microscopy, an x-ray diffraction, and a Raman spectroscopy. The thin film of this material was then purged with hydrogen, oxygen, and nitrogen gases respectively and the response signals were wired and detected at room temperature and the high temperature. The sensing can be working at room temperature and high temperature both. The sensing capability is high and the recovery time is only few seconds. The sensing signal depends on the distribution of carbon from the graphene. High addition of carbon exist stronger signal. The strong attraction to hydrogen gas is well related to the nano-coronal structure due to the wide angle of touching with hydrogen gas.

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Probing the electronic disorder in the graphitization range of sp^2 carbons using Raman scattering

M.R. Ammar, D. De Sousa Meneses, A. Canizarès, O.A. Maslova P. Simon

University of Orleans, France

Raman spectroscopy becomes today one of the most important tools in nanoscience and nanotechnology owing to its high sensitivity to the physical and chemical properties of materials, as well as to the environmental changes that affect these properties. Among these materials, Raman spectroscopy is a method of choice for characterizing sp^2 nano-carbons due to the detailed information that provides whether in terms of the structural, vibrational, mechanical or even electronic properties. Moreover, the presence of any defects in sp^2 carbon network leads to particularly rich and unique phenomena in their Raman spectra, which thereby place this characterization technique among the most sensitive one to defects in sp^2 carbon matter. Graphite exhibits the symmetry-allowed G band at 1581 cm^{-1} corresponding to one phonon Raman scattering process (q~0), simply described by a Lorentz model. However, additional bands appear when disorder is introduced into the material, breaking therefore the crystal translational symmetry. These bands are called "defect bands": D (~1350 cm^{-1}) and D '(~1620 cm^{-1}).

In the present work, Raman characterization was carried out on a series of anthracene-based coke in the graphitization range. While on one hand the network dynamic shows a structural ordering of sp^2 carbon upon increasing the pyrolysis temperature, the electronic structure of the carbon network, on the other hand, displays an inhomogeneous broadening of the defect-induced D band. The different characteristics of defect-induced D band in the graphitization range will be discussed in this presentation.

Biography :

Mohamed-Ramzi AMMAR studied drug delivery systems using several techniques as a PhD fellow from 2003-2007. As a post-doctoral fellow at ENS-Paris (2008-2010), he studied the irradiated nuclear graphite used in the first generation nuclear reactors (UNGG), and later as an Associate Professor at Orleans university-*CEMHTI* (since 2010), Mohamed-Ramzi AMMAR focused on the Raman characterization (in situ and ex situ) of a variety of materials subjected to extreme conditions namely high temperature and irradiation.

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Development of plasmonic colour filters for submicron pixels

Ranjith Rajasekharan Unnithan and Efstratios Skafidas

The University of Melbourne, Australia

We present a pathway for the development of submicron plasmonic colour filters. We initially determined the minimum plasmonic filter size required to define a submicron scale pixel using simple holes in aluminium. The results showed that the minimum number of holes required for realizing a polarization independent submicron colour filter is three in an equilateral triangular arrangement. This enables development of triangular pixels in displays. But the majority of state-of-the-art displays use rectangular or square shape pixels. We then demonstrated that development of rectangular or square shape pixels is hindered by boundary errors and stitching errors at the submicron scale. These errors cause blur, reduced sharpness and discontinuities in the displayed images. In order to eliminate these errors, we have developed a simple but powerful filling strategy by combining surface plasmon and Fabry-Perot resonances. These submicron colour filters will have applications in displays, projectors, spatial light modulators (SLM), liquid crystal over silicon technology (LCOS) and wavefront sensors.

Biography :

Ranjith R Unnithan is Lecturer of Electrical and Electronic Engineering at The University of Melbourne. His research is to combine both nanophotonics and nanoelectronics on a single chip. Ranjith finished his PhD in Electrical Engineering from the University of Cambridge in 2011. After finishing his PhD, he worked as a postdoctoral researcher and project manager in the Electrical Engineering Department at Cambridge for a Samsung funded project. He is recipient of a number of awards; including CambridgeSens innovation awards both in 2009 and 2010 and two awards from Cambridge University Entrepreneurs in 2011.

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Heat Treatment effect on corrosion behaviour of nanocrystalline coatings

Bacha Nacer Eddine

University of Blida 1, Algeria

The aim of this work is the electrochemical characterization of metallic coatings in the amorphous and nano-crystalline (amorphous aged) state. Two alloys, one based NiCrBSi and the other based FeCrPC were successfully deposited using thermal plasma technology. The corrosion behavior of amorphous coatings was evaluated by potentiodynamic tests in hot acids. The X-ray diffraction, optical microscopy, electron microscopy (SEM) and transmission microscopy TEM were used to characterize the microstructures of the coatings. The results show that moderate aging temperatures (<300 ° C) produce a beneficial structural relaxation, generally in improved corrosion resistance. When the aging temperature increases, the precipitates during crystallization cause a marked deterioration of corrosion resistance of amorphous coatings. This corrosion behavior of amorphous metallic alloys depends on their chemical composition.

Biography :

Bacha has completed his PhD from university of Sherbrooke, Canada. He is the director of Laboratory of Surface Treatment & Materials. He was vice rector of Research Studies and Head Materials Science Department at university of Blida. He was Head of Industrial Maintenance Department in the pulp and paper industry in Algiers before joining university. He has published more than 21 papers in reputed journals. He has organized many international conference in Algeria.

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Recent Progress of Quasi van der Waals Epitaxial growth of GaAs on Silicon Using Graphene

Shamsul Arafin

University of California, USA

III-V compounds epitaxially grown on silicon (Si) have attracted immense research interests for many years due to its applications in integration of optoelectronic devices with Si-based mature microelectronic technology. However, such direct heteroepitaxy is challenged by dissimilar chemical bonding, surface dangling bonds, surface states, and surface symmetry mismatch. In addition, lattice mismatch, polaron-nonpolar epitaxy, and thermal expansion mismatch make direct heteroepitaxial growth of GaAs/Si even more challenging. Quasi van der Waals epitaxial (QvdWE) growth of GaAs on Si using a two-dimensional layered material, graphene, as a lattice mismatch / thermal expansion coefficient mismatch relieving buffer layer is a novel route towards heteroepitaxial integration in the developing field of silicon photonics. Recently, we demonstrated the first example of an ultra-smooth morphology of quasi-epitaxial GaAs films deposited by molecular beam epitaxy on graphene/silicon system, making it a remarkable step towards an eventual demonstration of the epitaxial growth of GaAs by this approach for heterogeneous integration. In this talk, the details of thin film growth, theoretical calculations and material characterization results as well as our recent efforts for GaAs thin films on graphene/Si system will be presented.

Biography :

Shamsul Arafin is currently working as an Assistant Project Scientist in University of California at Santa Barbara (USCB), USA. Prior to joining UCSB, he worked as a Postdoctoral Research Scholar in Device research laboratory at University of California at Los Angeles, USA. He received the B.Sc. degree in Electrical and Electronics Engineering from Bangladesh University of Engineering and Technology (BUET), Bangladesh in 2005 and the M.Sc. degree in Communication Technology from Universität Ulm, Germany, in 2008. He received his Ph.D. degree from Technische Universität München, Walter Schottky Institut Germany in 2011. In 2012, he joined the nanophotonics group of Electrical and Computer Engineering Department at McGill University as a post-doc fellow.

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Graphene and its functionalization: developing a platform for flexible and transparent optoelectronics

Monica Craciun

University of Exeter, UK

Graphene –a single layer of carbon atoms with honeycomb structure- has emerged as a new paradigm in condensed matter physics due to the gamut of unique physical properties which also make it the ideal platform for novel transparent and flexible opto-electronic devices. These unique properties can be further tailored to fit specific device functionalities by means of chemical bonding of a molecule or a chemical element to the pristine graphene.

The most recent example of the potential of chemical functionalization is GraphExeter, (i.e. few-layer graphene intercalated with $FeCl_3$), a new graphene-based material Prof Craciun's team developed at Exeter. This material is currently the best performing carbon-based transparent conductor [Adv. Mater. 24, 2844 (2012)], with resilience to extreme conditions [Scientific Reports 5, 7609 (2015)]. In this talk I will review our latest developments in the use of functionalization for whole-graphene optoelectronics. We have recently demonstrated the potential of GraphExeter for flexible electronics [Scientific Reports 5, 16464 (2015)] and transparent photo-detectors [ACS Nano 7, 5052 (2013)] as well as light-emitting and energy harvesting devices.

Biography :

Craciun has completed her PhD from Kavli Institute of Nanoscience, Delft University of Technology, The Netherlands and postdoctoral studies from The University of Tokyo, Japan. She leads a group of 30 researchers focusing on two-dimensional materials for emerging technologies such as electronic textiles, smart windows – comprising displays integrated into windscreens of airplanes and cars – or next generation of highly efficient solar cells and light emitting devices. She has published more than 50 papers in reputed journals such as Nature Nanotechnology, PNAS, Advanced Materials, Nano Letters. Her publications have attracted more than 1500 citations and h-index of 20.

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Carbon nanotubes/polyethersulfone (CNT/PES) nanocomposite membranes fabrication and characterization

Vedat Uyak[1*], Vildan Cansiz Selcuk[1], Derya Karsi[2], Ismail Koyuncu[2]

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Multi-walled carbon nanotubes/polyethersulfone (CNT/PES) blend membranes were prepared by a phase inversion process, using N-methyl-2-pyrrolidinone (NMP) as a solvent and water as a coagulant. The prepared CNT/PES blend membranes were then characterized using the several analytical methods such as a Fourier transform infrared (FTIR) spectroscopy, a contact angle goniometer, a scanning electron microscopy (SEM) and permeation tests. Because of the hydrophic CNTs, the surface of the CNT/PES nanocomposite membranes appeared to be more hydrophilic than a just PES membrane. The carboxylic acid functional groups on the surface of CNTs seemed to act to increase hydrophilicity of the CNT/PES membranes. The morphology and permeation properties of the CNT/PES nanocomposite membranes were also found to be dependent on the amounts of CNTs used. The pore size of the nanocomposite membranes increased along with the contents of CNTs up to 1.0%, then decreased, and at 4.0% of CNTs, it showed smaller increase. The CNT/PES membrane with 1.0% of CNT content showed higher flux (434 L/m^2*h*bar) and rejection than the pristine PES membrane.

Dynamic Response of an Electrostatically Actuated Carbon Nanotube based NEMS Actuators

Hassen M. Ouakad

King Fahd University of Petroleum and Minerals, Saudi Arabia

Several nonlinear phenomena have shown to have significant effect on the electromechanical performance of carbon nanotube (CNT) based NEMS devices. To name few: the van der Walls forces, the Casimir forces, the tip charge concentration and the rippling phenomenon. Some of these effects have been take care of in previous investigation, however, some have been disregarded in the mechanical models suggested for simulation of the CNT based structures. In this talk we will discuss, the influence of rippling deformation on the vibration characteristics of CNT based actuators is investigated using a nonlinear Euler-Bernoulli beam theory that incorporates the effect of rippling deformation using an improved function including some correcting terms for the CNT curvature (rippling deformation). The influence of van der Waals forces attraction is considered in our proposed model. The dynamic response of CNT is investigated based on time history and phase portrait plots of the CNT based nano-actuator. We will show that the rippling deformation can significantly decrease the dynamic pull-in voltage of the CNT based actuator. We will also show that the rippling deformation of CNT increases the pull-in time and voltage a well. Effect of various factors such as vdW attractive force and the damping ratio on the dynamic stability and the pull-in characteristics of the nano-actuator are examined. Results of the present study are beneficial to precise design and fabrication of electromechanical CNT actuators. Comparison between the obtained results and those reported in the literature by experiments and molecular dynamics, verifies the integrity of the present analysis.of unexpected resonances, and unexplained patterns of the dependence of their natural frequencies on the gate voltage. In order to successfully take NEMS from research labs to real-life applications, knowledge about these issues need to be well assimilated.

Biography :

Hassen M. Ouakad was born in Bizerte (Tunisia) in 1983. He received the B.Sc. degree, with honors, in Mechanuics and Structures in 2007 from Tunisia Polytechnic School. In 2008 he received a master degree in Computational Mechanics from a joint graduiate program between Tunisia Polytechnic School, Tunisia, and Virginia Tech, VA, USA. Then he joined the MEMS characterization and Motion Lab of the State University of New-York at Binghamton (NY, ISA), where he received the Ph.D. degree in 2010. In January 2011, he joined the petroleum Engineering Department of the Texas A&M, Qatar as a postdoc research assistant. In September 2011 he joined the Mechanical engineering Department of King Fahd University as an Assistant Professor. He is the recipient of the 2010 Excellence in research award granted by the Watson School of the State University of New-York at Binghamton, NY, USA. Dr. Ouakad holds two patents dealing with introducing new techniques for controlling the micro-contact printing in roll-to-roll processes. Furthermore, Dr. Ouakad invented new miniaturized devices that rely on the fringing-fields electric loads as an actuation technique in MEMS devices. Dr. Ouakad authored and coauthored more than fifty scientific articles published in highly ranked international journals and conferences. His work has been cited more than 400 times and his H index is 10. He is a member in the Institute of Electrical and Electronic Engineers (IEEE), and the American Society of Mechanical Engineering (ASME). He currently serves as an Associate Editor for International Journal of Applied Mechanics and Engineering (IJAME) and has served on the scientific committees of several international conferences.

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Scientific Sessions

Day 2

Session 1 & 2

Nanomedicine and Biomedical Engineering
Nanomedical approaches for diagnostics and treatments
Cancer nanotechnology & tissue engineering
Drug delivery systems

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Title:	Effects of micro/nano pattern on neuronal polarization **Zhang Yilei,** Nanyang Technological University, Singapore
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Title:	Nanotechnology for Medicine **Sonia Trigueros**, Oxford University, UK
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Nanoelectronics
Nanodevices & Nanosensors

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Title:	Low-cost hybrid heterostructures for photovoltaic & light-emitting device architectures **Sylvain G. Cloutier**, Ecole de technologie superieure, Canada
Title:	A study of Magnetic Nanodot Arrays Fabricated by Intrinsic electromagnetic UV-imprinting technology **Ting-Ting Wen**, National Chiao Tung University, Taiwan

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Endogenous chromophores and their nanocomposites as contrast agents for imaging and bioengineering

Anton Liopo[1, 2], Olga Chumakova[3], Eugene Zubarev[2], Alexander Oraevsky[1]

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[2]Rice University, USA

[3]University of Texas Health Science Center, USA

Organic based nanoparticles (NP) have been designed and applied as contrast-enhancing agents in various imaging techniques: optical coherence tomography, fluorescence imaging, optical reflectance microscopy and recently, optoacoustic imaging (OA).

Hemoglobin and melanin, the two main endogenous chromophores, have been used as contrast agents for enhancement of OA imaging. Hemoglobin has been also explored for OA tomography in different applications. Hemoglobin-based photoacoustic imaging can facilitate the monitoring of many other biological processes: TomoWave Labs demonstrated OAT related changes during blood coagulation and de-oxygenation for the whole body of a mouse *in vivo* and *postmortem*.

Melanin is another primary absorber in living organisms. We describe the synthesis and characterization of melanin-like nanoparticles (MNP). Good dispersion stability of high concentration MNPs in different biological media was achieved with thiol-terminated polyethylene glycol (PEG), which can be used for further functional conjugation. MNP-PEG is biocompatible with human cells. Water suspensions of MNP have optoacoustic efficiency comparable to gold nanorod solutions of equal optical absorption. Natural biocompatible contrast agents are good candidates for *in vivo* applications.

Biography :

Anton Liopo earned his PhD degree from the Institute of Physiology of National Academy Science of Belarus (NASB). He went on to join the Institute of Biochemistry of NASB, where he had much success and was able to work his way up the ladder from a young scientist to a Senior Scientist, Associate Professor and eventually the Director of Government Program. He specialized in biochemistry of bioactive compounds, addiction biology, and investigation of the structural changes of neuronal membrane by atomic force microscopy. After moving to the United States (2002) He obtained intensive trainings in molecular biology and nanotechnology at the University of Texas, Medical Branch at Galveston (UTMB). In two years He went from his training level to being a leading Researcher for nanoparticle biomedical application at the Center for Biomedical Engineering at UTMB. In 2010 he was invited to join TomoWave Laboratories Inc. (Houston, TX, USA), where he is presently the lead Scientist over the nanobiotechnology program and director in vivo study. He has created the nano-based contrast agents for optoacoustic imaging and sensing, such as hollow gold nanoshells and gold nanorods at different size and aspect ratio, carbon nanotubes and polymeric nanoparticles. He is currently performing the investigations of novel nanoparticles to develop molecular probe for improving optoacoustic imaging, laser nanothermolysis, molecular sensing, and contrast diagnostics and therapy. As visiting scientist He has joined Rice University, Department of Chemistry where he works on biomedical applications of nano-base composites. He has served as a member of the International conference committees. He is a regular reviewer for many scientific journals and member of several international scientific societies. He has more 60 publications in peer-review journals, proceedings of international conferences and book chapters.

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Biomimetic Creation of Functionalized Polymeric Nanoscale Fibers for Controlled Drug Delivery

Anand Gadre

University of California, USA

Several fabrication techniques have been investigated for the growth of polymeric functional nanofibers. Electrospinning is the most popular and preferred technique because it is simple, cost effective, and has the ability to produce continuous nanofibers. Electrospun nanofibers show great promise for developing many types of novel drug delivery systems due to their special characteristics and effective top-down fabricating process. Therefore to explore more opportunities from the electrospinning process and the corresponding drug-loaded nanofibers for drug delivery, this work is focused on the fabrication of functionalized random and aligned Poly Lactic–co-Glycolic Acid (PLGA) electrospun two-dimensional (2D) and three-dimensional (3D) nanofibers for controlled drug-delivery application. PLGA nanofibers were well loaded without any chemical and structural modifications by soaking the polymer into 10% and 20% Lidocaine (pain medication) drug solution for various time intervals (1hr to 4 hrs). Morphological changes of the functionalized/drug-loaded fibers were analyzed using Scanning Electron Microscopy (SEM). Fourier Transform Infrared Spectroscopy (FTIR) was utilized to confirm the presence of Lidocaine drug into the fiber matrix. Drug elution experiments using UV Spectrophotometry showed clear indication in the absorbance change as the drug elutes from the fiber matrix over the period of time. Such drug-loaded nanostructures produced can be applied via different routes, such as implantation, injection, and/or oral administration for a wide range of disease treatment.

Biography :

Anand Gadre graduated with his BS and MS Degrees from the University of Mumbai, India and completed his doctorate (Ph.D.) from the Institute of Chemical Technology (ICT), Mumbai, India. From 2001-2004 Anand worked as a Postdoctoral Scholar in the University of Maryland (USA) and in Georgetown University at Washington DC. In 2004, Anand was appointed as an Assistant Professor of Nanobioscience in the State University of New York at Albany and later was promoted as an Associate Professor of Nanobioscience with tenure. Anand also achieved his Master in Business Management (MBA) degree from the State University of New York at Albany. In March 2011 Anand joined as the Director of a core Nanofabrication and Stem Cell Research facility in the University of California, Merced, where he is currently pursuing his research in Nanobioscience. Anand is an active researcher and has published several peer reviewed papers, co-authored book chapters, and has been serving as an editorial board member for several national/international journals.

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Dual Modality Nanomedicine for Imaging and Treatment of Brain Cancer: Nanoclinic in the Brain

Rameshwar Patil, Pallavi R. Gangalum, Hui Ding, Alexander V. Ljubimov, Szu-Ting Chou, Leila Mashouf, Irving Fox, Keith Black, Julia Y. Ljubimova and Eggehard Holler

Cedars-Sinai Medical Center, USA

MRI enhancement(s) can result from metastasis of primary tumors such as lung or breast, radiation necrosis, infections, or a new primary brain tumor (glioma, meningioma). Neurological symptoms are often the same on initial presentation. Differential diagnosis of brain magnetic resonance imaging (MRI) enhancement(s) remains a significant problem, which may be difficult to resolve without biopsy, which can be often dangerous or even impossible. To develop a more precise noninvasive MRI diagnostic method, we have engineered a new class of poly(β-L-malic acid) polymeric nano-imaging agents (NIAs). The NIAs carrying covalently attached MRI tracer are able to pass through the blood-brain barrier (BBB) and specifically target cancer cells for efficient imaging. A qualitative/quantitative "MRI virtual biopsy" method is based on a nanoconjugate carrying MRI contrast agent gadolinium-DOTA and antibodies recognizing tumor-specific markers and extravasating through the BBB. In newly developed double tumor xenogeneic mouse models of brain metastasis this noninvasive method allowed differential diagnosis of HER2- and EGFR-expressing brain tumors. After MRI diagnosis, breast and lung cancer brain metastases were successfully treated with similar tumor-targeted nanoconjugates carrying molecular inhibitors of EGFR or HER2 instead of imaging contrast agent. The treatment resulted in a significant increase in animal survival and showed markedly reduced immunostaining for several cancer stem cell markers. Novel NIAs could be useful for brain diagnostic MRI in the clinic without currently performed brain biopsies. This technology shows promise for differential MRI diagnosis and treatment of brain metastases and other pathologies when biopsies are difficult to perform.

Biography :

Rameshwar Patil received his PhD from the Institute of Organic Chemistry and Pharmacology, University of Regensburg, Germany and completed his postdoctoral studies from the Department of Neurosurgery, Cedars-Sinai Medical Center, USA. He is a Faculty at the Nanomedicine Research Center (NRC) in the Department of Neurosurgery, a "State of the Art" facility developing nanomedicine applications to image and treat brain diseases. He is an imaging specialist at NRC and has broad background in chemistry and pharmacology including drug delivery and Nanomedicine. Dr. Patil has over 70 peer-reviewed publications and he is Co-Investigator of several NIH/NCI grants.

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Effects of micro/nano pattern on neuronal polarization

Zhang Yilei and Shreyas Kuddannaya

Nanyang Technological University, Singapore

Neuronal growth, maturation and morphology affect the normal development of mammalian brain. The brain cortex is an active center of neuronal activity with control on diverse functions in motor sensory body functions. Development of cortical tissue consisting mainly of neuronal, and glial cells is dependent on active functions of these cells in the brain tissue microenvironment. Microfluidic chamber is a good tool to study neuron development or fusion in vitro. Surface conditions of the microfluidic chamber, such as functional group, roughness, etc., could all affect the neuron adhesion, growth as well polarization and neuronal network formation. A method based on self-assemble monolayer assembly, micro/nano patterning was developed to enhance the adhesion and growth of neurons in the in vitro environment as well as the effects of micro/nano pattern no neuronal polarization and network formation. This work demonstrates the importance of surface conditions on the neuronal activities.

Biography :

Zhang Yilei has completed his PhD from Iowa State University, USA and worked as a senior research engineer in the Goodyear Tire and Rubber Company, USA. Currently, he is an assistant professor in the School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore. He is interested in micro/nano sensor, neuroengineering and complexity, and has published more than 20 papers in reputed journals.

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Nanosponges as Potential Drug Delivery Systems: An Overview

Rana Zainuddin Ahmed

Y.B. Chavan College of Pharmacy, Dr. Rafiq Zakaria Campus, India

Nanotechnology - a word the new millennium has often heard and yet has not ceased to amaze scientists. Nanosponges are a comparatively new addition to the nano family. Appearing as 'honey comb' structures; they offer new advances in drug delivery. The nanoscopic biodegradable organic network resembles a sponge which can soak up drug molecules within its internal cavities. The presentation will acquaint researchers with a decade's work on nanosponges.

De Quan Li and Min Ma were one of the first to successfully develop 'Cyclodextrin nanosponges' that was employed to absorb and trap organic contaminants for water purification. In the pharmaceutical arena, nanosponges have been fabricated to overcome issues related to drug delivery. Their matrix presents external and internal binding sites for poorly-soluble drugs, entrapment into these sites subsequently improve drug solubility, bioavailability and stability. Prof. Eva Harth, Vanderbilt University, USA, has pioneered the art of attaching linkers, which carries the functional units to the target cancer cells. The sponge prevents drug and protein degradation and prolongs release in a controlled manner. The audience will be briefed in about the history, approaches to synthesis, advanced characterization methods employed and applications in improving drug delivery through different approaches.

Biography :

Rana Zainuddin Ahmed is presently working as an Assistant Professor at Y. B. Chavan College of Pharmacy, Aurangabad, India. She has 13 years of teaching and research experience and has published research articles in reputed journals. She has received a research project grant by the University Grants Commissions, India, to carry out work on Nanosponges as drug delivery systems. She has filed an Indian patent on Novel method for synthesis of Nanosponges. She is an Editorial board member of Journal of Innovations in Pharmaceutical and Biological Sciences.

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Interaction of Polymeric Nanoparticles with Biomimetic Models of the Lung Surfactant

Weiam Daear

University of Calgary, Canada

The human body offers various routes that could be used for drug delivery. In our lab, we are interested in the pulmonary drug delivery route. The lungs which are the major organs of this system, provide distinct advantages due to the large surface area it provides in addition to its close proximity to the blood circulation. Drugs or molecules pass through various parts of the respiratory system before reaching the lung's alveoli. The alveoli provide a thin air-blood barrier for drugs to enter the blood stream. The inner lining of this barrier is composed of a monolayer called the lung surfactant (LS). The major role of the LS is to reduce the surface tension experienced through breathing cycles. Any disruption to the stability of the LS monolayer could result in lung collapse.

As the field of nanomedicine advances, there is an increasing interest in the use of nanoparticles (NPs) as drug delivery vehicles. We are interested in understanding the interaction between various polymeric NPs and the LS and whether there is any destabilization effect upon interaction. Results on monolayer stability and lateral organization measurements have shown that there are differential interactions that are NP specific. Our lab is also interested in whether these NPs cause an immediate or long term destabilization effect on the LS. Overall, this work will help generate a better understanding of nanotoxicology in terms of NPs and the pulmonary drug delivery route.

Biography :

Weiam is currently a PhD student at the University of Calgary, Canada with 2 publications in peer reviewed journals (J. Phys. Chem. B. and Colloids Surf., B). She has a B.Sc. in Biological Sciences with a minor in Nanoscience. She attended two international conferences and gave a talk at the institute of Molecular Biosciences at the University of Graz, Austria. She won first prize in the biochemistry cluster in the Sigma Xi organization student showcase 2014.

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Nanotechnology for Medicine

Sonia Trigueros

Oxford University, UK

Nanotechnology is a new exciting field that has the potential to transform the way that medical and healthcare solutions are being developing. At the Oxford Physics Department we research on the newest techniques and materials at the nanoscale level. We apply this knowledge directly first to learn the relevant biology at the single molecule level and then to utilize the science and the technology to solve the most pressing medical problems of the 21st century.

Biography :

Sonia Trigueros' group focuses on the design of novel nanodrug delivery system to target dividing cells, specifically cancer cells. She is also developing new Nanomedicines to tackle bacterial antibiotic resistance problem. She has a PhD in molecular biology from IBMB-CSIC and Universidad de Barcelona. After her postdoctoral research fellowships at Harvard and Oxford Universities, Trigueros was a research visitor to several academic institutions including NIH-Washington and Havana University. She is currently an Academic Fellow at the Physics Department and the Co-director of the Oxford Martin Institute of NanoMedicine at University of Oxford. Her Current position is Academic Fellow. Department of Physics. Oxford University. She is Director of the Oxford Martin Program on Nanotechnology (Institute of Nanoscience for Medicine), Scientific Advisor at the Blavatnick School of Government. Oxford University, Scientific Advisor at the SAID Business School. Oxford University, European Commission Evaluator REA (Research European Agency), Evaluator for AGAUR (Agencia de Gestio d'Aduts Universitaris I de Recerca), Member of the Royal Society of Medicine. London UK, Editorial Board Member for: Nuclear Acid Research OUP, the Journal of International Studies for Cuba and Co-Fundadora de la Fundacion "Grandes Planes" para el studio y divulgacion de la Nanotechnologia.

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3D-Bioengineering of the Conventional Outflow Tract for High Throughput Drug or Gene Transfer Screening for Glaucoma Treatment

Cula N. Dautriche

SUNY Polytechnic Institute, USA

Among ocular pathologies, glaucoma remains the second leading cause of blindness. The exact molecular mechanisms that lead to glaucoma remain to be elucidated; yet have been attributed to damage of the conventional outflow tract. Conventional outflow tissues, a composite of the trabecular meshwork and the Schlemm's canal, regulate and maintain homeostatic responses of aqueous humor outflow. There are no drugs targeting this structure implicated as the cause of glaucoma. This is, in part, due to limits in our understanding of the pathology at the molecular level and lack of an *in vitro* model system for outflow studies. To address this problem, we have successfully engineered a biomimetic conventional outflow tract as a model for understanding of TM outflow physiology and pathology and development of TM targeted therapies. We designed and used a 3D multi-culture system consisting of HTM cells and HSC cells sequentially seeded on a highly porous, microfabricated, hydrogel-scaffold. We demonstrated that our biomimetic conventional outflow tract exhibited *in vivo*-like characteristics (ultrastructure, cytoskeletal orientation/organization, marker-gene expression, extracellular matrix (ECM) deposition, and outflow regulation). In particular, the biomimetic conventional outflow tract exhibited homeostatic responses to elevated pressure and physiological responses to pharmacotherapies and gene transfer. This model can be used to understand the physiology of the conventional outflow tract and the pathology of glaucoma, as well as to predict the physiological responses of its *in vivo* counterpart in the development of glaucoma pharmacotherapy. In addition, this modality may also facilitate more rapid development of technologies for glaucoma diagnosis and treatment.

Biography :

Cula N. Dautriche is currently studying medicine at SUNY Downstate Medical Center. She received her Ph.D in Nanoscale Science from Colleges of Nanoscale Science and Engineering at Albany University in 2015. She graduated *cum laude* with her B.A. in Chemistry and B.S. in Biology from the CUNY-Brooklyn College.

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Wide bandgap III-nitride nano-hetero structures for new generation of optoelectronic devices

Abdallah Ougazzaden

Georgia Institute of Technology, France

Nanostructures based on wide bandgap III-nitrides have recently emerged as one of the most promising class of material for site-controlled opto-electronic and nanophotonics devices. But growing high quality thick III-nitride alloys like InGaN, BGaN and AlGaN is challenging due to lattice mismatch induced phase separation, defects and dislocations. Nanoselective area growth (NSAG) of GaN, InGaN and BGaN nanopyramids on GaN template, Si substrates and sacrificial-ZnO/Al_2O_3 was investigated to mitigate the above issues. Nanopatterned SiO_2 with 100 nm circular openings was made using E-beam lithography. Growth of thick InGaN and BGaN was carried out by MOCVD on silicon substrates and ZnO templates. This nano bottom-up approach leads to dislocation free nanostructures due to the three dimensional stress relief mechanisms. In stark contrast to the conventional epilayers, which contain 3D surfaces, huge density of defects and V-pits network, the GaN, InGaN and BGaN nanopyramids are uniformly sized and hexagonal in shape. Cross sectional STEM analysis confirms that these nanopyramids are single crystalline and free from threading dislocations. Full PIN structures were grown sandwiching the InGaN nanopyramids on GaN templates. Further 2D layered BN on 2” sapphire wafers were realized for the first time to serve as a platform for combining graphene nanoelectronics with III-nitride nanophotonic components.

Given their expected high performances and lifetime, along with their industrial maturity for light-emitting diode (LEDs) applications, such alloy nanostructures are appealing for new generation of optoelectronc devices. New designs and device structures for high efficiency solar cells, μ-LEDs, gas and water sensors will be presented.

Biography :

Abdallah Ougazzaden Professor at ECE School at Georgia Tech, Director of GT-CNRS lab, Director of the European Campus of GIT, and Co-President of Lafayette Institute the platform of technology transfer. He worked in R&D at France Telecom 12 years and one year at Optoplus/Alcatel. In 1999, he joined Bell-Labs at Lucent Technologies (USA). He kept this position with the company Agere Systems (USA), and then at TriQuint Semiconductor (USA). His current research activity is in the field of semiconductors and related devices. He has published more than 350 papers and holds 23 patents and served as Chair of IC-MOVPE 2008.

Transport Processes due to Surface Plasmon

Peng-Sheng Wei

National Sun Yat-Sen University, Taiwan

A surface plasmon on a metal surface can be excited by an incident laser beam in a TM mode. The TM mode represents that magnetic field is perpendicular to the incident plane of electrical field. The surface plasma wave is an electromagnetic wave that propagates at the boundary between two media, leading to a distributed heat input on the surface. This study is thus to predict transport processed induced by surface plasmon for different electrical and magnetic properties and surface roughness on various materials. A systematical investigation of heating and melting of a micro-scaled component subject to a pulsed laser is essentially required for a penetrative study in various plasma processing and nanotechnology.

Biography :

Peng-Sheng Wei received Ph.D. in Mechanical Engineering Department at UC Davis. He is currently a Xi-Wan Chair Professor in Department of Mechanical and Electro-Mechanical Engineering of National Sun Yat-Sen University, Taiwan. Dr. Wei has contributed to advancing the understanding of electron and laser beam, plasma, and resistance welding, and involved defects such as humping, rippling, spiking and porosity. Aside from Fellow of AWS and ASME, he received the Outstanding Research Achievement Awards from both the National Science Council (NSC) and NSYSU, the Outstanding Scholar Research Project Winner Award from NSC, the Adams Memorial Membership Award from AWS, Warren F. Savage Memorial Award from AWS, and William Irrgang Memorial Award from AWS. He is also an Invited Distinguished Professor in Beijing University of Technology.

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New development in high power GaN transistor technology

Hassan Maher

University of Sherbrooke, Canada

Gallium nitride (gan) is a III-V material with high band gap and high electron velocity. These two key parameters allow the gan to answer different market and research needs in terms of high power and RF applications. Even if development of this material dates back to the late 90's, it is still seen as a new and promising material. This is mainly due to the fact that the current material quality remains below the standards of the more established III-V materials (gaas, inp). For the electronics devices, this can be seen by the traps density and crystal quality of the active layer, which will directly affect the electrical performance stability of the device. Consequently, the introduction of gan in the market is proceeding more slowly than first expected.

The device engineers are nonetheless working hard to introduce different concepts to minimise or to avoid the impact of the gan crystal quality and defect density on the electrical stability and the reliability of the device. On other hand, for high power gan device, self-heating during operation is a crucial parameter that can influence the carrier trapping and detrapping, which directly affect, among other things, the drain current, the pinch-off voltage, and the dynamic ON-resistance « Ron » of the device. Considering this situation, it is highly desirable that the junction temperature of the device be measured in real time and kept under control during the device operation. In this presentation we will show an example of the gan HEMT fabrication process and we will introduce a novel approach for « on-device » and « in-operation » temperature measurements developed at the University of Sherbrooke.

Biography :

Hassan Maher, received the Ph.D. Degrees in integrated micro-and opto-electronics and sensors from University Paris XI. In 1996 he joined the CNET, Bagneux, France, working on the growth of inp HEMT by MOCVD and design, implementation and characterization of inp composite channel hfets for PIN-HEMT circuits. In 2000 he joined the CSDL at Simon Fraser University, BC, Canada, working on algan/gan microwave field-effect power transistors. In 2001 he joined perkinelmer-Optoelectronics, QC, Canada, working on the development of the PIN-HBT circuits. In 2003 he joined OMMIC, Limeil-Brevannes (Paris), France, leading the R&D division, working on FP7, ESA, ANR and other national projects dealing with RF mmics based on hemts (inp, gaas, Metamorphic, Pseudomorphic and gan), RITD (diode) and hbts. Since 2012 he is a professor at the Université de Sherbrooke, QC, Canada and a member of the Laboratoire Nanotechnologies Nanosystèmes (LN2)-CNRS-UMI-3463, Institut Interdisciplinaire d'Innovation Technologique (3IT). His research is focused on advanced fabrication processes of III-V (gaas, inp, gan) devices and circuits.

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Fluorescent Dye Copolymerized Silica Nanoparticles for Labeling and Sensing

Gabor Patonay, Maged Henary, Kyle Emer and Gala Chapman

Georgia State University, USA

Fluorophores are often used in bioanalytical and medical applications as labels and sensors but their applications are not limited to these areas. There have been continuous research efforts to increase fluorescence intensity of these reporting labels and probes. One approach to achieve high fluorescence intensity is to incorporate several fluorophores into a single reporting or sensor entity which chemical and physical properties are controlled. Nanotechnology made possible these new designs. The most stable sensor and reporting label can be made if the fluorophores are copolymerized into the nanoparticle. Silica nanoparticles are one of the most economical ways to achieve these goals. Fluorescent dye copolymerized silica nanoparticles can be made of using almost any desired fluorophores, or more than one type of fluorophores, that can be modified to have suitable functional moiety for covalent binding to the silicate monomer used during the silica nanoparticle synthesis. Although fluorescent silica nanoparticles can be made by simply saturating commercially available porous silica nanoparticles with fluorescent dyes; solid or porous silica nanoparticles containing covalently copolymerized dyes have much superior properties as no leaching would occur. For example using appropriate functional moieties, absorption and fluorescence properties of the nanoparticle would change when complexes to metal ions, to detect pH changes, bind to biological molecules, etc. NIR dyes that are copolymerized in these structures have significant spectral advantages over visible dyes as the NIR spectral region (650-900 nm) offers reduced background interference and larger penetration depths. Fluorescent dyes confined to such small volume (20-100 nm diameter) often prone to self quenching. This can significantly be reduced by using dyes that have larger Stokes' shift. This presentation discusses facile synthesis of dye copolymerized silica nanoparticles. This can be achieved for example by using dye modified TEOS during the silica nanoparticle synthesis. The molar ratio of TEOS and modified TEOS will determine the fluorescent dye load in the silica nanoparticle. Dependent on the functional groups present in the reporting dye to be used to prepare the modified TEOS and its spectral properties, the resulting silica nanoparticle can be used for many applications. Several advantages emerge from using silica nanoparticle protected sensors; such as higher dye stability and brighter fluorescence. Several applications will be discussed including chemical, biological and medical uses of these fluorophore copolymerized silica nanoparticles.

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April 21-23, 2016, Dubai, UAE

Compact and energy-efficient on-chip silicon photonic devices based on micro-resonators

Christine TREMBLAY[1], Jiayang WU[2], Xinhong JIANG[2], Yikai SU[2]

[1]Ecole de technologie supérieure, Canada

[2]Shanghai Jiao Tong University, China

After decades of development and miniaturization, the integrated electronic devices for computing and information processing are rapidly approaching their fundamental speed limitations. In comparison with electronic processing, all-optical computing and information processing based on photonic devices may show advantages in processing speed, power consumption and compact footprint. On the other hand, ever-increasing capacity and efficiency are driving the demand for high-performance optical filter and switching technologies in optical communication networks. Wavelength selective switches (WSSs) are core components in wavelength division multiplexing (WDM) optical networks. In recent years, a number of photonic devices performing real-time information processing and wavelength switching have been proposed and demonstrated. In this presentation, we will show the potential improvements in footprint and energy efficiency offered by silicon photonics through the analysis of two specific devices that have been developed for signal processing and telecommunication applications. First, an on-chip tunable photonic differential-equation solver based on a modesplit micro-resonator monolithically integrated on a silicon-on-insulator (SOI) wafer will be presented. This device provides a new way to solve high-order differential equations in optical domain with reduced tuning complexity and improved stability, which could be a functional component for high-speed computing and information processing. Second, we present on-chip silicon wavelength switch and comb filters developed for optical communication systems. The feasibility of the fabricated devices has been verified by system demonstrations. The compact footprint, high processing speed and CMOS-compatible fabrication process, together with reconfigurability and scalability, are all key attributes required for on-chip processors, making the proposed devices promising candidates in future all-optical information processing systems and networks.

Biography :

Christine Tremblay received the Ph.D. degree from the École Polytechnique de Montréal, Canada, in 1992. She held senior R&D and technology management positions at the National Optics Institute, EXFO, Nortel and Roctest before joining the École de technologie supérieure as a Full Professor in 2004. Founding Researcher and Head of the Network Technology Lab, her current research interests include coherent optical networks, performance monitoring, and silicon photonics. She has served as Coinstructor for OFC short courses SC314 (2009–2015) and SC210 (2011–2015) of the Optical Society of America (OSA), and authored/coauthored more than 40 journal articles and conference papers.

Surface Plasmonic Effects on Organic Solar Cells

Ashraf Uddin

The University of New South Wales, Australia

Organic photovoltaics (OPV) have huge potential to reduce costs of electricity production in clean renewable energy. This low-cost photovoltaic recently demonstrated cell efficiencies of over 12%. The light trapping in device structures is one of the potential ways to improve the cell efficiency further by increasing the effective optical path length within the active layer without the need of altering its physical thickness. Plasmonic is the most suitable technique that involves light trapping inside the cell by exciting surface plasmons on metallic nanostructures. Metallic nanoparticles (NPs) such as Ag, Au, etc. are potential candidates for improving the light absorption due to the localized surface plasmon resonance (LSPR). Metal nanoparticles have optical properties which are different from bulk metals. Surface plasmons are the coherent oscillations of conductive electrons in thin metal nanoparticles film. LSPR contributes to the significant enhancement of local electromagnetic fields and improves the optical properties of nanostructure devices. The excitation of LSPR is achieved when the frequency of the incident light matches its resonance peak, resulting in unique optical properties; selective light extinction as well as local enhancement of electromagnetic fields near the surface of metallic NPs. The resonance peak of LSPR depends strongly on the size, shape, and the dielectric environment of the metallic NPs. In the conference the progress on plasmonic enhanced OPV device performance will be presented. The concepts of surface plasmonics for OPV devices, suitable plasmonic materials, location, optimum size and concentration of NP materials within the device will be explained in the conference.

Biography :

Ashraf Uddin obtained his Ph.D degree in March 1991 in Semiconductor Physics from Osaka University, Japan. After his Ph.D, he worked at the R and D centre of Toshiba Corporation, Japan as a scientist (1991–1997). After that he worked on III–V semiconductor laser diodes in ANU, Australia. He worked at the School of MSE, NTU, Singapore from 1 July 2001 to 30 June 2007. He then worked in the Department of Electrical and Computer Engineering, King Abdulaziz University, Saudi Arabia. Currently, he is working on organic and perovskite solar cells in the School of Photovoltaic and Renewable Energy Engineering, UNSW, Australia. He has published over 150 research papers and 12 patents on semiconductor devices.

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Moving a Technology from Invention to implementation – with a Focus on NanoCopper Based Electronic Interconnect Technology

Susan Ermer

Lockheed Martin Space Systems Company, Advanced Technology Center, USA

The Lockheed Martin Space Systems Company Advanced Technology Center has developed a solder-free electronic interconnect material based on a novel nanocopper materials system that can be sintered around 200 °C and processed using existing industrial equipment such as stencil, pick & place and reflow ovens. This is made possible by formulating pastes with suitable rheology using sub-50 nm copper particles taking advantage of the rapid drop in processing temperature and time of nanostructured materials. We have demonstrated assembly of fully functional LED lighting systems using nanocopper containing paste with a consistency very similar to AuSn solder and is already outperforming the latter in both electrical and thermal performance. Initial stress and oxidation tests confirm a path to high reliability performance under field conditions. We are currently in the process of transitioning the technology to a first application and working with a commercial customer to integrate it into manufacturing equipment. Setting up a supply chain and scaling-up the manufacturing process is underway.

Nanocopper is only one of several materials and process technologies that has been developed and matured by our organization. We have ongoing development in the areas of CNT-based nanoelectronics, graphene-based materials and additive manufacturing.

There are several common elements essential to the success of these efforts:

People: technically and experientially diverse team

Focus: a significant mission and problem statement

Leverage: partners that are motivated by mission or technology advancement

This talk will focus on the process involved in the creation, ongoing maturation and application demonstration of this nanotechnology based application.

Biography :

Susan Ermer holds a Ph.D. in Chemistry from the University of Southern California, USA and has held research positions at Imperial College, London, UK, and the University of Pennsylvania, USA. She is currently the Senior Manager of the Advanced Materials and Nanosystems Organization at Lockheed Martin's Advanced Technology Center, headquartered in Palo Alto, CA, USA. In earlier technical assignments, Dr. Ermer established Lockheed Martin's internal capability in the development of Electro-Optic polymer materials for photonic switching devices. She is an active member of the Materials Research Society, and has served on its Board of Directors for two terms.

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Gold Microelectrode Biosensors for Biomarkers Detection

Adnane Abdelghani, Hanen Chammem and Imen Hafaid

Carthage University, National Institute of Applied Science and Technology, Tunisia

Cardiovascular diseases are the leading cause of death in the world due to ischemic complications including heart disease and stroke. C-Reactive Protein (CRP) and HDL-cholesterol levels are biomarkers inversely correlated with cardiovascular risk and which represent therapeutic targets for atherosclerosis.

In this work, we developed a biosensor for the detection of C-Recative Protein and High-Density Lipoproteins (HDL) particles. The electrochemical properties of the grafted antibody on interdigitated gold electrode were achieved by Impedance Spectroscopy (IS). The used deposition method was based on oriented antibody Anti-ApoA1 with an intermediate thin layer of protein G. The developed biosensors are able to differentiate the HDL particles according to their differences in size and interactions with the immobilized antibody.

Biography :

A Abdelghani is a Full Professor at the National Institute of Applied Science and Technology (INSAT, Tunisia) working mainly in the field of Microsensors and Microsystems. He obtained the master degrees in “Microelectronic Devices” at the INSA of Lyon (France) in 1994, then a Ph.D thesis from Ecole Centrale of Lyon (France) in 1997. He obtained a post-doc position in Germany between 1997-2000. He obtained the Habilitation in Physics in Tunisia (faculty of Science of Tunis) in 2004 and a Habilitation (worlwide recognition for conducting and leading research) in “Sciences pour l’Ingénieur” in 2009 at the Ecole Normale Supérieur de Cachan (France). He organized three International Conferences in Tunisia in the Field of Nanotechnology (2009, 2012 and 2014) with the Alexander Von Humboldt Foundation (Germany). He is now the leader and principal investigator of a research group working mainly on gas sensors based on functionalized carbon nanotubes (metallic oxides, nanowires, nanoneedles, polymers) and on the development of interdigitated gold microelectrodes integrated in microfluidic cell for bacteria analysis in biologic medium. He published more than 85 papers in International Journals and supervised more than 10 Ph.D thesis and 30 masters student. Prof. Abdelghani is part of worldwide renowned scientists as editorial member of several peer-reviewed scientific journals. He was a coordinator of Science For Peace NATO Project (2009-2011), National science Fondation Project (2009-2013), of Tempus-Project (2013-2016) and coordinator of a recent NATO-SFP project (2013-2016). He is deeply involved in industrial applications in his field of research with implications for the design and the development of affordable and cost-effective sensing devices for diagnostics and theranostics which will have an effective impact in the developing countries.

Iron Pyrite (FeS2) Nanocubes as Photon Absorbing Films in Solar Cells: Unravelling the Issues

Thirumany Sritharan

Nanyang Technological University, Singapore

Iron pyrite (FeS2) has a high light absorption coefficient and a suitable bandgap for photovoltaic applications but its poor performance in experimental devices has precluded its use until now. This is loosely attributed to impurity phases and defects but definite proofs have not been forthcoming. For successful use in a photovoltaic device, the extraction of photoexcited carriers without loss from the absorber material is a key requirement. With the advent of chemical synthesis techniques for nanoparticles, it may be possible to produce pure pyrite without impurities. In this paper we deal with fundamental photophysics and possible carrier loss mechanisms in films made from pure pyrite nanocubes synthesized by a hot injection method. The nanocubes are {100} faceted and their optical, transport and magnetic properties are evaluated. Ultrafast transient absorption spectroscopy was done to elucidate the charge carrier lifetimes during relaxation. We found fast carrier localization of photoexcited charges to indirect band edge and shallow trap states with a short characteristic decay time, followed by relaxation to deep states and recombination of trapped carriers with long characteristic decay times. Temperature dependence of electrical resistivity exhibits a Mott - variable range hopping (VRH) conduction mechanism consistent with the presence of high density of defects. Temperature dependence of magnetization showed magnetic ordering at low temperatures which could be associated with sulfur vacancies clustering when the thermal vibrations are low to give rise to magnetically ordered, sulfur deficient phases such as FeδS1-δ ($0 \le \delta \le 1$).

Biography :

Sritharan obtained his PhD from The University of Sheffield, UK and did his postdoctoral research at The University of Melbourne. Then he worked at the Comalco Research Centre, Melbourne before moving to NTU, Singapore when the Materials Engineering program was established. His current research interests are in functional properties of oxides and sulphides. He leads a group of researchers from NTU in a multifaceted program with University of California, Berkeley funded by Singapore's NRF. This programme is on Solar Energy harvesting with the aim of reducing the cost of solar to electrical energy conversion and also to explore the solar to liquid fuel conversion.

Plasmonic Moon: a Fano-like approach for magnetic field enhancement

Andrea Toma

Italian Institute of Technology, Italy

In the last decade, several efforts have been spent in the investigation of the so-called “artificial magnetism”. Within this context, plasmonic Fano resonances can be viewed as key-elements for revealing and modulating the magnetic properties of matter, especially in frequency ranges where the saturation of the magnetic response strongly hinders resonant phenomena. Here, we present a plasmonic nano-assembly (namely a “Plamonic Moon Trimer”) able to sustain a Fano coil-type resonance at optical frequencies, thus promoting the formation of a strongly subwavelength magnetic hot-spot. In order to efficiently boost the magnetic enhancement, we employed a moon-like geometry supporting a third order plasmonic mode (i.e. quadrupole-like). In particular, we demonstrated how the conceptualization of Fano-like resonances in coil-type configuration can induce a pronounced magnetic field squeezing and enhancement from the visible to the mid-infrared range. These results are particularly remarkable considering that we conducted our study for exciting radiation orthogonal to the substrate and therefore without external magnetic component aligned to the trimer magnetic moment. Summing-up, the proposed architectures can offer a novel and unconventional way for the generation of intense and localized hot-spots of magnetic nature, thus representing a viable perspective in the optical triggering of spintronic devices and/or metasurface engineering.

Biography :

Andrea Toma has a long-standing experience in the fabrication and characterization of 3D nanostructures, facing cutting-edge issues in plasmonics and nanophotonics. He is research scientist at the Italian Institute of Technology where he currently leads the magneto-plasmonics group. He published 80 scientific papers and holds 5 patents (citations>400/year, h-index=22). He is Adjunct Professor at the University of Genova and, since 2012, member of the Proposal Study Panel at the Lawrence Berkeley National Laboratory. He works as referee for many international journals and international funding agencies. In 2014 he was appointed Editor on Nano-Plasmonics for the Encyclopedia of Nanotechnology, Springer.

Nanotechnology-enhanced Solar Thermal Energy Conversion

TieJun Zhang

Masdar Institute of Science and Technology, UAE

Solar energy is one of the most abundant renewable energy resources in the Middle East and North Africa region and around the world. Many large-scale concentrated solar power (CSP) plants are emerging to provide baseload clean power. In fact, significant research is needed to promote the solar energy conversion efficiency and lower the cost. In this talk, I will start with our fresh research experience at a 100 MW CSP plant and introduce the challenges and research opportunities at the component and device level. The major focus of this talk will be dedicated to the role of nanotechnology in solar thermal energy conversion. Our recent research shows nanotechnology can significantly enhance the overall solar thermal energy conversion by tailoring the interfaces for light absorption, vapor generation and condensation. Nanoporous and nanocomposite materials enable multiple functionalities for solar absorber and evaporator. Nanostructured surfaces and selective monolayer coating promise great potential for high-performance dropwise condensation. At the end, I will summarize our perspectives on nanoengineered solar thermal energy conversion technologies in hot and harsh environment.

Biography :

TieJun (TJ) Zhang is an Assistant Professor of Mechanical and Materials Engineering at Masdar Institute of Science and Technology in Abu Dhabi UAE. He was also a visiting faculty member at Massachusetts Institute of Technology (MIT), USA. Prior to that, Dr. Zhang was a postdoctoral research associate at Rensselaer Polytechnic Institute (RPI), USA. Since 2011, Dr. Zhang has been a Principal Investigator of six national and international research projects. He has over 80 peer-reviewed publications on micro/nano-scale heat transfer and fluid flow, solar power generation and cooling, energy process dynamics and control. He is an active member of Steering Committee of ASME NanoEngineering for Energy and Sustainability and Heat Transfer Division K18 Technical Committee.

Soft piezoelectric MEMS Technologies for Tactile Sensing and Energy Harvesting

Massimo De Vittorio

Istituto Italiano di Tecnologia (IIT), Center for Bio-Molecular Nanotechnology & Università del Salento, Italy

In the last years there have been impressive advances on science and technologies for MEMS sensors and actuators based on silicon bulk and surface micromachining. In spite of its good electrical and mechanical properties, silicon, however, is not suitable for applications where flexibility, conformability and ultra small elastic constants are required.

In this talk soft MEMS technology based on piezoelectric aluminum nitride on Kapton substrate will be discussed. The activities currently running at the Center for Biomolecular Nanotechnologies of IIT on piezoelectric MEMS for robotic biomimetic tactile sensing and on mechanical energy harvesting will be described. The piezoelectric stack, composed of AlN embedded between two molybdenum electrodes, is deposited on a Kapton tape, and processed to obtain piezoelectric/flexoelectric dome-shaped multifunctional tactile devices for sensing both vibrations, normal and shear forces. The same heterostructure is applied to produce ultra-soft flexible cantilevers, to produce energy from both vibrations and air flow, with cut-in wind speed as small as 0.2 m/sec.

Biography :

Massimo De Vittorio is director of the Center for Biomolecular Nanotechnologies (CBN) of the Istituto Italiano di Tecnologia (IIT), associate professor at Università del Salento and co- founder of the national nanotechnology laboratory (NNL) of the Istituto Nanoscienze CNR. His research activity deals with the development of science and technology applied to nanophotonics, nanoelectronics and nano and micro electromechanical systems (NEMS/MEMS). Author of about 180 papers, 60 proceedings of international conferences, 13 patents and several invited/keynote talks to international conferences, he is also senior editor of the Journal IEEE Transactions on Nanotechnology.

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Ultrasonic Cutting of an Individual Silver Nanowire in Air

Xu Wang

Nanjing University of Aeronautics and Astronautics, China

Over the past few years, the ultrasonic micro/nano manipulation technology had a breakthrough, which makes ultrasonic trapping, orientation, transportation, rotation and concentration of nanowires possible. The ultrasonic micro/nano manipulation technology has the potential applications in many fields, such as fabrication of high-performance electronic and photonic devices, micro machining, property testing of nanomaterials, assembly of nanostructures, etc. However, the existing ultrasonic micro/nano manipulation technology cannot cut a single nanowire directly. It would widen the application range if a manipulator has a nano cutting function. In this work, we demonstrate an ultrasonic nanowire cutting method, which uses the linear vibration of the tip of a micro tool and the fixing capability of the water molecules between the NW and substrate. The nanowires with a diameter from 50 nm to 400 nm are cut by the needle with the vibration velocity amplitude from 18-220 mm/s at 96.9kHz. The dependency of the minimum cutting velocity and lower limit of the optimum cutting velocity range on the NW diameter is experimentally clarified. The incision quality is compared with that caused by an elliptical vibration of the micro cutting tool.

Biography :

Xu Wang received the B.E. degree in aircraft design and engineering from Nanjing University of Aeronautics and Astronautics, Nanjing, China, in 2011. He is currently pursuing the Ph.D. degree in mechanical engineering at Nanjing University of Aeronautics and Astronautics. His research interest is now mainly focused on the optimum design of the device with the ultrasonic manipulation of micro/nano-scale entities

Design of a nanophotonic modulator based on vanadium dioxide for optical Communications

Miao Sun, Stuart Earl, William Sheah and Ranjith Rajasekharan

The University of Melbourne, Australia

Silicon based modulators are widely used in optical communications and they can be classified as either resonant or non-resonant. The majority of silicon-based modulators reported so far operate using the plasma dispersion effect in silicon or the Pockels effect in nonlinear cladding. Resonant modulators suffer from bandwidth limitations, temperature fluctuations and fabrication tolerances. In contrast, non-resonant modulators operate across a large spectral window and are typically based on a travelling wave configuration. In order to get sufficient modulation depth, there should be long interaction time between the optical and the modulating radiofrequency (RF) signal and hence non-resonant modulators are bulky, often up to several millimeters in length. Surface plasmons are electromagnetic surface waves that couple propagating light to charge density oscillations and are confined to the interface between a metal and a dielectric. Plasmonic modulators can be realized with a footprint on the order of a few microns. Here, we present a plasmonic modulator design based on vanadium dioxide to enhance the modulation depth in a small footprint of less than 10 μm.

Biography :

Miao Sun was born in Henan, China. She received the B.S. degree of communication engineering from Chongqing University, China in 2014. She is currently pursuing a PhD degree in Electrical and Electronic Engineering at the University of Melbourne, Victoria, Australia. Her research interests mainly cover high speed plasmonic modulators for optical communications and high performance nano-optic devices.

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Low-cost hybrid heterostructures for photovoltaic & light-emitting device architectures

Sylvain G. Cloutier

Ecole de technologie superieure, Canada

We will discuss about how we use nanocrystals to engineer superior hybrid heterostructures that we integrate into basic device architectures to produce low-cost light-emitting devices and solar cells. In addition to producing good heterostructures, we will discuss critical device issues including hole-blocking mitigation strategies that do not affect carrier injection, hybrid collector designs, new highly-conductive transparent electrodes and new co-jetting strategies to avoid orthogonal solvent requirement issues. In conclusion, we will demonstrate that those issues are also essential to producing performing devices at low-cost using all solution-based fabrication strategies.

Biography :

Sylvain G. Cloutier has completed his PhD from Brown University, USA. He is currently the dean of research at the Ecole de technologie superieure, where he also leads the Canada Research Chair on hybrid optoelectronic materials and devices. He has published more than 40 papers in reputed journals and he is a member of the College of New Scholars, Artists and Scientists of the Royal Society of Canada

A study of Magnetic Nanodot Arrays Fabricated by Intrinsic electromagnetic UV-imprinting technology

Ting-Ting Wen and Jung-Ruey Tsai

National Chiao Tung University, Taiwan

Magnetic nanostructures are of considerable interest both on fundamental science and industrial applications. This is because of the novel magnetic and magneto-transport properties that such nanostructures can exhibit and the possibility to engineer structures with specific properties. Therefore current and potential uses have arisen in a range of technological applications such as information storage, sensors, bio-medical applications including drug delivery, and spintronic devices, etc. There are several methods for fabrication of magnetic nanostructures. Some examples are electron beam lithography, AFM lithography, EUV interference lithography, capillary force lithography, step growth methods, radiation damage and self-assembled structures. These techniques are complex, expensive and require the use of clean-room facilities and extensive process control.

Here, we proposed a simple method for rapid replication of magnetic nano-scale structures. By using intrinsic electromagnetic pressure to pull the magnetic photoploymer into a soft mold written with nanopore features, the magnetic nanodot arrays can be successfully fabricated at room temperature. The intrinsic electromagnetic UV-imprinting system which consists of a transparent glass plate with PDMS soft mold, a UV-lamp with wavelength of 365–410 nm, and an electromagnet controller. The current of the electromagnet is controlled by the power supply, through which the imprinted force is determined. The curing dose is equal to the intensity of UV-light times the curing time. The imprinted substrate with nickel support is coated magnetic photopolymer on the front surface. The liquid magnetic photoploymer is made by mixing nano-Fe 25nm powders into the UV-curable polymer through the surfactant. The effects of processing conditions on the shape and quality of the magnatic nanodots are investigated in this study. Under the processing conditions of magnetic pressure 0.69 kgf/cm2, pressing duration time 24s and UV curing dose 150 mJ/cm2, the fabricated magnetic nanodot has the average diameter of 501.1nm, the average sag height of 200.5 nm and the pitch around 0.5um. Scanning electron microscopy (SEM) and atomic force (AFM) observations confirm that the magnetic nanodot arrays are produced without defects or distortion and with good uniformity over a large area.

This technique shown here appears as a good alternative to the current method for efficient fabrication of magnetic nano-scale structures at low pressure on large substrates with high productivity at low cost.

Biography :

Ting-Ting Wen received her M.S. degree in Mechanical Engineering of Chang Gung University (Formosa Plastics Group) in 2003. Then she received the Ph.D degree in Power Mechanical Engineering of National Tsing-Hua University in 2009. Her Ph.D. work, development of Electromagnetic force-assisted Micro- and nanoimprint lithography Systems, has successfully established a novel imprinting system. During her Ph.D. study, she also got the funding of National Science Council to be a research scholar of UC Berkeley, USA. (2008-2009). Her research fields in Berkeley are 'Development of Nanoimprint Technology with soft mold' and 'Fabrication of double sided optical element for Brightness Enhancement in OLED device'. After she got Ph.D. degree, she does the postdoctoral research at Precious Instrument Center of National Tsing Hua University in 2009. She also worked at AU Optronics Corporation (AUO) in 2010 to 2011, for creating G4 size OTFT process and flexible display. Now, she does the research at Nano Facility Center in National Chiao Tung University in Taiwan. The main study is about Rapid replication of nano-scale arrays by electromagnetic UV-imprinting technology' and 'Fabrication of optical element for Brightness Enhancement in OLED device'. Her research interests include MEMS process, Nano-imprint technology and applications, Fabrication of micro and nano-scale device, Organic TFT, OLED/PLED devices and Gate-stack with high K dielectric material deposit. Up to the present, she has published 21 papers and also got the patent from the Intellectual Property Office (TIPO) of the Ministry of Economic Affairs, R. O.C.

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Global Nanotechnology

Congress and Expo

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Scientific Sessions

Day 3

Session 1 & 2

Nanotechnology for Energy and the Environment
Materials science and engineering
Green nanotechnology
Greenchemistry & Engineering

Title:	Direct Integration of Anodic Metal Oxide Electrochemical Capacitors on Screen-Printed Solar Cells **Alison Lennon**, UNSW, Australia
Title:	Nano-Engineered Fischer-Tropsch Catalysts for Synfuel Production **Daniela Mainardi**, Louisiana Tech University, USA
Title:	Effect of conductive additives to gel electrolytes on activated carbon-based supercapacitors **Ncholu Manyala**, University of Pretoria, South Africa
Title:	Zero Waste Generation from Palm Oil Mills: Emergence of a Novel Technology to Mitigate Environmental Pollution **Zulkifli Ab. Rahman**, Malaysian Palm Oil Board, Malaysia
Title:	Molecular Engineering of Hole Transporting Materials for Perovskite Solar Cells **Mohammad Khaja Nazeeruddin**, Ecole Polytechnique Federale de Lausanne, Switzerland
Title:	Residual Cypermethrin in Palm Oil and Environmental Samples in an Oil Palm Plantation **Halimah Muhamad**, Malaysian Palm Oil Board, Malaysia
Title:	Science and applications of nanostructured transparent and conducting materials **Daniel Bellet**, University of Grenoble, France
Title:	Supercapacitors based on Nanostructured Oxide Materials **Kafil M. Razeeb,** University College Cork, Ireland
Title:	Indium Functionalized Metal Organic Frameworks for possible CO2 Adsorption Application **Rana Sabouni,** American University of Sharjah, UAE
Title:	A Custard Apple shaped Composite of CuAlO2 microspheres/Reduced Graphene oxide for high efficient ozone gas sensing performance **S. Thirumalairajan,** University de São Paulo, Brazil
Title:	Method Development of Residual Metsulfuron Methyl in Crude Palm Oil by Triple Quadrupole Liquid Chromatography **Nik Sasha Khatrina Khairuddin,** Malaysian Palm Oil Board, Malaysia
	Advancements in Material Science **Polymer based Nanocomposites** **Multifunctional Nanobiomaterials**
Title:	Bio-Nanocomposites for Nanotechnology **Ayben Kilislioglu**, Istanbul University, Turkey
Title:	Nano Structures Induction of PLD-grown ZnO Alloyed with BaO, SrO, and CaO **Hamad A. Albrithen**, King Saud University, Saudi Arabia
Title:	Computer Modeling of the Self-assembly and phase morphologies of the Miktoarm Copolymers **Dan Mu**, Zaozhuang University, China
Title:	Simulation of Biological and Nanostructured Interfaces to Discover New Materials **Hendrik Heinz**, University of Colorado-Boulder, USA
Title:	Effect of temperature and holding time on injection molded HDPE-TiO2 nanocomposites **Mohammad Sayem Mozumder**, UAE University, UAE
Title:	Luminescent hexanuclear metal cluster complexes: Synthesis, properties and possible applications **Konstantin A. Brylev**, Ewha Womans University, Korea

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Direct Integration of Anodic Metal Oxide Electrochemical Capacitors on Screen-Printed Solar Cells

Alison Lennon

UNSW, Australia

The increased penetration of photovoltaics into the electric grid has raised concerns about frequency regulation and ramp rate control due to the intermittency of solar energy. This has encouraged investigation into the coupling of photovoltaic electricity generation with storage at different levels of the integration. This paper describes the direct integration of an anodic molybdenum oxide (MoO_x) electrochemical capacitor on the rear surface of an industrially-produced screen-printed solar cell. The MoOx electrode was formed by anodizing a layer of Mo that was sputtered over the screen-printed rear electrode of the solar cell using the light-induced current of the solar cell. The surface area of the resulting metal oxide was increased by hierarchical nanostructuring through the rough aluminium electrode surface of the cell and the porosity introduced by the anodization process. When the cells were annealed at 450 ^{o}C after anodization, the MoOx layer crystallized forming quasi 2D Van de Waal planes which were shown to intercalate sodium ions enabling charge storage via facile intercalation in addition to surface double layer capacitance. Symmetrical electrochemical capacitors were fabricated and capacitance-voltage (C-V) and charge-discharge measurements were performed confirming charge storage in the device. The presence of Faradaic peaks in the C-V curves confirmed the contribution of pseudocapacitive storage in the metal oxide electrodes. A key advantage of the presented method for direct coupling of electrochemical capacitors with solar cells is that the performance of the solar cell was not impacted by the addition of the electrochemical capacitor.

Biography :

Lennon completed PhDs in Biochemistry from the University of Sydney (Australia) and Photovoltaic Engineering from UNSW (Australia). She has worked as a Research Scientists for Canon for 10 years conducting research in material science and device simulation and is currently a n academic at the School of Photovoltaic and Renewable Energy Engineering at UNSW where she conducts research into electrochemical processes for silicon photovoltaics and capacitor technology. She has published more than 60 papers in reputed journals and has been serving as an editorial board member of the ASME Journal of Solar Energy Engineering.

Nano-Engineered Fischer-Tropsch Catalysts for Synfuel Production

Daniela Mainardi

Louisiana Tech University, Ruston, Louisiana, USA

Due to the high dependence on fossil fuels, Fischer–Tropsch (FT) synthesis is attractive for the production of clean fuels. In general, FT synthesis transforms CO and H_2 into long–chain liquid hydrocarbons. Despite extensive experimental and theoretical work conducted to date, several mechanistic details for FT synthesis remain unclear and unpredictable; specially the selectivity and reactivity of catalytic materials.

The work conducted by the Mainardi group employs multi-scale molecular simulation tools to nano-engineer FT catalysts. Using molecular simulations in combination with experiments lowers the costs related to design, as the simulations can be used to screen and suggest only the useful catalysts that can be subjected to experimental testing. In order to implement the FT process at a large scale, two fundamental issues need to be addressed, as they relate to the identification of the preferred sites for catalytic reactions to occur, the intermediate species in the FT process, and the preferred FT reaction pathway on a given catalyst surface.

The ultimate goal of this work is to provide insights into the design of novel nano-engineered FT catalysts that will alleviate energy and environmental issues in the medium and long term. Thus, in this work, promising core-shell binary nanocatalysts were design and investigated using electronic structure methods. Multi-scale molecular simulation tools were used to investigate the stability, activity, and selectivity of core-shell FT catalysts as functions of the transition-metal type used.

Biography :

Daniela Mainardi is a full Professor and the Program Chair of Chemical Engineering at Louisiana Tech University in the United States; currently holding the Thomas C. & Nelda M. Jeffery Professorship in Chemical Engineering.

Mainardi has extensive experience in a large variety of multi-scale molecular simulation tools and has conducted research on different and complementary nano- and bio-technology-related topics with applications to transport and catalysis. She has published 23 peer-reviewed articles, 51 conference papers, 6 book chapters, and has given 12 invited talks at international conferences, educational institutions, and research laboratories. Dr. Mainardi have participated in the organization of several international workshops, being her latest the “World Congress on Petrochemistry and Chemical Engineering”, that took place in November 2013 in San Antonio, Texas, USA. Dr. Mainardi has been nominated and selected Editorial Board Member of the Elsevier Editorial System for Surface Science, the Petrotex Publication Group, and the Chemical Sciences Journal. Dr. Mainardi has received the prestigious USA National Science Foundation (NSF)-CAREER award in 2005 for her work on Modified-Methanol Dehydrogenase Enzymatic Catalysts For Fuel Cell Devices.

Mainardi is a senior member of the USA American Institute of Chemical Engineers (AIChE) since 2010. She have been the Chair and Co-Chair for several AIChE Spring and National meetings, a Director (2009-2011) and Topical Chair (2010) of the AIChE-TEP Division, the 2010 Spring AIChE Meeting TEP Division Programming Chair, and an Advisory Board Member of the AIChE Center for Energy Initiatives. In 2012, Dr. Mainardi was publically nominated and elected Chair of the AIChE Transport and Energy Processes Division, and in 2013, she was honored to receive an AIChE Excellence and Service Award.

Effect of conductive additives to gel electrolytes on activated carbon-based supercapacitors

N. Manyala[a], F. Barzegar[a], A. Bello[a], J. K. Dangbegnon[a] and D. Y. Momodu[a]

[a]Department of Physics, Institute of Applied Materials, SARChI Chair in Carbon Technology and Materials, University of Pretoria, South Africa

This presentation is focused on polymer based gel electrolyte due to the fact that polymers are cheap and can be used to achieve extended potential window for improved energy density of the supercapacitor devices when compared to aqueous electrolytes. Electrochemical characterization of a symmetric supercapacitor devices based on activated carbon in different polyvinyl alcohol (PVA) based gel electrolytes was carried out. The device exhibited a maximum energy density of 24 Wh kg^{-1} when carbon black was added to the gel electrolyte as conductive additive. The good energy density was correlated with the improved conductivity of the electrolyte medium which is favorable for fast ion transport in this relatively viscous environment. Most importantly, the device remained stable with no capacitance lost after 10,000 cycles.

Biography :

Ncholu Manyala is Associate Professor and Chair of South African research chair initiative (SARChI) in Carbon Technology and Materials at the University of Pretoria, South Africa. Prof. Manyala got his PhD from Louisiana State University working on low temperature transport and magnetic properties of strongly correlated materials where published two papers in Nature and one in Nature Materials in this field. Prof. Manyala's recent research interest is on graphene based materials and their applications in energy storage and sensing. Prof. Manyala has published more than 40 papers in this subject. Prof. Manyala is the member of International Society of Electrochemistry.

Zero waste generation from palm oil mills: Emergence of a novel technology to mitigate environmental pollution

Zulkifli Ab. Rahman

Malaysian Palm Oil Board, Malaysia

After decades of research to find a technology that could effectively and consistently comply with the mandatory requirement of the Malaysian Department of Environment (DOE) to keep the biological oxygen (BOD) demand of the effluent discharged from the mils, a new technology has finally emerged developed by Malaysian Palm Oil Board (MPOB) and its industrial partner to completely do away with the effluent discharge itself. This has no doubt far reaching benefits for the millers as when the whole question of BOD itself does not arise the concern over a descending BOD limit frequently set by the DOE also does not arise. This paper intends to highlight the salient features of the new technology, the parameters to be monitored, the essential maintenance that has to be carried out and the precautions to be observed in order to ensure that the plant delivers the required performance to fully neutralise the waste discharged from the mill without the need for alternate discharge into the water course under any circumstance. This simply means that the effluent utilization plant must be self-dependant to cope with the entire mills effluent without having an alternate option even in emergency situations.

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Molecular Engineering of Hole Transporting Materials for Perovskite Solar Cells

Mohammad Khaja Nazeeruddin

École Polytechnique Fédérale de Lausanne, Switzerland

Perovskite solar cells have created enormous excitement among the photovoltaic community after the seminal work of Miyasaka and co-workers[1] and followed by solid-state perovskite solar cells.[2-4] Several groups have demonstrated that the Methylammonium lead triiodide perovskite ($CH_3NH_3PbI_3$) have remarkable properties such as panchromatic absorption with large molar extinction coefficient, long carrier diffusion length with low non-radiative recombination rates, and an electron and hole transporter in both mesoscopic networks and planar heterojunctions. The band gap of the $CH_3NH_3PbI_3$ perovskite absorber layer can be tuned by using various cations and anions, and deposited using a broad range of techniques. One major bottleneck for highest efficiency PSCs is the dearth of suitable hole transporting materials (HTMs) where we are restricted to two options: either polytriarylamine polymer (PTAA) with 20.1%[2] or the small organic molecule 2,2',7,7'-tetrakis(N,N-di-p-methoxyphenylamine)-9,9'-spirobifluorene (*spiro*-OMeTAD) with 19.7%[3]. In this presentation, we present molecularly engineered HTMs, which can be easily modified, providing the blueprint for an entire generation of novel low-cost HTMs. We show state-of-the-art devices using new HTM's achieve PCEs of 20.2%, the highest reported value yet, outcompeting comparable control devices with *spiro*-OMeTAD.

Biography :

Md. K. Nazeeruddin received M.Sc. and Ph. D. in inorganic chemistry from Osmania University, Hyderabad, India. He joined as a Lecturer in Deccan College of Engineering and Technology, Osmania University in 1986, and subsequently, moved to Central Salt and Marine Chemicals Research Institute, Bhavnagar, as a Research Associate. He was awarded the Government of India's fellowship in 1987 to study abroad. After one year postdoctoral stay with Prof. Graetzel at Swiss federal institute of technology Lausanne (EPFL), he joined the same institute as a Senior Scientist.In 2014, EPFL awarded him the title of Professor. His current research at EPFL focuses on Dye Sensitized Solar Cells, Perovskite Solar Cells, CO2 reduction, Hydrogen production, and Light-emitting diodes. He has published more than 500 peer-reviewed papers, ten book chapters, and he is inventor/co-inventor of over 50 patents. The high impact of his work has been recognized by invitations to speak at over 100 international conferences. He appeared in the ISI listing of most cited chemists, and has more than 47'000 citations with an h-index of 103. Recently he has been appointed as World Class University (WCU) professor by the Korea University, Jochiwon, Korea (http://dses.korea.ac.kr/eng/sub01_06_2.htm), Adjunct Professor by the King Abdulaziz University, Jeddah, Saudi Arabia and Eminent Professor at Brunei University.

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Residual cypermethrin in palm oil and environmental samples in an oil palm plantation

Halimah Muhamad, Najwa Sulaiman, Nik Sasha Khatrina Khairuddin and Yeoh Chee Beng

Malaysian Palm Oil Board, Malaysia

A field trial to quantify residual cypermethrin in an oil palm agro ecosystem *i.e.* soil, leaf, water, crude palm oil and crude palm kernel oil (CPO & CPKO) samples was conducted at Yuwang Estate, Sepang, Selangor. Experimental plots in the estate were sprayed with the insecticide cypermethrin, while the control plot was sprayed with water. The concentrations of the insecticide used were at the recommended manufacturer's dosage (16.0g a.i./hectare) and at double the recommended dosage (32.0g a.i./hectare). Composited soil samples were collected randomly from five sampling points at different depth (0-10cm, 10-20cm, 20-30cm, 30-40cm and 40-50cm) whereas leaf samples were collected and composited from three different portions (top, middle and bottom) in different palms. The sampling of water was carried out at five sampling points whereas fresh fruit bunches (FFBs) were sampled from each plot. These FFBs were then chopped, hatched and processed to obtain the oil. Cypermethrin residue in all matrices was monitored after spraying. All samples were taken at intervals of -1, 0, 1-10, 12-15, 21, 29 and 36 day(s) after treatment (DAT). Results showed that cypermethrin was not detected in any of the soil, water and oil samples at all sampling days for both treatment dosages. For leaf samples, residual cypermethrin was detected in leaf sampled from 0 to 2 DAT for recommended manufacturer's dosage. For the palms treated at double the recommended dosage, cypermethrin was detected from 0 up to 5 DAT.

Keywords: cypermethrin; fate; oil palm; insecticide; residual

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April 21-23, 2016, Dubai, UAE

Science and applications of nanostructured transparent and conducting materials

Daniel Bellet[1,2], Mélanie Lagrange[1,2], Thomas. Sannicolo[1,2,3], Shanting Zhang[1,2], Dan Langley[1,2], David Muñoz-Rojas[1,2], Carmen Jiménez[1,2], Vincent Consonni[1,2], Yves Bréchet[4,5]

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The past few years have seen a considerable amount of research devoted to nanostructured transparent conducting materials which play a pivotal role in many modern devices such as: solar cells, flexible light-emitting devices, touch screens, electromagnetic devices or flexible transparent thin film heaters. Currently, the most commonly used material for such applications (Tin-doped Indium oxide) suffers from two major drawbacks: indium scarcity and brittleness. This contribution aims at presenting an overview of the main properties and applications of transparent electrodes as well as the challenges which still remain in front of us in terms of integration in devices.

Two directions will be more detailed. First metallic nanowire networks will be discussed, they can be deposited by low cost deposition techniques and exhibit simultaneously very promising optical, electrical and electro-mechanical properties. Then polycrystalline fluorine-doped SnO2 (FTO) thin films have received increasing interest due to their promising application in a wide variety of devices such as gas sensors, coatings and front transparent electrodes for solar cells. FTO layers combined with ZnO nanoparticles exhibit average haze factor as high as 54% in the visible range, whilst maintaining very good electrical and optical properties.

In addition of the fundamental properties of such transparent electrodes, their integration into devices such solar cells or transparent heaters will also be presented and discussed.

Biography :

Daniel BELLET has completed his Ph.D from Grenoble University (France) in 1990. He became Assistant-Professor at 26 years old and Professor at Grenoble Institute of Technology at 34 years old. He was a junior member of the “Institut Universitaire de France” (IUF), an institution which promotes high level research within French universities, between 1999 and 2003. He spent one sabbatical year in the Center of Excellence of Photovoltaic in Sydney (Australia) in 2006-2007. He is now Full professor at Grenoble Institute of Technology and his research activities focuses on the physics of materials, mainly for energy applications and transparent electrodes. He heads the Academic Research Community of Energies at the Région Rhone-Alpes (France).

Supercapacitors based on Nanostructured Oxide Materials

Kafil M. Razeeb

University College Cork, Ireland

Renewable green energy sources, in conjunction with conventional energy storage systems, such as rechargeable batteries and supercapacitors, are one of the key solutions to alleviate the critical problems of escalating energy crisis and environmental issues derived from consumption of fossil fuels. Supercapacitor is regarded as the most promising variant of electrical energy storage because of its fast charging-discharging kinetics, high power density, excellent reliability and long life span. However, current carbon based materials used in supercapacitors does not meet the demands of high energy density, which required for many technological applications. Nanotechnologies can improve the specific capacitance, energy and power density of the supercapacitor decisively with the high performance nanostructured electrode materials. Transition metal oxide nanostructures based on NiO, Co_3O_4, and MnO_2 are a group of promising supercapacitor electrode materials, which have a large theoretical capacitance. Recently, we have designed NiO,[1,2] Co_3O_4,[3] and $CoMoO_4$-graphene oxide[4] based nanowire / nanoflake / nanoflower microstructure on carbon fiber cloth (CFC) as supercapacitor electrodes. Furthermore, binary transition metal oxides based electrode material have been investigated as supercapacitor electrode due to their multiple oxidation states to realize multiple redox reactions. Symmetric supercapacitors made from these electrodes delivered good specific capacitance, high energy and power density, and showed excellent cyclability in both aqueous and non-aqueous electrolytes.

Biography :

Kafil M. Razeeb has completed his PhD from University of Limerick, Ireland and postdoctoral studies from University College Cork, Ireland. He is the leader of Nano-Interconnection group at Tyndall National Institute and coordinator and principal investigator of Horizon 2020 funded project "Thermally Integrated Smart Photonics Systems" worth 5.2 million euros. He has published 37 papers in reputed journals, more than 40 conference articles, 8 book chapters, 1 book and holds 2 patents. His current research focuses on the broad area of nanostructures and nanocomposite materials for energy storage, scavenging and management.

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Indium Functionalized Metal Organic Frameworks for possible CO_2 Adsorption Application

Rana Sabouni

American University of Sharjah, UAE

Recently metal organic frameworks (MOFs) have gained wide research interest due to their outstanding properties including high surface areas, pore volume as well as high structural and chemical diversity and diverse organic functionalities. Furthermore, MOFs have emerged with very wide industrial applications such as gas storage, separation processes, catalytic reactions and drug delivery. Metal organic frameworks (MOFs) are new class of porous materials consist of inorganic metal ions linked together with multi-functional organic ligands (e.g. carboxylates, tetrazolate, sulfonates, etc.), in order to form a three-dimensional structure. In this research work, Indium metal organic framework was successfully synthesized using 1,2,4,5 benzenetetracarboxylic acid functionalized linker instead of 1,4 benzenedicarboxylic acid in microwave irradiation. The synthesized MOFs were characterized using different characterization tests. This new MOFs can be promising adsorbents for carbon dioxide adsorption applications, due to the additional carboxylic functional group.

Biography :

Rana Sabouni earned her PhD in Chemical Engineering in 2013 from the University of Western Ontario, Canada. During her graduate study, she was awarded several scholarships and merit awards including Ontario Graduate Scholarship (OGS), and Mitacs. Prior to joining AUS, she worked as a Post-Doctoral Fellow at the University of Western Ontario. She published several research papers in high impact factor refereed Journals, in addition to a number of conference proceedings and presentations. Dr. Rana main research interest includes: fluidization, nano-materials and their application to carbon dioxide capture, drug delivery, and wastewater treatment.

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April 21-23, 2016, Dubai, UAE

A Custard Apple shaped Composite of CuAlO2 microspheres/Reduced Graphene oxide for high efficient ozone gas sensing performance

S. Thirumalairajan and Valmor R. Mastelaro

University de São Paulo, Brazil

In the present work, we have reported the first time low temperature ozone gas sensors with enhanced performance, fast response and recovery behavior based on $CuAlO_2$ microsphere modified rGO sheet prepared by cost-effective wet chemical process. Thus, the synergistic effect between the rGO and $CuAlO_2$ microspheres cause an enhanced ozone sensing performance compared to pure $CuAlO_2$ microspheres at 150 °C, in contrast to the high temperature (< 250 °C) as in the case of reported ozone gas sensors The enhancement in gas sensing properties is attributed to their porous structure, surface morphology, rGO with decorated $CuAlO_2$ microspheres acts as a conducting channel directly bonded effective and the amount of ozone gas adsorbed onto the surface. In addition, the phenomenon was found to be reasonable based on a conducting model, which mainly focuses on the active sensing layer resistance.

Biography :

S. Thirumalairajan received his Ph.D. degree in Physics–Nanoscience and Technology (interdisplanery) from Bharathiar University, Coimbatore, India in the year 2013. He is currently working as FAPESP – Post doctoral Fellow in the Institute of Physics, University of Sao Paulo, Sao Carlos, Brazil. His research interests are on developing new techniques to prepare size and morphologically different functional nanostructure and thin films. Also, systematic investigation on size and morphology dependent properties for nergy, environmental and biological applications. He is the author of over 25 papers in international peer-reviewed journals.

Method development of residual metsulfuron methyl in crude palm oil by triple quadrupole liquid chromatography

Nik Sasha Khatrina Khairuddin[1], Halimah Muhamad[1], Yeoh Chee Beng[1], Najwa Sulaiman[1], Farah Khuwailah Ahmad Bustamam[1] and Ismail B.S.[2]

[1]Malaysian Palm Oil Board, Malaysia

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Metsulfuron methyl (MSM) is one of the registered pesticides used in oil palm plantations for control of weeds. However, due to the worldwide pressing issues on residual pesticides toward human health and safety of the environment, it is extremely important to ensure that palm oil is free from contaminants and safe to be used for food and non-food applications. Therefore, the aim of this study was to develop a method for determination of MSM in crude palm oil (CPO) samples. In this study, the method of analysis involved a liquid-liquid extraction of MSM using suitable organic solvent, followed by sample clean-up using solid phase extraction (SPE), concentration and drying of samples before injection into the triple quadrupole liquid chromatography (LC/MS/QQQ). Using this method, good linearity with average coefficient correlation (r^2) of more than 0.99 was obtained for seven-point matrix-matched calibration curve (n=7) constructed using the LC/MS/QQQ. The LOD and LOQ for the method were determined as 5 ng/g, respectively. Results showed that the average recoveries obtained for MSM in CPO samples at three levels of concentration ranged between 80-90% with relative standard deviation (RSD) of less than 10%. Based on the method that was developed, a monitoring study for the detection of MSM in CPO samples obtained from various mills in Malaysia was performed. No residual MSM was detected in any of the CPO samples.

Keywords: metsulfuron methyl; pesticide; crude palm oil; validation; method development

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Advances in nanomaterials research for waste water remediation

Ajay Kumar Mishra

University of South Africa, SA

Nano size materials offer unique and sometimes unexpected material properties. This means that at the nano scale, materials can be 'tuned' to build faster, lighter, stronger, more efficient and stimuli responsive materials. Such properties of nanomaterials provide a platform for eco-toxicological based research investigations. Clean water is always essential which often calls for a cheap and efficient water purification system. Nanomaterials are being used to develop more cost-effective and high-performance water treatment systems. Nanomaterials in water research have been extensively utilized for the treatment, remediation, and pollution prevention. The focus of my talk will be to provide an overview of the nanomaterials for water remediation.

Biography :

Ajay Kumar Mishra has completed his PhD from University of Delhi, India and postdoctoral studies from University of the Free State and University of Johannesburg, SA. He is currently working as Professor at NanoWS, University of South Africa, SA. He is also Adjunct Professor at Jiangsu University, China. He has published more than 10 papers in reputed journals and has been serving as an editorial board member of repute. Also he has edited 9 books thus far in reputed journals.

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Photocatalytic reactions and nanomaterials for the Green Nanotechnology

Gulin Selda Pozan SOYLU

Istanbul University, Turkey

Over the last century, continued population growth and industrialization have resulted in the degradation of various ecosystems on which human life relies on. The quest for renewable energy sources and the constant access to clean water resources are vital research challenges for modern society. During the past decades, Advanced Oxidation Processes (AOPs) have proven to be effective in degrading organic constituents in industrial wastewaters, including persistent organic pollutants. Chlorophenols (CPs) represent an important class of environmental water pollutants. Most phenolic compounds are present in waste waters from the water disinfection, industrial effluent and other artificial activities. These organic compounds can be oxidized by chemical, photochemical and microbiological processes.

Environmental applications of heterogeneous photocatalysis have been intensively studied in the past decades. Heterogeneous photocatalysis has shown a high efficiency in the photooxidation of many organic pollutants. UV and/or visible light are often used to accelerate the degradation of the pollutants catalyzed by these heterogeneous catalysts. The application of these lights needs specific equipment and additional cost. Photocatalysis, which is well-known as one of the advanced oxidation processes (AOPs), involves the utilization of a comparatively non-toxic semiconductor photocatalyst in conjunction with light irradiation. Most of the photocatalytic materials developed so far are wide-band gap semiconductors (e.g. TiO_2, $SrTiO_3$, WO_3) active only under ultraviolet (UV) light. For this scope considerable research was focused on the development of photocatalysts with visible light response in order to obtain high utilization efficiency of solar energy.

The controlled fabrication of inorganic compounds with desired crystalline structures and well-defined shapes is an attractive and challenging goal in modern materials chemistry. As a kind of important materials utilized in pigments industry, photocatalysis, ferroelastics, and conductors, have been investigated intensively and extensively over the past two decades due to their unique physicochemical properties.

Biography :

Gulin Pozan Soylu has completed her PhD **(Chemical Engineering)** from Engineering Faculty of Istanbul University, TURKEY. She has published more than 25 papers in reputed journals and projects.

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Nanoremediation to clean up the Environmental pollutants

Nirmal Kumar J.I.

Institute of Science and Technology for Advanced Studies and Research (ISTAR), India

Use of nanoparticles in solar systems, electronic gadgets, medicines, space crafts, fuel cells, cosmetics, solar cells, batteries is widely known. Nanoremediation is the use of metallic nanoparticles for environmental cleanup. It involves the design, characterization and application of structures and systems by controlling the shape and size at the nanometer scale. Environmental nanotechnology would be the new innovation to remediate and treat the contaminants to acceptable levels. This paper highlights the synthesis of two metallic Nanoparticles (ZnO and ZVI) by using precipitation route and characterization by using XRD and TEM. Application of nanoparticles in photocatalytical abatement of dyes, nutrients, heavy metals & wastewater borne pathogens was investigated. The experiments were carried out by irradiating (with UV) the aqueous solutions of pollutant containing photocatalysts. The average particle sizes and shape of synthesized ZVI and ZnO were 55 nm, spherical and 26 nm, hexagonal correspondingly. The experimental results indicated that the maximum decolourization (more than 90%) of dyes occurred with ZVI and ZnO catalyst at 1g/L catalyst dose at 6-8 hours UV irradiation. Absolute removal of heavy metals (As, Cr) and nutrients (SO_4, PO_4, and NO_3) was observed by both nanoparticles. Inhibitory growth of wastewater pathogens was observed in presence of both nanocatalysts. Moreover, the results revealed that ZVI offers great promise over ZnO for delivering new and improved remediation technologies to clean up the environment.

Biography :

Nirmal Kumar J.I has completed PhD from Sardar Patel University , Gujarat and further research was carried out in CES, Indian Institute of Sciences, Bangalore, India on Biodiversity Inventory Network on Western Ghats. He is presently working as Professor and Head in P.G .Department of Environmental Science and Technology, ISTAR. He has published more than 150 papers in reputed journals in the field of Bioremediation & biodegradation, Environmental Toxicology, Biodiversity and Forest & Nutrient Dynamics, Lake, River, Costal and Marine Pollution and monitoring , guided 14 Ph.Ds and Completed 13 major research projects from various funding agencies.

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Bio-Nanocomposites for Nanotechnology

Ayben Kilislioglu

Istanbul University, Turkey

In nanotechnology, bio based nanocomposites are commonly studied by researchers. Some advantages to this type of nancomposite are: nontoxicity, no detrimental effect on environment and easy preparation. Biopolymers are used successfully as bio-matrices but have weak mechanical and thermal performance. The most commonly used method of reinforcing these biopolymer matrices by researches is the addition of inorganic additives. Many researchers have shown that adding fillers and choosing the correct matrix can suitable matrix alter the chemistry and structure of the targeted bio-composites to serve a specific target.

If one could control the inter-attraction between the surfaces of filler and matrix on the molecular level, good dispersion in nanoscale can be achieved. In our study, a novel biodegradable antibacterial material was developed using gum arabic from Senegalia senegal (stabilizer), silica (structure reinforcer) and zero valent iron particles. Silica particles work to not only strengthen the mechanical properties of the Senegalia senegal but also to prevent the accumulation of ZVI nanoparticles due to attraction between hydroxyl groups and FeO. The gum arabic/Fe–SiO_2 bio-nanocomposite showed effective antibacterial property against the Gram-positive *Staphylococcus aureus* and Gram-negative *Escherichia coli*. Using scanning electron microscopy, homogeneous dispersion and uniform particle size were viewed in the biopolymer. X-ray diffraction studies of iron particles organization in Senegalia senegal also showed that the main portion of iron was crystalline and in the form of FeO and Fe^0. X-ray photoelectron spectroscopy was used to evaluate the chemical composition of the surface but no appreciable peak was measured for the iron before Ar etching. These results suggest that the surface of iron nanoparticles consist mainly of a layer of iron oxides in the form of FeO.

Biography :

Ayben Kilislioğlu is currently working in the Department of Chemistry, Istanbul University (IU), Turkey. She received her Master of Science degree in physical chemistry from IU in 1994. She received her doctor of philosophy degree in physical chemistry from IU in 2000. She worked as visiting research assistant professor at the University of Illinois, Chicago, Department of Chemistry, between 2005-2006. She also worked at University of Chicago in Dr. Graeme Bell's Lab in 2007. She has research interest in preparation and characterization of nanocomposites, molecular adsorption, surface characterization and ion exchange. She worked on different projects funded by Istanbul University Grant Commission. She has published several research articles and edited two books in these areas.

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Nano Structures Induction of PLD-grown ZnO Alloyed with BaO, SrO, and CaO

Hamad A. Albrithen[1,2,3], Zeyad A. Alahmed[1], Ahmed Elnaggar[1], Joselito P. Labis[2], Hassan Ouacha [2], Ahmed Y. Alyamani[3], Anwar Q. Alanazi[1], Essa Alfaifi[1], Hassan Alshahrani[1], Mudi Almutairi[1], Jaber Alshaqiqah[1] , Ahmed Alyamani [3], and Abdulrahman Albadri [3]

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Zinc oxide has received very intensive investigations due to its wide spectrum of applications and also the ability of synthesis by different methods. ZnO stabilizes in a wurtzitic structure with a direct band gap of 3.31 eV. The growth of ZnO alloys utilizing group-II elements has been investigated mainly for MgZnO, CdZnO, and BeZnO. MgZnO and BeZnO show increase in the band gap while CdZnO has lower band gap in comparison with ZnO. On the other hand, there have been fewer reports about the rest of group-II, namely CaZnO, SrZnO, and BaZnO. We have grown BaZnO, SrZnO, and CaZnO; the crystalinity of the grown films were investigated as a function of temperature, pressure, and group-II concentrations. Indeed, the effect of these conditions was essential to have variable growth modes. For the case of alloying with BaO and SrO, it was found that at certain growth conditions the alloys exhibit different nanostructures. However, Alloying with CaO resulted mainly in films, having different bandgaps as a function of CaO content in the film. The funding for this is provided by the saudi national plan for science and technology and innovation under the project # 10-NAN1197-02.

Computer Modeling of the Self-assembly and phase morphologies of the Miktoarm Copolymers

Dan Mu

Zaozhuang University, China

Earlier studies have demonstrated that poly(ethylene oxide) (PEO) and poly(methyl methacrylate) (PMMA) blocks are compatible at 270 and 298 K, and that their Flory–Huggins interaction parameters have the same blending ratio dependence at both temperatures. At a much higher temperature (400 K), the behavior of PEO/PMMA blends is strikingly different as both components become incompatible. So we designed twelve PEO-*b*-PMMA copolymers (BCP) in multi-arm structures, where six include EO block as joint points and the other six have MMA block as joint points), and studied the mechanics of the self-assembly and observed their phase morphologies. All of the BCPs with A as the joint points form disordered phases with the exception of long-chained and four-armed BCP. The main mesophases of all of the BCPs with B as joint points are micelle-like, bicontinuous phases. In particular, the short-chained BCP with four-arms and EO segments outside form a new phase type (i.e., crossed lamellar phase). With the application of computer modeling methods, we provided a comprehensive representation of the micelle and crossed lamellar phase formation mechanisms based on both thermodynamic and dynamic analyses. A shear force on a micelle-like phase could promote a hexagonal columnar phase, which can be proved as a good technique for generating an ordered arrangement of nanotube arrays. Blending homopolymers with the same constituents could promote uniformity of the micelle size and decrease the polydispersity, especially for blends with a high BCP concentration, which may provide a new approach for regulating the properties of materials.

Biography :

Dan Mu has completed her PhD from Jilin University, China and postdoctoral studies from Shandong University, China. She is the director of the Institute of Research on the Structure and Property of Matter of Zaozhuang University. She has ever worked in the CNRS of the France for half year. She has completed four projects supported by the National Natural Science Foundation of China, Department of Science & Technology of Shandong Province, Shandong Provincial Education Department and Zaozhuang Scientific and Technological Project; published 22 papers, additionally, two papers in Soft Matter have been published as the front and back cover paper.

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Simulation of Biological and Nanostructured Interfaces to Discover New Materials

Hendrik Heinz

University of Colorado-Boulder, USA

The mechanism of specific adsorption of polymers and biomacromolecules onto metallic and oxidic nanostructures will be explained in atomic resolution resulting from simulations with novel force fields and surface models in comparison to measurements. Variations in peptide adsorption on Pd and Pt nanoparticles depending on shape, size, and location of peptides on specific bounding facets are determined by soft epitaxial processes and induced charges. Predictions of specific nanocrystal growth and shape development are possible using computation and experiment and will be illustrated by examples. Also, computational estimates of reaction rates in C-C coupling reactions and in olefin hydrogenation will be shown using particle models derived from HE-XRD and PDF data, which illustrate the utility of computational methods for the rational design of new catalysts. On oxidic nanoparticles such as silica and apatites, it is shown how changes in pH lead to similarity scores of attracted peptides lower than 20%, supported by model surfaces of appropriate surface chemistry and data from adsorption isotherms. The results demonstrate how new computational methods can support the design of nanostructures, hydrogels and drug delivery vehicles, as well as the understanding of calcification mechanisms in the human body. The main features of the INTERFACE force field for accurate simulations of inorganic/organic and inorganic/biological interfaces will be discussed and explained by means of examples.

Biography :

Hendrik Heinz is an associate professor at the University of Colorado-Boulder. He received his PhD degree from ETH Zurich in 2003 and carried out postdoctoral work at the Air Force Research Laboratory in Dayton, Ohio. His research interests include the simulation of biological and nanostructured materials, metals, minerals, polymers, inorganic-organic interfaces, and multiscale computational methods. Recent honors include the Sandmeyer award of the Swiss Chemical Society, the Max Hey Medal of the Mineralogical Society, an NSF Career Award, as well as guest professorships at ETH Zurich and at the National Institute for Materials Science (NIMS) in Tsukuba, Japan.

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Effect of temperature and holding time on injection molded HDPE-TiO_2 nanocomposites

Mohammad Sayem Mozumder, Anusha Mairpady, Hifsa Pervez, and Abdel-Hamid I. Mourad

UAE University, UAE

Polymeric nanocomposites have recently gained significant attention in fabrication of advanced biomaterials; and as a result, considerable amount of studies have been carried out to design these nanocomposites through efficient method(s) so that they can potentially be used in bone regeneration and dental applications. In the present study, high density polyethylene (HDPE)-TiO_2 nanocomposites have been developed by using injection molding technique. The objective of the study is to determine the optimum operating parameters of the injection molding process, which include temperature and holding time. In this paper, the effect of the temperature and holding time have been studied individually by keeping the concentration of nanofiller constant (wt. 5%). Scanning electron microscope (SEM), X-ray diffraction (XRD) and Fourier Transform Infrared (FTIR) spectroscopy were used to analyze the dispersion and surface morphology of TiO_2 on the HDPE matrix. Influence of operating conditions on the mechanical properties (Young's modulus, Tensile strength, % Elongation at break) and thermal stability was investigated through uniaxial tensile testing, thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC).

Biography :

A.S. Mohammad Mozumder is an Assistant Professor of Chemical and Petroleum Engineering Department at UAE University. He joined the department in August 2011. Dr. Mozumder earned his Ph.D degree from the University of Western Ontario, Canada in April 2010. Earlier he earned his M.A.Sc. and Bachelor degrees in Chemical Engineering from King Fahd University of Petroleum and Minerals (KFUPM), Saudi Arabia in 2004 and Bangladesh University of Engineering and Technology (BUET), Bangladesh in 2000, respectively.His research interest is the fabrication of nanobiocomposite coatings. His work emphasizes the incorporation of metallic nanoparticles into polymeric matrix to develop biocompatible coatings that favor Human Embryonic Palatal Mesenchymal (HEPM) cells growth and proliferation and would be used for biomedical applications. Moreover, he is working on developing superhydrophobic coatings to be used in solar panels in order to ease their cleaning. He is teaching several courses including Chemical Engineering Fluid Mechanics, Engineering Thermodynamics, Mass Transfer, Physical Chemistry and Engineering Applications I and Chemistry Lab I for Engineering and General Chemistry II in addition to supervision and coordination of senior design projects.

Global Nanotechnology Congress and Expo
April 21-23, 2016, Dubai, UAE

Luminescent hexanuclear metal cluster complexes: Synthesis, properties and possible applications

Konstantin A. Brylev[1, 2] and Sung-Jin Kim[1]

[1]Ewha Womans University, Korea

[2]Nikolaev Institute of Inorganic Chemistry SB RAS, Russia

The chemistry of soluble complexes based on $\{Re_6(\mu_3\text{-}X)_8\}^{2+}$ (Q=S, Se, or Te) or $\{Mo_6(\mu_3\text{-}X)_8\}^{4+}$ (X = Cl, Br, or I) octahedral cluster cores attracted much attention due to their chemical and physical properties, such as their ability playing the role of robust nanosized building blocks to form various coordination polymers, possibility to be modified by apical ligand exchange reactions and the remarkable photophysical properties being highly emissive in the red-NIR region. Such properties offer promising perspectives for applications of cluster containing materials to red-NIR emitters. The recent investigations of the photophysical properties of such cluster complexes support their potential applicability in medicine. For instance, the $[\{M_6(\mu_3\text{-}X)_8\}L_6]$ complexes are powerful singlet oxygen generators. This makes them potentially interesting as a novel class of potential photosensitizers for photodynamic therapy.

Luminescent materials, containing octahedral cluster complexes of molybdenum or rhenium clusters as luminophores, can be divided into two groups: inorganic and organic hybrid materials. Silica doped by an octahedral cluster complex is an example of the inorganic material, while poly-(methyl methacrylate), polystyrene or poly(N-vinylcarbazole) with incorporated $[\{M_6(\mu_3\text{-}X)_8\}L_6]$ complex exemplify the organic hybrid material.

Details on syntheses, structures, physicochemical and biological properties of some octahedral molybdenum and rhenium cluster complexes with inorganic and organic outer ligands as well as materials based on them will be presented at the congress.

Acknowledgement: K.A. Brylev thanks the Brain Pool Program through the Korean Federation of Science and Technology Societies (KOFST) funded by the Ministry of Science, ICT and Future Planning (151-S-1-3-1190).

Biography :

Konstantin Brylev has completed his PhD from Nikolaev Institute of Inorganic Chemistry of Siberian Branch of the Russian Academy of Sciences (NIIC SB RAS). Since 1998, he has an uninterrupted career at NIIC SB RAS. K. Brylev visited different research centers as a Postdoctoral Researcher, in particular: three-month visits at Helmholtz Zentrum Dresden-Rossendorf, Germany (2004, 2007); two-year stay at Ewha Womans University, Korea (2005-2007); two-year JSPS Postdoctoral fellowship at Hokkaido University, Japan (2008-2010); etc.

Supported by the Brain Pool Program of the Korean Federation of Science and Technology Societies (KOFST), Konstantin Brylev is currently working as a Research Professor at Ewha Womans University, Korea, while he also keeps his position of a Senior Researcher at NIIC SB RAS. He has published more than 55 papers in reputed peer-reviewed international journals and occasionally acted as a reviewer for various international chemical journals.

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The application of biotechnology innovations for food sustainability

Fahad M. Al-Jasass

King Abdulaziz City for Science and Technology, Saudi Arabia

There are some challenges facing our generation, which will create an effective and flexible system to provide food and food products in a sustainable manner. Biotechnology is the most promising technologies will provide excellent potential to increase the efficiency improvement and optimization of the crop. Thus can play to strengthen global food production and availability in a sustainable manner. We have to feed a population that is expected to grow to more than nine billion people by the middle of the twenty-first century. Biotechnology is one tool will provide food and alleviate hunger and poverty. There are many crops are not use in appropriate ways is to maximize the benefit and increase production. For example, Saudi Arabia produces large quantities of dates, but local consumed amount an 60% of the quantity produced and the part of the remaining exported and sell it in less prices and the remaining are disposed or used in animal feed. The implementation of biotechnology in the field of dates fruits will be maximum benefit and will be producing new products with high economic value. When using the biotechnology in the field of food, the main goal is to use these techniques in reducing the proportion of losses in crops as well as take advantage of all the waste produced during the manufacturing processes in the production of other products. In this paper I will focus on recent trends in nanotechnology use in crops to produce new products and comparisons between the use of biotechnology and not used in the crop to be highlighting the role of biotechnology in the food sustainability.

Biography :

Aljasas has completed his PhD from Kansas State University, USA. He obtained Almarai Creative Award in 2011 in the area of manufacturing dates. Prof. Aljasas received a patent from the US Patent Office and registered patent in 2015. He is Deputy Director for Administration Affairs, Life science and Environment Research. He has published more than 30 papers and two books and review many papers for the journals.

Investigation of the effect of organic additives on the morphology and electrocatalytic activity of Pt nanomaterials

Weldegebriel Yohannes, S.V. Belenov and V.E. Guterman

Southern Federal University, Russia

Platinum nanomaterials have received considerable attention in recent years because of their importance in a wide range of applications such as electrocatalyst, sensors, and low temperature fuel cells. In the present study, different Pt/C nanomaterials were prepared using electrodeposition method and the effect of some organic additives such as potassium citrate, Nafion, polyvinylidene fluoride (PVDF) on the morphology, electrochemically active surface area (ESA) and electrocatalytic activity of platinum nanomaterials (Pt/Vulcan XC-72) was studied. The materials were electrodeposited on a rotating disk electrode (RDE) from the electrolyte of hexachloroplatinic acid (H2PtCl6) and H2SO4 in the absence and presence of the organic additives and the materials obtained were characterized by using the methods of powder X-ray diffraction, scanning electron microscopy and chronopotentiometry. In addition, the electrocatalytic activity of the materials toward oxygen reduction reactions was evaluated by employing linear sweep voltammetry on RDE at 1000 rpm. It was found that the presence of the organic additives increased the overpotential at the growth stage of the particles, resulting in a decrease of particle size and hence an increase in the ESA of platinum nanoparticles from 19 to 43 m2/ g (Pt). Among the investigated organic additives, PVDF displayed the highest impact on the morphology, ESA and electrocatalytic activity of the obtained Pt/C nanomaterials.

Biography :

Weldegebriel Yohannes finished his PhD from Southern Federal University, Faculty of Chemistry, Rostov-on-Don, Russia. He also received his B.Sc. degree in chemistry and M.Sc. degree in analytical chemistry from Addis Ababa University. He worked as Lecturer at Addis Ababa University, Ethiopia. His research of interest mainly includes: electrodeposition, nanomaterials, Pt-based electrocatalysts and fuel cells.

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Poster Presentations

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Title:	Biomimetic tactile perception of micro/nano features **Zhang Yilei**, Nanyang Technological University, Singapore
Title:	Preparation of "Porous Carbon/Bi-Fe nanoparticles/TiO2" Composite Materials with Potential in Water Analysis and Purification **Cadar Calin**, Babes-Bolyai University, Romania
Title:	Preparation of Bi Impregnated Carbon Xerogels and Aerogels for Heavy Metal Amperometric Sensor Construction **COTET Liviu Cosmin**, Babes-Bolyai University, Romania
Title:	Effects of pH on the Crystallization of Hydrous-Zirconia Particles by Hydrolysis **Kyu H. Hwang**, Gyeongsang National University, Korea
Title:	Dissolution Stability of Spark Plasma Sintered Hydroxyapatite **Kyu H. Hwang**, Gyeongsang National University, Korea
Title:	SnS Thin Films Fabricated by Atmospheric Pressure Chemical Vapor Deposition (AACVD) for Thin Film Solar Cell Devices **Ghadah AlZaidy**, University of Southampton, UK
Title:	Asymmetric supercapacitor based on VS2 and activated carbon materials **Tshifhiwa M. Masikhwa**, University of Pretoria, South Africa
Title:	Probing of the Sodium Intercalation mechanism into Nano-sized V2O5 for Sodium-ion Batteries **Ghulam Ali**, Korea Institute of Science and Technology, Korea
Title:	Yellow Emitting Chitosan Capped ZnO Synthesized by Wet Chemical Route **Rekha Sunil Roy**, Union Christian College, India
Title:	Effects of Cerium Doping on the Morphology and Photoluminescence of Calcium Sulfide Nanophosphors **Rekha Sunil Roy**, Union Christian College, India
Title:	Catalytic pyrolysis of polysaccharides on the surface of metal oxides: kinetics and mechanisms **Tetiana Kulyk**, Chuiko Institute of Surface Chemistry of National Academy of Sciences of Ukraine, Ukraine
Title:	Nano-oxides ceria/silica for pyrolytic conversion of fatty acids, triglycerides and biomass **Kostiantyn Kulyk**, Stockholm University, Sweden
Title:	Metal organic framework (MOF) derived N-doped graphene hybrid nano-architectures as multi-functional catalysts **Barun Kumar Barman**, Indian Institute of Science, India
Title:	Comparisons between quantum well laser Based on the In1-xGaxAsyP1-y /InP and AlyGaxIn1-x-yAs /InP materials **RIANE Houaria**, Mascara University, Algeria

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Preparation of graphene-material membranes with potential in water filtration and energy storage

L. Baia, L.C. Cotet, M. Rusu, N. Cotolan, A. Lazar, C.I. Fort and V. Danciu,

Babes-Bolyai University, Romania

Graphene, a hexagonal lattice of carbon, is the first 2D atomic crystal available with astonishing properties: strongest material ever measured, thinnest flexible membrane ever created, impermeable to gases, record value for thermal conductivity, current density 10^6 higher than that of Cu, room temperature quantum Hall effects, zero band gape semiconductor, etc.. Beside these, the functionalized derivatives of graphene such as oxidized form of it, i.e. graphene oxide (GO), is intensely studied in process as water desalination and energy storage device construction.

Nowadays, one of the desideratum is represented by the mass production of large-area graphene materials by mild and cheap synthesis pathways.

In the present study, an original and versatile oxidation-exfoliation process for GO synthesis is proposed in order to obtain two types of GO membranes: self-assembled and peeled GO membranes, by adapting a protocol in which no toxic gases are generated [4]. Our interest is focused on tuning the morphological and structural properties of the obtained membranes to be strong enough for handle and to be proper for further reduction processes. Thus, these GO membranes are very promising for molecular sieve production for water desalination and for supercapacitor construction as energy storage device.

Biography :

Lucian Baia earned his Ph.D. degree in 2003 at the University of Würzburg, Germany. Since 2008, he works as Associate Professor at the Department of Condensed Matter Physics and Advanced Technologies at the Faculty of Physics of the Babes-Bolyai University. His current research focuses on the obtaining and characterization of nanoarchitectures with controllable morphology and structure for environmental and biomedical applications. He is author or coauthor of more than 100 peer-reviewed publications (h-index: 19), three books, and three book chapters, 3 patent applications and is serving as editorial board member for the following scientific journals: ISRN Nanotechnology, Journal of Material Science and Technology Research, Journal of Biosensors & Bioelectronics and Journal of Electrical & Electronics.

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Biomimetic tactile perception of micro/nano features

Zhang Yilei and Yi Zhengkun

Nanyang Technological University, Singapore

Tactile perception is critical to obtain information via direct contacts with the environment. Human skin is extremely sensitive to small deformation, which could be utilized to detect details of surface features, even in the micro/nano scale. By mimicking the mechanoreceptors inside the skin, engineering tactile sensors could be developed to mimic the functions of human fingers. By applying different pressure or speed, different signals could be detected and modeled. A neuron spiking model was applied to convent the analog signals to spiking signals, which is similar to the information utilized inside human brain. Comparing with signals obtained from animal skin, the converted signals representing some key features reasonably well. Polished surfaces with micro/nano features were utilized to test the biomimetic sensor and model.

Biography :

Zhang Yilei has completed his PhD from Iowa State University, USA and worked as a senior research engineer in the Goodyear Tire and Rubber Company, USA. Currently, he is an assistant professor in the School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore. He is interested in micro/nano sensor, neuroengineering and complexity, and has published more than 20 papers in reputed journals.

Preparation of "Porous Carbon/Bi-Fe nanoparticles/ TiO_2" Composite Materials with Potential in Water Analysis and Purification

C. Cadar[1,2], M. Rusu[1], G. Kovacs[1], Z. Pap[1], C.I. Fort[1], L.C. Cotet[1], I. Ardelean[2], L. Baia[1]

[1]Babes-Bolyai University, Romania

[2]Technical University of Cluj Napoca, Romania

By implementing different approaches of sea water desalination or waste water cleaning, only a part of the requirements for obtaining fresh water are solved. The process efficiency is determined by the particularities of the involved devices and used methods. In capacitive deionization by applying an electrical potential difference over two porous carbon electrodes water purification occurred. Even if this technique involves energy-efficient technology, its industrial application was limited to the case of water with low salt concentrations. To increase the purification efficiency, new material electrodes are encouraged to be prepared and tested.

In this respect, very porous monolith carbon materials represented by the aerogel type ones have huge potential as high surface area electrode for capacitive deionization. In order to increase the multifunctionality of these aerogels, impregnation with Bi and Fe nanoparticles and embedding of TiO_2 structures to the proposed electrode material was done in the present study. Bi species possess analytical properties for the detection of heavy metal ions, Fe nanoparticles increase the electrical conduction and exhibit magnetic properties, while TiO_2 presents photocatalytic activity for the degradation of organic compounds.

The morphological, structural and functional properties of the obtained composite material are tuned by changing sol-gel synthesis parameters (e.g. resorcinol amount used as precursor), amount of metal precursors ($Bi(NO_3)_3 \cdot 5H_2O$ and $Fe(OAc)_2$), pyrolysis temperature of precursor polymeric aerogel, etc. The results obtained in our studies revealed improved properties as compared to those previously reported in the literature.

Biography :

Cadar Calin, since 2015 is doing his PhD studies. He has a BSc degree in Chemistry and Food Engineering and a MSc in Analytical Methods, attending several international conferences and an Erasmus Scholarship. His task is to prepare and study doped monolith carbon aerogels and their applications in water treatment and energy storage devices.

Preparation of Bi Impregnated Carbon Xerogels and Aerogels for Heavy Metal Amperometric Sensor Construction

L.C. Cotet, M. Rusu, R.A. Deac, N. Cotolan, A. Lazar, C.I. Fort and L. Baia

Babes-Bolyai University, Romania

Nowadays, the monitoring of fresh water quality is a major problem since pollutions with heavy metal ions (e.g. Pd, Cd, Cu, Zn, Hg, etc.) can generate diseases even in trace amounts. At the present, Hg electrode is the most efficient sensor for heavy metal detection. Because it is toxic, expensive and difficult to be handled, its replacement from the analytical applications is a demand.

Due to similar electrochemical behavior as Hg, Bi spices are intensely promoted as alternative sensing part of sensor electrodes for heavy metal ion detection. The most common used materials are Bi-carbon based composites. In this respect, carbon xerogels and aerogels impregnated with Bi nanoparticles were proved to be an excellent electrode material for heavy metal detection . These materials are obtained in the first step as a wet gel by a sol-gel process using resorcinol and formaldehyde as carbon sources and $Bi(NO_3)_3{\cdot}5H_2O$/acetic acid as Bi precursor. It follows the drying process that is performed either in ambient conditions, to obtain xerogels, or in supercritical conditions of CO_2 liquid, to obtain aerogels. Then, the resulted Bi^{2+} impregnated polymeric frameworks were pyrolysed (750°C/Ar). High porous monolithic carbon xerogels and aerogels impregnated with well dispersed Bi nanoparticles were obtained. Using small amounts from the obtained materials and immobilizing them by chitosan matrix on a glassy carbon electrode surface, extremely low detection limits (10^{-13} mM Pb(II)) for heavy metal trace were obtained. The achieved results prove the potential of these materials in the construction of miniaturized sensor-devices.

Biography :

COTET Liviu Cosmin has completed his PhD from "Babes-Bolyai" University, Romania and postdoctoral studies from Rovira i Virgili University, Spain. He is the director of Research Young Team Grant funded by Romanian National Research Authority. He has published more than 20 papers in reputed journals, participated at more than 30 conferences and submitted 3 patent requirements.

Effects of pH on the Crystallization of Hydrous-Zirconia Particles by Hydrolysis

Kyu Hong Hwang, Jingming Zhao, and Jong Kook Lee

Gyeongsang National University, Korea

Chosun University, Korea

The crystal structures of hydrous-zirconia fine particles, produced by the hydrolysis of Zr salt such as $ZrOCl_2$, $ZrONO_3$, and Zr-Acetate in aqueous solutions were investigated using X-ray diffraction (XRD) and differential thermal analysis(DTA). Main emphasis was placed to cIarify the effects of pH on the crystal formation and formation times. According to pH, XRD patterns of hydrous zirconia varies from monoclinic to tetragonal crystalline zirconia, and the fraction of the tetragonal phase also showed a tendency to increase as the pH increased. These experimental results indicated that the crystal phase in hydrous zirconia is primarily governed by the concentration of H^+ ions (pH) produced during hydrolysis.

Dissolution Stability of Spark Plasma Sintered Hydroxyapatite

Kyu H. Hwang[1], Jingming Zhao[1], Young H. Han[2] and Jong K. Lee[2]

[1]Gyeongsang National University, Korea

[2]Yeungnam University, Korea

Nano size defect formation at grain boundary during the dissolution of hydroxyapatite in water was evaluated after spark plasma sintering for densification enhancement. In the case of sintered pure hydroxyapatite, significant dissolution occurred after immersion in distilled water or in simulated body fluid. The dissolution initiated at the grain boundaries creating nano-size defects like small pores that afterwards grew up to micro scale by increasing immersion time. This dissolution resulted in grain separation at the surfaces and finally in fracture. The dissolution concentrated on the grains adjacent to pores rather than those in the dense region. So more densified hydroxyapatite ceramics even at grain boundaries were prepared to prevent the dissolution by spark plasma sintering. Glass phase was incorporated into hydroxyapatite to act as the sintering aid followed by crystallization in order to improve the mechanical properties without reducing biocompatibility. Dissolution tests, as well as X-ray diffraction and SEM showed little decomposition of hydroxyapatite to secondary phases and the fracture toughness increased compared to pure hydroxyapatite.

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SnS Thin Films Fabricated by Atmospheric Pressure Chemical Vapor Deposition (AACVD) for Thin Film Solar Cell Devices

Ghadah AlZaidy, Chung-Che Haung and Daniel W. Hewak

University of Southampton, UK

One of the major obstacles in PV technology is reducing the price of the electricity (cost/watt) produced through lowering of the production cost or improving the device efficiency. The search for new materials suitable for PV devices needs to satisfy many requirements such as low toxicity, optimum energy gap and the ability to synthesize by a wide range of methods. Tin sulphide satisfies these advantages and has the potential for PV applications where a theoretical efficiency of 32% and an experimental efficiency of 4.36% was achieved. Tin can form many phases of sulphides such as SnS_2, Sn_2S_3, Sn_3S_4, Sn_4S_5, SnS and the two most important tin sulphides are SnS, and SnS_2, both materials are semiconductors and can act as an p-type and n-type conductor respectively. Tin mono-sulphide, a p-type semiconductors with a band gap of ~1.3 eV, has attracted great interest for the use as an absorber layer in chalcogenide thin film solar cells.

In this work thin films of tin sulphide have been deposited by a two-step process via atmospheric pressure chemical vapour deposition (APCVD). Two groups of SnS samples were studied: first those fabricated at room temperature and second a higher substrate temperature of 150 °C. Both were annealed at various temperatures for single phase engineering. SnS thin film was achieved in the phase by the annealing at the temperatures in the region of 300 °C–400 °C, which finds application in fabrication of solar cells.

Biography :

Ghadah joined ORC at the University of Southampton in April 2014 as a PhD student. Her research focuses on the fabrication of chalcogenides for photovoltaic applications. Her interests lie in material synthesis, thin film technology and the structural and optical characterization methods. She received her Master and Bachelor in Physics from Saudi Arabia.

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Asymmetric supercapacitor based on VS_2 and activated carbon materials

Tshifhiwa M. Masikhwa, Julien K. Dangbegnon, Abdulhakeem Bello, Moshawe J. Madito, Damilola Momodu, F. Barzegar[a] and Ncholu Manyala

University of Pretoria, South Africa

An asymmetric supercapacitor based on the VS_2 nanosheets as the positive electrode and the activated carbon (AC) as the negative electrode with a 6 M KOH solution as electrolyte was assembled. These materials were paired to maximize the specific capacitance and to extend the potential window, hence improving the energy density of the device. A specific capacitance of 64 F g^{-1} at 0.5 A g^{-1} with a maximum energy density as high as 17 Wh kg^{-1} and a power density of 287 W kg^{-1} was obtained for the asymmetric supercapacitor within the voltage range of 0–1.4 V. The supercapacitor also exhibited a good excellent stability during voltage-holding over 50 h at 1 A g^{-1} and kept constant at high potential, retaining a specific capacitance of 17.14 F g^{-1} (i.e., approximately 90% of its initial capacitance of 22.6 F g^{-1}).

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Probing of the Sodium Intercalation mechanism into Nano-sized V_2O_5 for Sodium-ion Batteries

Ghulam Ali[1] and Kyung Yoon Chung[2]

[1]Korea Institute of Science and Technology, Korea

[2]University of Science and Technology, Korea

In recent years, numerous efforts have been made to develop high performance rechargeable batteries to use for large scale applications such as electrical energy storage systems (ESS). Lithium ion batteries have been the most popular and widely used batteries in portable devices like cell phones, laptops, etc. However, it has some constraints to be used for large scale applications as the cost for the raw materials for lithium is expensive. There have been ongoing studies searching for alternative shuttle ions and sodium can be one of the possible substitutes since it is more abundant and cheaper.

High performance materials with large sodium storage capacities are required for the realization of sodium-ion batteries. Vanadium pentoxide (V_2O_5) is considered as promising active material due to its unique crystal structure with large interlayer spacing of 4.4 Å. It is known that layered V_2O_5 is electrochemically active when the electrode was applied in NIBs but exhibiting less noticeable performances. Herein, we designed the novel composite electrodes which consist of V_2O_5 nanoparticles and carbon and investigated the electrochemical energy storage mechanism of the electrode materials. Due to the incorporation of carbon-based material, the charge transfer resistance was significantly improved compared to the electrode with V_2O_5 alone. Accordingly, the nano sized V_2O_5/C composite has shown a superior reversible capacity as well as high rate capability. The electrodes with fully charged-discharged states have been further investigated by ex situ XRD and the result reveals the reversible sodium de/intercalation. Ex situ TEM analysis of the fully discharged electrode shows both crystalline and amorphous phases of $Na_2V_2O_5$. In addition, NEXAFS spectroscopy is employed to monitor the oxidation stage changes of vanadium ions upon Na^+ insertion/extraction and it is found that the redox (V^{4+}/V^{5+}) is responsible of the delivered capacity.

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Effects of Cerium Doping on the Morphology and Photoluminescence of Calcium Sulfide Nanophosphors

S.Rekha[1] and E.I. Anila [2]

[1]Maharajas College, India

[2]Union Christian College, India

Cerium doped CaS nanophosphors were synthesized using solid state diffusion method. The surface morphology and structural properties of as prepared phosphors are characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM). The XRD pattern revealed the crystalline nature of the CaS and the average grain size was found to be around 25nm. SEM was employed to study the changes in morphology and particle size of the nanoparticles as a function of Ce concentration. SEM microgragphs revealed that the morphology of the particles varied from nanofibers to nanosheets with increasing concentration of cerium. The photoluminescence (PL) emission spectrum showed a peak at 500 nm and a shoulder at 556 nm due to the transition from the excited state to ground state of Ce^{3+}. The variation of PL intensity with Ce concentration was investigated and the maximum PL intensity was obtained for 3% by weight of Cerium. The improved PL efficiency of CaS:Ce nanoparticles can be exploited in many optoelectronic devices.

Biography :

Rekha Sunil Roy is doing research at Mahatma Gandhi University, Kottayam , India. Her research interests include synthesis and characterisation of optoelectronic materials like luminescent materials in bulk form and nanoform. Her research work includes the synthesis of nanophoshors especially alkaline earth metal sulfides using very simple and less expensive methods like chemical wet co-precipitation, microwave method, hydrothermal method, sol –gel method etc. for optoelectronic applications and biomedical applications such as bioimaging, in vivo labeling, and sensing, and for drug delivery systems.

Yellow Emitting Chitosan Capped ZnO Synthesized by Wet Chemical Route

S Rekha, T A Safeera and E I Anila

U C College, India

Capping by organic compounds will results drastic changes in the structural and optical properties of nanomaterials. Here we try to find out the effect of capping on nano ZnO phosphor synthesized by wet chemical method. Yellow emitting ZnO was obtained by Na doping and effect of capping was studied using a natural polymer, chitosan. On capping, grain size of the particles reduced and thereby shows an enhancement in photoluminescence (PL) emission. The identification of crystal structure and grain size was calculated using x-ray diffraction (XRD). The photoluminescence emission is in well agreement with Commission International d'Eclairage (CIE) diagram.

Biography :

Rekha Sunil Roy is doing research at Mahatma Gandhi University, Kottayam , India. Her research interests include synthesis and characterisation of optoelectronic materials like luminescent materials in bulk form and nanoform. Her research work includes the synthesis of nanophoshors especially alkaline earth metal sulfides using very simple and less expensive methods like chemical wet co-precipitation, microwave method, hydrothermal method, sol –gel method etc. for optoelectronic applications and biomedical applications such as bioimaging, in vivo labeling, and sensing, and for drug delivery systems.

Catalytic pyrolysis of polysaccharides on the surface of metal oxides: kinetics and mechanisms

T. Kulik[a], K. Kulyk[b], M. Larsson[b], B. Palianytsia[a]

[a]Chuiko Institute of Surface Chemistry of National Academy of Sciences of Ukraine, Ukraine
[b]Stockholm University, Sweden

Pyrolysis is the thermochemical process that is capable of converting any form of biomass into biofuels and/or chemicals. Catalytic pyrolysis reactions take place at significantly lower temperatures, in a single step, and with less harmful conditions to the environment in comparison with classic biomass conversion methods. Therefore, pyrolysis meets all the requirements of modern green chemistry. Among renewable resources, lignocellulosic biomass and algae are particularly suitable as low-cost raw material for the production of biobased products by pyrolysis. Polysaccharides are the largest components of these materials.

The work is devoted to the studying of the kinetics and mechanisms of the thermal transformation of polysaccharides on the surfaces of fumed silica, titania/silica and alumina/silica. Pyrolysis of cellulose, dextran and dextran adsorbed on the nanosized metal oxides surfaces was investigated using temperature-programmed desorption mass spectrometry. Stages and products which relate to the pyrolysis of non-connected segments of adsorbed dextran (loops, trains) and segments directly connected to the silica surface were defined. Kinetic parameters of the thermal reactions (T_{max}, n, $E^{\neq}$, v_0 and $dS^{\neq}$) of the most important products formation were calculated. For example, it was found that the lowest activation energy of formation butadiene observed on the alumina/silica surface.

Acknowledgment: This publication is based on work supported by a grant UKC2-7072-KV-12 from the U.S. Civilian Research & Development Foundation (CRDF Global) with funding from the United States Department of State and by the Swedish Research Council (VR) under contract 348-2014-4250.

Biography :

Kulik has completed her PhD from Chuiko Institute of Surface Chemistry of National Academy of Sciences of Ukraine. She is the Head of Laboratory of the Kinetics and Mechanisms of Chemical Transformations on Solid Surfaces. She has published more than 70 papers in reputed peer reviewed journals.

Nano-oxides ceria/silica for pyrolytic conversion of fatty acids, triglycerides and biomass

K. Kulyk[a], M. Borysenko[b], B. Palianytsia[b], M. Larsson[a], T. Kulik[b]

[a]Stockholm University, Sweden

[b]Chuiko Institute of Surface Chemistry, Ukraine

The manufacture of fine chemicals based on sources other than petroleum is becoming a hot topic and a key tool in evolution from fossil-based to bio-based economies. Technologies relying on heterogeneous nanocatalysts do not require utilization of hazardous solvents, concentrated acids or bases, and generally are known to meet modern demands of green chemistry. At present, one of the most feasible technologies for the production of bio-chemicals at an industrial scale is heterogeneously catalyzed pyrolysis. The development of novel efficient nano-catalysts is the key to the pyrolytic technology innovation.

We synthesized novel nano-oxides CeO_2/SiO_2 and tested their catalytic activity in the reactions relevant to the pyrolytic conversion of biomass. The prepared nanomaterials were characterized by FTIR, TGA, XRD, SEM, Specific Surface Area analysis, etc. The optimum conditions for the synthesis of silica-supported nano-oxides with a controllable size of ceria crystallites (from 3 to 24 nm) were found. The pyrolitic conversion of fatty acids, triglycerides and biomass on the surface of ceria/silica nano-oxides was investigated by Temperature Programmed Desorption Mass Spectrometry. It was observed that the reaction of symmetric ketones formation takes place on the surface of CeO_2/SiO_2. The activation energy of ketonization was found to decrease as the concentration of ceria nanoparticles in the nano-catalyst sample increased. Novel CeO_2/SiO_2 nano-oxides demonstrated high catalytic activity in pyrolytic generation of high value ketones from biomass and its model compounds.

Acknowledgment*:* This work was financially supported by the Swedish Research Council in the framework of the Swedish Research Links programme grant #348-2014-4250.

Biography :

Kulyk's research career started at the Department of Chemistry at Taras Shevchenko National University of Kyiv (Ukraine). Following graduation in 2007 he joined the Chuiko Institute of Surface Chemistry (National Academy of Sciences of Ukraine) where he obtained PhD degree in Surface Chemistry in 2011. Since January 2013 he has worked as a postdoctoral researcher at the Department of Physics of Stockholm University (Sweden). The results of his work are summarized in 15 research articles published in international peer reviewed journals.

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Metal organic framework (MOF) derived N-doped graphene hybrid nano-architectures as multi-functional catalysts

Barun Kumar Barman and Karuna Kar Nanda

Indian Institute of science, India

We develop a novel core-shell nano-architectures of CoxFe1-x /N-graphene by simple pyrolysis of metal organic framework (MOF) and report the catalytic activity towards oxygen reduction reaction (ORR), oxygen evolution reaction (OER), hydrogen evolution reaction (HER) and the reduction of 4-nitrophenol (4-NP). It shows superior ORR activity with a half wave potential (-0.22 V vs. Ag/AgCl) comparable to traditional Pt/C in 0.1M KOH solution and excellent methanol tolerance. The OER activity is also found to be superior as compared to traditional RuO2 catalyst. A current of 10 mA/cm2 is obtained at 1.54 V with an over-potential 314 mV in 1M KOH solution. The core-shell nano-architectures show very high activity towards the 4-NP reduction in presence of NaBH4 that are magnetically separable. Finally, the nano-architectures have been explored for electro-catalytic HER which indicates better performance for optimized doping of Co in CoxFe1-x and N in graphene. Overall, the non-precious and earth abundant core-shell nano-architecture is very active and stable for multi-functional catalysts for various applications.

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Comparisons between quantum well laser Based on the $In_{1-x}Ga_xAs_yP_{1-y}$ /InP and $Al_yGa_xIn_{1-x-y}As$ /InP materials

H. Riane[1, 2],F. Hamdach[2] and S. Bahlouli[2]

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[2]LPPMCA, Algérie

There has been a great deal of interest in semiconductor optoelectronic devices, mainly for large-capacity optical communication system. Quantum well laser draw considerable attention because of their superior characteristics such as low threshold current, narrow gain spectrum and less temperature dependence, as compared with those of conventional semiconductor lasers. The successful design of long-wavelength quantum well laser requires particular consideration of thermal aspects, such as heat generation as well as heat conduction. The measurement of gain spectra is an important material characterization tool for the development of semiconductor lasers, semiconductor optical amplifiers, and other waveguide devices.

The aim of this paper is the comparison of two structures of quantum well laser based respectively on the $In_{1-x}Ga_xAs_yP_{1-y}$ /InP and $Al_yGa_xIn_{1-x-y}As$ /InP semiconductors. So, we purpose the calculus of the gain for various values of carrier's densities. Our study is based on the parabolic model with the intrabande relaxation taking into account.

We see that for a small well width for a small well width, the gain is small in the region of low injection and became important if the injected carrier density increase. And that the spectrum is not fixed at the wavelengths determined by the quantized levels, but are shifting toward shorter wavelength. Second, the gain spectra around the peaks broaden due to the intraband relaxation. The principal remarks is that the structure based on $Al_yGa_xIn_{1-x-y}As$ /InP, is a good alternative for the $In_{1-x}Ga_xAs_yP_{1-y}$ /InP quantum well laser in Infrared region of spectrum.

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Cross-linked latex particles grafted with polyisoprene as model rubber-compatible fillers

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Model filler particles were obtained by grafting polyisoprene (PIP) chains onto spherical latex particles of polystyrene (PS) cross-linked with 12 mol % divinylbenzene (DVB). These particles, with a narrow size distribution and a diameter of ca. 400 nm, were synthesized by starved-feed emulsion polymerization without emulsifier. Acetyl coupling sites were introduced randomly at either low (5 mole %) or high (30 mole %) substitution levels on the latex particles by Friedel-Crafts acylation with acetyl chloride and AlCl3 in nitrobenzene. The acetylation reaction was monitored by Fourier Transform Infrared (FT-IR) analysis of the particles. 'Living' polyisoprenyllithium chains, generated from isoprene and sec-butyllithium (sec-BuLi), were then coupled with the acetylated PS latex particles. The PIP side chains had a high cis-1,4-polyisoprene microstructure content and a number-average molecular weight (Mn) of either 2×103 (2K), 5×103 (5K), or 3×104 (30K). The PIP content of the grafted particles was determined from the yield of isolated particles and by 1H NMR spectroscopy analysis. The grafted latex particles were blended in solution with linear polyisoprene (Mn = 3.95 ×105, 395K) as a rubber matrix. The influence of the filler-matrix interactions on the rheological behavior of the blends was determined by dynamic mechanical analysis for the different filler structures generated. All the blends exhibited increases in complex viscosity and storage modulus, and decreased damping factors relatively to the pure matrix polymer. The enhancements observed, decreasing in the order 30 mol % > 5 mol % acetylation, and in terms of the grafted PIP chain length as 30K > 5K ~ 2K, are deemed to reflect the extent of interactions between the filler particles and the polymer matrix.

Exciton-Plasmon interaction in Hybrid Transition Metal Dichalcogenide/Gold Nanostructures

Adnen Mlayah

CNRS-Université de Toulouse, France

Monoatomic layers of Transition Metal Dichalcogenide materials have recently triggered a strong interest due to their unique optical, electronic and spintronic properties. These properties arise from the combination of ultimate exciton confinement in two dimensions, strong spin-orbit interaction at the valence band edges and non-centrosymmetric crystal structure. Transition Metal Dichalcogenide (TMD) MX_2 (where M is Mo or W and X is S, Se or Te) are very promising for applications as they might be exploited in a new class of opto-electronic devices based not only on the charge and spin degrees of freedom but also on the valley polarization induced by circularly polarized light pumping. On the other hand, surface plasmons sustained by metal nanoparticles have been extensively investigated in recent years because of their ability to capture, confine and guide light at the nanoscale and in a broad spectral range. Hence, it is very interesting to fully integrate TMD monolayers and metallic resonators within hybrid excitonic/plasmonic nanostructures with the aim of generating new optical excitations based on the near-field interaction between localized surface plasmons and confined excitons.Various applications are targeted : plasmonic enhanced sensitivity of field-effect transistors and photodetectors, enhanced photocatalytic water splitting, enhanced photoluminescence emission via direct plasmon-to-exciton conversion. In this presentation, I will discuss the physics of the plasmonic-excitonic near-field interaction in various hybrid TMD/Metal nanostructures and present recent experimental results obtained by optical spectroscopy techniques and simulations.

Biography :

Adnen Mlayah is a Professor of Physics at Paul Sabatier University of Toulouse and a researcher at the Centre d'Elaboration de Matériaux et d'Etudes Structurales-CNRS, working in the field of Nanoscience and Nanotechnology. Main research interests are centred around the optical properties of nanomaterials and nanostructures. He authored 110 research papers reporting experimental and theoretical investigations of the light-matter interaction at the nanoscale.

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The Development of Nanpscale Surfactant Based Electrochemical Sensor for the Trace Level Detection of Mercury

Afzal Shah

Quaid-i-Azam University, Pakistan

A highly sensitive electrochemical sensor using a novel thiourea-based surfactant 1-(2, 4-dinitrophenyl)-dodecanoylthiourea (DAN) was developed for the detection of Hg (□□) using cyclic, square wave and differential pulse voltammetry. For optimization, the effect of several experimental factors such as concentration of the surfactant, scan rate, pH, accumulation time, number of cycles and supporting electrolytes were investigated. Under suitable experimental conditions, calibration plot with a good linearity up to 2 μg/L was obtained with detection limits of 0.64 μg/L in doubly distilled water at accumulation time of 360 s using square wave voltammetry. The sensitivity of the proposed method was found to be 0.164μAL/ μg .The performance of the developed methods was evaluated by the determination of mercury in drinking and tap water samples of pH 7. The results revealed that our analytical methods are very promising and reliable for the trace level detection of mercury even by using BRB pH 7. Significant interaction energy between DAN and Hg^{2+} was determined theoretically by using hyperchem 7.5 (AM1 method), which favored the experimental work.

Drug Delivery System For Tocotrienol To Promote Osteoporotic Fracture Healing

Ahmad Nazrun Shuid & Nurul ‘Izzah Ibrahim

Universiti Kebangsaan Malaysia, Malaysia

Oral delivery of agents to treat osteoporosis and its fracture complication do not directly target bones as these agents may diffuse to other parts of the body and cause adverse effects. However, there are challenges in delivering drugs directly to bone as there is no direct route to reach this organ. In this study, potential anti-osteoporotic agent, tocotrienol was delivered directly to the fracture site. In order to maintain the continuous release of tocotrienol, it was combined with PGLA, a polymer carrier before injected to the fracture site to promote healing.

Ovariectomised rat was used as model of postmenopausal osteoporosis and fracture was created at the proximal tibia. After fixation of the fracture site with plates and screws, the tocotrienol+PGLA was injected into the fracture site and the wound closed.

Biomechanical testing showed that tocotrienol+PGLA significantly increase callous strength which indicated that the targeted delivery system had promoted fracture healing of osteoporotic bone.

This showed that targeted delivery system may be developed further for promotion of fracture healing. Tocotrienol delivered through this method had successfully promoted fracture healing.

Biography :

Ahmad Nazrun Shuid is a Professor of Pharmacology at the Pharmacology Department, Faculty of Medicine UKM (University Kebangsaan Malaysia). He graduated with a medical degree from RCSI in 1997 and completed his PhD in UKM in 2005. He is a member of the Bone Metabolism Research Group with the interest in the use of natural product for treatment of osteoporosis. He has published more than 70 articles in ISI/Scopus indexed journal and has represented his research group to international expos and conventions.

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Sirt1 protects against oxidative stress in diaphragm muscles

Aladin M. Boriek and Patricia S. Pardo

Baylor College of Medicine, USA

Muscle contractility is associated to ROS production due to increased mitochondrial activity and activation of NADPH oxidase. The protective mechanisms against excessive ROS generation in muscles constantly active (heart, diaphragm) are elusive.

The protein deacetylase SIRT1 promotes MnSOD and catalase expression by activating FOXO (1). In skeletal muscle cells, mechanical stretch leads to an EGR1-dependent transcriptional activation of Sirt1 leading to a $FOXO_4$ dependent activation of Sod2 (2). In diaphragm muscles from young mice we found an increase of 2-fold in SIRT1 protein and RNA 1h after mechanical stretch SIRT1 protein showed a 3-fold increase of basal levels in aged vs young diaphragms. However, further increase of SIRT1 protein or RNA by stretch was blunted in old diaphragms.

EGR1 binding to the *Sirt1* promoter was evaluated in stretched and non-stretched diaphragms from young and aged mice. *Sirt1* promoter occupancy by EGR1 had a 6-fold increase by stretch in diaphragms from young animals, whereas in old animals was not detectable Our results in stretched cultured muscle cells also showed that higher expression of SIRT1 partially rescues the stretch-induced increase in ROS levels. Our data suggest the existence of two mechanisms involving SIRT1 to prevent oxidative stress due to mechanical loading.

Multi-Beam Engineering Microscopy: A Versatile Tool for Nanoscale Material Design

Alexander M. Korsunsky

University of Oxford, UK

Multi-modal microscopy is a term that refers to combining different imaging and mapping modes applied to the same object in order to obtain complementary information about material structure, function and properties. Alongside the well-established modalities, such as optical microscopy (including using polarised light) and scanning electron microscopy (including EDX and EBSD), multi-modal microscopy includes the use of TEM and STEM, AFM, as well as focused beams of ions (FIB), neutrons and X-rays. The advent of tight (sub-micron) focusing of X-rays has opened up a vast range of possibilities in terms of full field imaging (including tomography), as well as scanning transmission X-ray microscopies (STXM) that can be used in the WAXS or SAXS regimes, and also for spectroscopic analysis (XAS). My particular interest lies in the tight integration of these techniques with materials modelling across the scales. As examples, in my lecture I shall draw on our studies of the structure and thermo-mechanical response of human dental tissues (dentine and enamel); the structure and residual stress of carbon monofilament cores used in SiC fibre composites for aerospace applications; and some studies of materials for Li-ion batteries.

Biography :

Alexander Korsunsky is a world-leader in engineering microscopy of materials systems and structures for optimisation of design, durability and performance. He consults Rolls-Royce plc on matters of residual stress and structural integrity, and is Editor-in-Chief of Materials & Design, a major Elsevier journal (2013 impact factor 3.501). He co-authored books on fracture mechanics (Springer) and elasticity (CUP), and published ~300 papers in scholarly periodicals on subjects ranging from multi-modal microscopy, neutron/synchrotron X-ray analysis, contact mechanics and structural integrity to micro-cantilever bio-sensors, size effects and scaling transitions. His h-index is 25, and his top publications have over 400 citations.

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Nanoparticles fabrication and modification with pulse laser technique

Alexander Pyatenko

National Institute of Advanced Industrial Science and Technology (AIST), Japan

A variety of different NPs are now available on the market. Particles of different materials with different sizes and shapes have been commercialized by many companies. However, more precise observation indicates that very often the particle shapes are very irregular, the particle size distribution is very wide, and metal particles are often partly oxidized.

With pulse laser irradiation technique we can produce spherical nanoparticles with different controllable sizes and narrow size distribution. Different materials for particle formation, metals, oxides, semiconductors were used already. In different experimental condition we can vary the morphology, surface structure, porosity, and other properties of nanoparticles. For the same raw materials solid spheres or hollow particles can be produced. Using the mixture of two different raw materials we can produce the core-shell structures. Magnetic nanoparticles with different surface properties and morphology can be also synthesized by this method.

Biography :

Alexander Pyatenko has completed his PhD in Chemical Physics from Moscow Institute of Physics and Technology in 1981. He worked as senior researcher at Institute of High Temperatures Russian Academy of Science. Since 1993 he works as a senior researcher at National Institute of Advances Industrial Science and technology (AIST) in Japan. His main research interests are Nanotechnology and Laser Processing. He has published more than 70 papers in reputed journals, two book chapters, and is serving as an editorial board member of several International Journals.

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Thermoacoustic Projectors: Alternative Carbon Nanostructures

Ali E. Aliev

University of Texas at Dallas, USA

Thermophones are highly promising for such applications as high power sonar arrays, flexible loudspeakers, and noise cancellation devices. So far, freestanding carbon nanotube aerogel sheets provide the most attractive performance as a thermoacoustic heat source. However, the limited accessibility of large-size freestanding carbon nanotube aerogel sheets, and other even more exotic materials recently investigated, hampers the field. We here describe alternative materials for a thermoacoustic heat source with high energy conversion efficiency, additional functionalities, environmentally friendly and cost effective production technologies. We discuss the thermoacoustic performance of alternative nanostructured materials such a sheet of carbonized polymer nanofibers, graphene sponge, and compare their spectral and power dependencies of sound pressure in air. Applications of thermoacoustic projectors for high power SONAR arrays, sound cancellation, and optimal thermal design, regarding enhanced energy conversion efficiency, are discussed.

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Evaluation of Ibuprofen Nano-Particles Prepared by Ultra-Homogenization

Aly Nada, F. Bandarkar, Y. Al-Basarah

Kuwait University, Kuwait

The objective of the present work was to prepare ibuprofen (IBU) -PVP K30 nano-particles using ultra homogenization technique to enhance the dissolution rate of IBU.

Phase solubility study with PVP K 30 was done to investigate the effect of polymer concentration on solubility of IBU. Nano-suspensions were prepared using different drug:polymer ratios by high pressure ultra-homogenization technique and were evaluated for particle size and zeta potential. The suspensions were then lyophilized and studied for drug content and dissolution. DSC and FTIR studies were performed to identify the physicochemical interaction between the drug and the polymer. An additional series of nano-suspensions was investigated to explore the effect of Tween® 80 on size reduction.

Phase solubility study indicated a linear increase in IBU solubility with increasing PVP K30 concentration. The saturation solubility of IBU (particle size - 60 µm) was found to be only 47 µg/ml. An optimized ultra-homogenization procedure was found (50 cycles gradually increased from 500 to 1500 bar were found to be optimum). Increase in polymer concentration, number of homogenization cycles and pressure decreased particle size up to 527 ± 31 nm. The nano-suspension showed good stability with zeta potential values above -30 mV. The lyophilized nanoparticles derived from these suspensions showed 100% drug release as compared to micronized IBU (53.06 ± 4.79%) after 60min. DSC endotherms demonstrated mutual interaction between IBU and PVP K30 which was further confirmed by FTIR. Nano-suspensions containing Tween® showed excellent re-dispersibility and further reduction in particle size (127 nm).

IBU-PVP nano-suspensions/ nano-particles exhibited improved aqueous solubility and dissolution rate, with the potential of enhancing drug bioavailability, decreasing gastric irritancy and patient safety. Moreover, as IBU is known to enhance the anti-cancer activity of cisplatin in lung cancer cells, further studies can be done to formulate combination products with increased efficacy.

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Analytical Chemistry as a tool towards Green Technology

Andriana Surleva

University of Chemical Technology and Metallurgy, Bulgaria

It is well known that the new technology starts operating when the analytical tools and methodologies are validated. Nowadays the industry is focused in two main directions: first, development of new green technologies to ensure sustainable development of our modern society, and second, maintain and optimize the operational conditions of existing technologies in order to avoid problem operation of the units and even accidents. It is a practice that the factories establish analytical laboratories with specialized equipment. Usually, these laboratories have highly qualified experts and modern analytical instruments. However, our practice has showed that the routine laboratories face some problems when non-routine for their practice samples should be analyzed. Another problem is that a great number of laboratories even scientific ones are specialized in given analytical method and provide only partial analytical information to the industry. The aim of this report is to present some examples of our collaboration with industry in their efforts to prevent irregular operation of units or improve their technologies.

First case is related with an irregular operation of a unit in a Bulgarian refinery. A solid deposit was formed in a heat transfer unit which caused high pressure increase and danger of accident. The composition of the deposit was the key to diagnose and prevent irregularities. Second case, a factory introduced a new incinerator with modern waste gases purification system in order to broaden their activities. The purification process was highly effective; however a lot of solid waste from gas purification system was generated. The factory is trying to find a way to reuse this waste. The exact composition and full characterization of waste are needed. The factory laboratory faced the problem with partial information provided from specialized analytical laboratories. Finally, the fine tuning of a technology for nitrating of organic compounds demands for fast and accurate analytical information. The choice of appropriate analytical method is a result of balanced compromise.

As a result of collaboration between industry and the Analytical Chemistry dep. of UCTM a methodology for planning the research activities of industry analytical laboratories to deal with non-routine samples was proposed. Obtaining fast and accurate analytical data is an important step to maintain the chemical technology in a green manner.

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Green Nanotechnology

Arti Goel[1] and Kanika Sharma[2]

Amity University, India

MLSU, India

Green Nanotechnology denotes an application of nanotechnology that envisions sustainability. Green nanotechnology is a great industrial revolution as well as this technology supports the development of sustainable solutions to address global issues. The technology is basically used to develop clean technologies in order to minimize human health and potential environmental risks. The goals of green nanotechnology involve production of nanomaterials that do not harm the environment and are eco-friendly and also to derive specific nanoproducts from these nonmaterials which can be used in human welfare. Several products have been developed that are important in generation of energy like fuel cells, thermoelectric devices, solar cells and improved batteries. These materials are small sized and use less material thus in turn save energy and fuel.

Green nanotechnology works on the principles of "green engineering" which design such products that conserve natural resources and do not harm environment. It emphasizes the use of "sustainable chemistry" in order to develop products that minimize the use of hazardous materials. Products of green nanotechnology are used for remediation of hazardous waste sites, desalinate polluted water as well as allow sensing devices to detect plant pathogens, toxins and hazardous pollutants.

In the field of green nanotechnology lot of innovations has been done which has proved to be of great importance for the future. Innovations in the field of green nanotechnology will also have a high impact to the economy from automobile to food.

Biography :

Arti Goel after receiving her master's degree in Botany and doctorate in Microbiology from Mohan Lal Sukhadia University, Udaipur (Rajasthan) – India, she entered the Central Arid Zone Research Institute for a postdoctoral fellowship in Microbial and Agricultural Nanotechnology. Her research involved medicinal plants antimicrobial potential as well as synthesis, characterization and applications of microbially synthesized nanoparticles on agrosystem. Currently, She is working as an Assistant Professor at Amity Institute of Microbial Biotechnology, Amity University, Noida (U.P.) - India. Her publications in this field include research papers (National and International), articles (National and International) and patents (filed). Recently, she have got FSASc award for significant contribution in the field of Microbiology and Nanotechnology by Society for Advancement of Sciences.

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Preparation of graphene nano layer by pure sheer milling

Asghar Kazemzadeh and Mohammad Ali Meshkat

Materials and Energy Research Center, Iran

A method for preparation of few-layer graphene sheets from graphite powder by sheer milling is described. Graphite was well dispersed in deionized water as a lubricant in the presence of sodium dodecylsulfate (SDS) and shaked for 60 hours to be milled under low energy. The applied sheer forces a continuous delaminating of graphene flakes. Ultrathin multilayer structure of graphite was achieved by using SDS as surfactant and structural study was carried out by SEM. In order to determine distinct levels of carbon in different fragments of graphite the energy dispersive X-ray spectroscopy was used. This method of production has advantage of being low-cost and easy to produce a lot of graphene nano layers.

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Thermo- chemical treatment and Plasma nitriding at low pressure of the cermets (W,Ti) C-9% Co

B. Bouledroua M. A[1], A. Saker Pr[1], T. Belmonte Pr[2]

[1]Badji Mokhtar University, Algeria

[2]Nancy University, Algeria

The object of this study is the cermets (W,Ti) C-9% Co obtained by sintering at liquid phase according to classical technology of powder metallurgy. For the sake of improving the resistance to wearing of the cut plates, several thermo-chemical treatments (gaseous nitride, liquid nitride and plasma nitriding) have been tested. Independently from the types of treatment, the plate revealed a modification of the nature of the update phases at the superficial layers. The appearance of TiN, Ti (CN) and other oxycarbonitride generated a hardening of the surface with micro-hardness values exceeding 45.000 MPa. Tungsten nitride have been revealed by X-ray diffraction only on plasma nitriding tested plates. The W/N stoichiometry is a now still investigated.

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ZnO nanostructures for quantum dots sensitized solar cells

Basma EL Zein

University of Business and Technology, Saudi Arabia

Nano-materials are considered as building blocks of many optoelectronic devices. They differ from bulk counterpart in the size, characteristic and their new physical properties and offer new opportunities to be employed in various applications.

Zero dimensional (0D) and one Dimensional (1D) nanostructures have attracted lots of attention in solar energy harvesting, conversion and storage, owing to their unique physical and chemical properties.

Zinc oxide (ZnO) nanowires provide separation and transportation of the generated carriers by the excitation of the attached Quantum Dots (QDs).

The geometry of the NWs arrays allows improved optical reflection and light trapping leading to enhancing the light absorption. Furthermore, ZnO NWs will drive and direct the transportation of the photo-generated electrons, and thus improving the energy conversion efficiency of the solar cell.

In this presentation, we will discuss one dimensional nanostructures in quantum dots sensitized solar cells and the role they play in increasing the conversion efficiency of solar cells, taking in consideration the materials to be used to meet the main objective of developing an eco-green solar cell with high conversion efficiency.

Biography :

Basma El Zein, PhD. The director of Research and Consultation Center at the University of Business and Technology (UBT) – Jeddah Saudi Arabia. She was a Research Scientist at King Abdullah University of Science and Technology (KAUST), and previously a faculty member at Dar AL Hekma University, KSA and an associate researcher at the Institut D'Electronique, Microelectronique et Nanotechnologie (IEMN), Lille, France.

Dr.El Zein is a senior member of Institute of Electrical and electronics Engineers (IEEE), member of ACS, MRS, SPIE, ECS and Lebanese Engineering syndicate. She has been selected as Solar Pioneer by MESIA during the WFES 2015 in Abu Dhabi.

Her recent research interests include working on nanostructures for third generation solar cells, energy harvesting and energy storage. She recently gained 2 grants from KACST, to support her research on Nanostructures for Photovoltaic applications, where she is mentoring a PhD student and collaboration with many international research centers.

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Statistical Timing Yield Prediction of CNFET-based Circuits in the Presence of Nanotube Density Variation and Metallic-Nanotubes

Behnam Ghavami

Shahid Bahonar University of Kerman, Iran

Fundamental limits of CMOS scaling led the researchers to explore possible alternatives for the future of nano-scale semiconductor industry. Carbon Nanotube Field Effect Transistors (CNFETs), consisting of aligned semiconducting single-walled Carbon Nanotubes (CNTs), are considered to be promising candidate devices for future technology nodes due to their superior electrostatic properties. CNTs are grown using chemical synthesis, and the exact positioning and chirality of CNTs are very difficult to control. Hence, CNFET-based circuits will face great fabrication challenges that will be translated into imperfections and variability which in turn lead to significant functional and parametric yield reduction. In this paper, we address the parametric timing yield problem of CNFET-based digital circuits. We develop an analytical approach to timing yield prediction of CNFET-based circuits with respect to CNT density variation and metallic-CNTs. The proposed technique allows for closed-form computation of gate delay probability density functions given variations in relevant CNTs synthesis parameters. We express the current and capacitance of a gate as a function of random parameters and then, use these parameters to compute the moments of delay distribution. Finally, these variability-aware moments are exploited in closed-form delay metrics to predict the parametric timing yield of the circuit. The superiority of the proposed technique is studied and verified against Monte-Carlo simulation. With realistic limitation on timing yield metric, the proposed method provides processing guidelines that are required for CNFET-based VLSI digital circuits.

Theoretical investigation on the structural, energetic, magnetic and electronic properties of chemically modified defective single-wall carbon nanotubes

Bessem BEN DOUDOU[1] and Jun CHEN[2,3,4,5]

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[5] UMR, France

Their unusual electronic and structural physical properties promote carbon nanotubes as promising candidates for a wide range of nanoscience and nanotechnology applications. However, like in most materials, the presence of defects in carbon nanotubes has been demonstrated experimentally. These defects may take different forms: vacancy, bi-vacancy, Stone-Wales defect, 5/7 pair, atoms in substitution… The introduction of defects in the carbon network is an interesting way to modify its intrinsic properties and to create a new potential nanodevices. On the other hand, it was found also that structural defects make possible the functionalization of carbon nanotubes. In this work, we have investigated the chemical functionalization of (5,0), (8,0) and (13,0) zigzag single wall carbon nanotubes (SWNTs) by carboxyl, amine and hydroxyl groups on Stone-Wales (SW) defect by using spin-density functional calculations. Geometric changes of the regular hexagonal nanotube structures as well as alterations of their energetic, magnetic, and electronic characteristics induced by the presence of the defect and the functional group are recorded and discussed as a function of the tube diameter.

Nanocellulose-backboned water-insoluble Prussian blue as adsorbents for selective elimination of radioactive cesium

Bunshi Fugetsu[1], Adavan Kiliyankil Vipin[1], Ichiro Sakata[1], Morinobu Endo[2], Mildred Dresselhaus[3]

[1]The University of Tokyo, Japan

[2]Shinshu University, Japan

[3]Massachusetts Institute of Technology, USA

Prussian blue (PB) nanoparticles with nanocellulose as backbones were synthesized via a wet-reaction/freeze-drying approach. This type of the nanocellulose-backboned PB nanoparticles was found to be truly insoluble in water. This unique water-insoluble property is highly desirable for the radioactive cesium elimination with the nanocellulose-backboned PB nanoparticles as the adsorbent. Complexation between nanocellulose and PB nanoparticles is the key interaction considerably for the PB/nanocellulose complex formation. Capabilities and behaviors of cesium sorption by the nanocellulose-backboned PB nanoparticles were evaluated via a breakthrough approach with the absorbent being packed into a chromatographic column. Seawater containing a certain amount of spiked cesium ion was prepared for the sorption studies; the cesium ion was selectively retained by the nanocellulose-backboned PB nanoparticles from the other competitive ions with the so-called size-based affinity interaction as the key mechanism. In conclusion, nanocellulose has been demonstrated to be capable of binding PB nanoparticles via the formation of nanocellulose/PB complexes; this new class of the "chelate-like", water-insoluble, three-dimensional porous nanostructures can open up new possibilities for effectively eliminating radioactive cesium from contaminated waters including the contaminated seawaters.

Biography :

Bunshi Fugetsu has completed his PhD from Nagoya University, Japan and has long been learning Nanomaterials & Nanotechnologies from Prof. Morinobu Endo and Prof. Mildred Dresselhaus.

Global Nanotechnology Congress and Expo

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Electronic Structure of Nanostructured Energy Materials by X-ray Spectroscopy

Chung-Li Dong

Tamkang University, Taiwan

Global extreme climate and gradual shortage of nature resources remind us the rising energy crisis. A new era of renewable energy is dawning and material scientists are devoted to search new sources of clean energy that can satisfy the human demand for energy. The new energy material that has efficient energy conversion/generation/storage is the most pressing challenge. In many important energy-material systems such as artificial photosynthesis, nanostructured catalysts, and smart materials, the change of atomic and electronic structure near the interfacial region upon the reaction provide the fundamental understanding of the physical and chemical properties of a material. Investigation of these interfacial phenomena provides the critical information to better design the material and thus control its performance. X-ray spectroscopy, including x-ray absorption and x-ray emission spectroscopies can be used to study the local unoccupied and occupied electronic structures. Use of the in situ/in operando technique, determination of the change of atomic/electronic structures of the energy material under its real working condition now becomes possible. This presentation will report the emerging in situ/in operando characterization on energy relevant materials by x-ray spectroscopy. A number of recent studies of electronic structure of energy-related materials will be presented.

Biography :

Chung-Li Dong is an assistant professor of Department of Physics, Tamkang University, Taiwan. He received his Ph.D. in Physics from Tamkang University in 2004. He worked as a postdoc in Institute of Physics, Academia Sinica (2005-2009). Concurrently he also worked as postdoc in Advanced X-ray Inelastic Scattering group at the Advanced Light Source, Lawrence Berkeley National Laboratory, USA. He joined the scientific research group as an assistant scientist at National Synchrotron Radiation Research Center in 2009. He has published more than 100 papers in reputed journals. His research focuses on x-ray spectroscopic study of the electronic structure of energy materials.

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Controlling domain wall motion on the nanoscale in Ta-CoFeB-MgO devices with perpendicular anisotropy

D.Ravelosona[1], L.Herrera Diez[1], Y.Liu[1], W.Lin[1], K.Garcia[1], J.P Adam[1], N.Vernier[1], G.Agnus[1], T.Devolder[1], J-P.Tetienne2, T.Hingant[2], V.Jacques[2], B.Ocker[3], J.Langer[3], Eric E. Fullerton[4], A.Lamperti[5], R.Montovan[5], M.Fanciulli[5], M.Mariani[6], L.Baldi[6]

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[6]Micron Semiconductor Italia S.r.l., Italy

One crucial breakthrough in spin electronics has recently been achieved regarding the possibility to move magnetic domain walls (DWs) in magnetic tracks using the sole action of an electrical current instead of a conventional magnetic field. Here, I will present our recent results of DW dynamics obtained in Ta-CoFeB-MgO nanodevices with perpendicular magnetic anisotropy (PMA), which are widely used in STT-RAM applications, and discuss the critical problems to be addressed for implementation into a memory device. Particularly, an important parameter that will ultimately determine the scalability of this technology is the energy landscape experienced by DWs. Using NV center microscopy to map DW pinning along a magnetic wire, I will first show[1] that Ta/CoFeB(1nm)/MgO structures exhibit a very low density of pinning defects with respect to others materials with PMA. Then I will demonstrate[2] that NV center microscopy can be used to determine the DW structure (Neel versus Bloch wall) in this material and quantify the Dzyaloshinskii-Moriya Interaction (DMI). I will also show[3] our recent experiments of controlling DW motion with an electric field that provides a new route to control domain wall (DW) dynamics with low power dissipation. Finally, I will demonstrate that storing pinning sites can be developped to control with high thermal stability domain wall pinning through anisotropy contrast.

Biography :

Dafiné Ravelosona received his Ph.D. degree in solid-state physics from University of Paris Jussieu in 1995. He was a Postdoctoral Fellow with the National Centre for Microelectronics (CNM), in Madrid, Spain from 1996 to 1998. In 1998, he became a permanent research member of CNRS at Institut d'Electronique Fondamentale within the University of Paris-Sud, Orsay, France. From 2004 to 2005, he was an Invited Scientist at the Research Center of Hitachi Global Storage Technology, San José, CA. Since 2010 he has been the director of the Nanoelectronics Dept (60 staff members) at Institut d'Electronique Fondamentale, University of Paris-Sud 11. He is an experimentalist physicist and he has more than 15 years of experience on magnetic thin-film growth, ion irradiation of magnetic films, nanodevice development, magnetotransport phenomena, and nanomagnetism. He has participated to the demonstration of several breakthroughs in the field of domain wall motion in films with perpendicular anisotropy. He has co-authored over 110 papers, given more than 40 invited talks and filed 4 patents. He has been the Coordinator of a collaborative FP7 STREP European project in charge of developing a domain-wall-based memory prototype integrated into CMOS technology. He also coordinates 2 USA–French "Materials World Network" projects on spintronic devices and has launched an international associated laboratory between CNRS and University California of San Diego. He was recently awarded 7 prizes of innovation to launch his startup company SILTENE in 2012.

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Nano-Devices For Enhanced Thermal Energy Storage, Cooling And Sensing

Debjyoti Banerjee

Texas A&M University, USA

We are developing nanotechnology enabled platforms for enhancing cooling, sensing, energy storage and safety systems (involving both experimental and computational studies). Coupling of thermal and hydro-dynamic features during phase change (boiling, condensation) causes spatio-temporal fluctuations of surface temperature at the micro/nano-scales, which are termed as “cold-spots” and can transmit over 60-90% of the total heat transfer. Using Carbon-Nanotube (CNT) nanocoatings - cooling was enhanced by 60~300% by leveraging cold-spots and the “nano-fin” effect (enhanced surface area). Using silicon nanofins - cooling was enhanced by ~120%. Nano-thermocouples and diode temperature nano-sensors integrated with the nanocoatings enabled the study of chaos/ fractal structures in boiling. Specific heat capacity was enhanced by ~120% using nanofluids. This has applications in the energy technologies, such as: concentrated solar power/ CSP (thermal energy storage/ TES), nuclear, oil and gas exploration (deep drilling, reservoir engineering using nanotracers). Microchannel experiments using nanofluids showed that the precipitated nanoparticles behaved as nanofins (enhanced surface area) that dominate heat transfer for micro/nanoscale flows. DPN™ (Dip Pen Nanolithography™) leverages Scanning Probe Microscopy using microfluidics. Commercial microfluidic devices called “Inkwells™” were developed earlier. The next generation microfluidic devices are being developed for DPN (e.g., Fountain Pen Nanolithography, “centiwells”). The applications are in nano-catalysis, bionanotechnology, maskless-lithography and nano-sensors for homeland security, bio-security and explosives detection (e.g., “nano-nose”/ “nano-tongue”). We invented a gasless process for synthesis of organic nanoparticles (e.g., graphene, CNT, etc.) under ambient conditions with synthesis temperature less than 300 °C (US Patent 8470285, awarded in 2013).

Biography :

Banerjee received his Ph.D. in Mechanical Engineering from UCLA (with minor in MEMS). He received 3 M.S. degrees and was invited to 4 national honor societies. He attended the Indian Institute of Technology (IIT), Kharagpur for his Bachelor of Technology (Honors). Prior to TAMU, Dr. Banerjee worked as a Manager of Advanced Research & Technology (ART) group at Applied Biosystems Inc. (ABI), CA, (currently merged into Life Technologies). Also as a Hiring Manager at ABI he hired ~ 30 PhDs in ~6 months and managed a group of 10~15 Ph.D. engineers / scientists. Previously in a singular capacity, he developed from concept to a commercial product at NanoInk Inc. (called “InkWells™”, which are microfluidic platforms used for bio/nano-lithography of proteins, nucleic acids, etc.). Dr. Banerjee has 13 US patents (33 intellectual properties/IP: 10 US provisional, 5EP and 5 WO patents/applications), from his work at ABI, Ciphergen Biosystems, NanoInk, Coventor Inc. and TAMU. He received the “Amlan Sen Best Mechanical Engineering Student Award (Endowment)” at the graduation convocation at IIT and the “J.C. Bose National Science Talent Scholarship” from the Govt. of India. He received the “Morris Foster Fellowship (2007-2008)” from Mechanical Engineering Department; L.T. Jordan Career Development Professor and the “TEES Select Young Faculty Fellowship (2008-2009)” from the D. Look College of Engineering; and was designated as a Faculty Fellow at the Mary Kay O’Connor Process Safety Center at TAMU. He received the “2001 Best Journal Paper Award” from the ASME Heat Transfer Division (HTD), the “New Investigator Award (2005)” from the Texas Space Grants Consortium (TSGC), “3M Non-Tenured Faculty” award (’09-’12), the “ASEE/ AFOSR Summer Faculty Fellowship (’06, ’07)” at AFRL, and the “ASEE/ ONR Summer Faculty Fellowship (’09)” at SPAWAR. He has supervised thesis of 11 PhD and 17 MS students.

Optical and Magnetic Propertis of Doped Graphene and Silicene System: A First Principles Study

Debnarayan Jana

University of Calcutta, India

2D materials are always fascinating in their own right from a basic physics point of view. The similar properties of silicene and graphene have been observed both experimentall and theoretically. The striking similarity between graphene and silicene originates from the basic fact that both carbon (C) and silicon (Si) belong to the same group in the periodic table of elements. Graphene nanosheet has been doped with nitrogen, boron and nitrogen–boron pair of different concentrations. Band gap opening has been observed and besides, its magnitude increases with the doping concentration of three different species of adatoms. The static dielectric constant in the long wave length limit for parallel polarization of electric field increases with the doping concentration, whereas for perpendicular polarization it remains almost constant with respect to the doping concentration and specific types. The magnetic properties were studied by introducing monovacancy and di-vacancy, as well as by doping phosphorous and aluminium into the pristine silicene. It is observed that there is no magnetism in the monovacancy system, while there is large significant magnetic moment present for the di-vacancy system. Besides, the numerical computation reveals that the magnitude of the magnetic moment is larger when the system is doped with aluminium than phosphorous. We would also indicate the optical anisotropy of four differently shaped Silicene nanodisks within the framework of density functional theory in the long wavelength limit ($q \rightarrow 0$). The calculations of density of states of all these nanodisks reveal clearly zigzag trigonal (ZT) has the maximum magnetic moment. Optical properties are studied by varying the concentration of substituted Aluminium (Al), Phosphorus (P) and Aluminium - Phosphorus (Al-P) atoms in silicene nanosheet. It has been observed that unlike graphene, no new electron energy loss spectra (EELS) peak occurs irrespective of doping type for parallel polarization. But for perpendicular polarization two new small yet significant EELS peak emerge for P doping. All these theoretical results may shed light on device fabrication in nano opto-electronic technology and materials characterization techniques in doped graphene and silicene.

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Overcoming the Power Barrier in Computation with the PiezoElectronic Transistor

Dennis M Newns

IBM TJ Watson Research Center, USA

Power production in computation has already frozen clock speeds at 2003 values (~2-3 GHz), limits mobile battery life, and is an increasingly serious constraint on supercomputer and Cloud applications, for example. Circumventing power limitations demands a novel low-power logic switching device. Here we present a new device, the PiezoElectronic Transistor (PET), with applications in low power/high performance logic, switching, and memory. In the PET, the gate input is applied across a Piezoelectric (PE) actuator, a *linear* element which expands and compresses an adjacent Piezoresistor (PR). The PR, a material which undergoes a pressure-driven insulator-metal transition, then conducts, turning the switch On. High On/Off (~10^4) ratios at low voltage (~100 mV) are achievable. Mechanical contact is continuous, distinguishing the concept from NEMs. Simulation and modeling, based on the bulk properties of the materials, shows that the PET is capable of forming the switching element in a CMOS-analog logic, functioning at higher speeds than current CMOS but at ~1/100 the power. By use of a hysteretic PR material, such as SmS or a variant, the PET can be used as the storage element in a memory cell, which is fast and low voltage with moderately high density. At micron scales, simulations show that the PET can be used as an RF switch with an outstanding figure of merit. We describe the current capabilities in fabricating high performance thin PE and PR films, and the fabrication and performance of three forms of the device, and outline the future trajectory of the technology.

Biography :

D M Newns has a PhD from Imperial College, UK, and postdocs at University of Chicago, USA and Cambridge, UK. Then followed an Associate Professorship at Imperial College, finally research staff member at IBM. Have over 140 papers in reputed journals and 40 patents.

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Results of Mass- and Energy Balances for important Organic Synthesis Reactions

Dieter Lenoir, Helmholtz-Zentrum, München, Germay

Marco Eissen, Ganderkesee, Germany

For evaluation of the sustainability of organic synthesis reactions a mass- and energy balance is necessary besides the ecotoxicological evaluation of the protocols of the whole process. We have performed this method for estimation of atom economy and Sheldon factor, E of some important organic synthesis reaction by use of the program EATOS.

For selective oxidation of prim. and sec.alcohols we selected are 8 standard methods, each one has its own specific advantages and disadvantages. Economic factors (price) were also included in this study. New catalytic processes seem superior compared to the older methods.

For bromination of alkenes about 20 new alternative methods have been suggested avoiding the hazardous potential of molecular bromine. All methods besides of one (with HBr and H_2O_2) suffer from severe disadvantages due to the mass balance.

Synthesis of tetrasubstituted alkenes is still in the center of interest of organic chemistry. Therefore, we have evaluated 22 different methods for synthesis of alkenes. The results show that the development in history of synthesis-chemistry follows an improvement of mass- and energy balance, Grubb's metathesis reactions are by far superior compared to all its forerunners of alkene synthesis like elimination reactions and the Wittig reaction.

For classical chlorine chemistry with Cl_2, $SOCl_2$, and phosgene about 30 new alternative chlorine-free methods have been suggested recently. First results of the mass balances will be presented for an unbiased discussion of this controversial matter. The results may have great impacts on industrial chlorine chemistry.

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The Synergy of Autologous Biomaterials and Artificially Designed Scaffolds in Bone Tissue Engineering: A Concept for the Treatment of Various Dental Bone Defects

Dmitry Bulgin

Polyclinic ME-DENT, The Center for Regenerative Medicine, Croatia

Interest in applications for bone tissue engineering in dentistry continues to increase as clinically relevant methods alternative to traditional treatments. Recent progress in the studies of molecular basis of bone development and regeneration, adult stem cell biology, will provide fundamental knowledge for that. This information is already being used for the generation of dentoalveolar tissues *in vitro* and *in vivo*. Autologous biomaterials enriched with progenitor/stem cells and growth factors can be produced from components of bone marrow, peripheral blood, adipose tissue, cancellous bone, and represent a very interesting research field for dental bone regeneration and suppose a good perspective of future in the clinical dentistry. The adjunctive clinical benefit of the autologous biomaterials preparation can be explained on the basis of tissue engineering, i.e., tissue engineering generally combines three key elements for regeneration: 1) scaffolds or matrices, 2) signaling molecules or growth factors, and 3) cells. Stem cells need a scaffolds that facility their integration, differentiation, matrix synthesis and promote multiple specific interactions between cells. Synthetic or artificially designed substitutes has numerous interconnecting pathways similar to cancellous bone and facilitates bone formation by providing an exceptional osteoconductive scaffolding which results from the retention of the natural porous architecture and trabeculation of human cancellous bone. Synthetic scaffolds show resorbable characters during bone regeneration, and can be completely substituted for the bone tissue after stimulation of bone formation. The use of autologous biomaterials combined with synthetic scaffolds is a recent and promising innovation in dental bone regeneration. Dental bone tissue engineering could not have advanced to the current stage without the incorporation of interdisciplinary skill sets of stem cell biology, bioengineering, polymer chemistry, mechanical engineering, robotics, etc. Our experience with autologous biomaterials combined with artificially designed scaffolds in the treatment of various dental bone defects is presented. The techniques are based on stimulation of natural events continuously present in living bone, that is, the process of bone remodeling and offering both osteoinduction and osteoconductive features.

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Exosomes as Drug Delivery Vehicles

Elena V. Batrakova[1,2,], Matthew J. Haney[1,2], Natalia L. Klyachko[1,2,3], Yuling Zhao[1,2], Richa Gupta[1,2], Evgeniya G. Plotnikova[3], Zhijian He[1,2], Tejash Patel[2], Aleksandr Piroyan[1,2], Marina Sokolsky[1,2], and Alexander V. Kabanov[1,2,3]

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Exosomes are naturally occurring nanosized vesicles that have attracted considerable attention as drug delivery vehicles in the past few years. Exosomes are comprised of natural lipid bilayers with the abundance of adhesive proteins that readily interact with cellular membranes. We posit that exosomes secreted by monocytes and macrophages can provide an unprecedented opportunity to avoid entrapment in mononuclear phagocytes (as a part of the host immune system), and at the same time enhance delivery of incorporated drugs to target cells ultimately increasing drug therapeutic efficacy. In light of this, we developed a new exosomal-based delivery system for a potent antioxidant, catalase, to treat Parkinson's disease (PD). Catalase was loaded into exosomes *ex vivo* using different methods: the incubation at room temperature, permeabilization with saponin, freeze-thaw cycles, sonication, or extrusion. The size of the obtained catalase-loaded exosomes (exoCAT) was in the range of 100 - 200 nm. A reformation of exosomes upon sonication and extrusion, or permeabilization with saponin resulted in high loading efficiency, sustained release, and catalase preservation against proteases degradation. Exosomes were readily taken up by neuronal cells *in vitro*. A considerable amount of exosomes was detected in PD mouse brain following intranasal administration. ExoCAT provided significant neuroprotective effects in *in vitro* and *in vivo* models of PD. Overall, exosome-based catalase formulations have a potential to be a versatile strategy to treat inflammatory and neurodegenerative disorders.

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Nano-alumina powders/ceramics derived from aluminum foil waste at low temperature for various industrial applications

Emad M.M. Ewais[1], Ahmed A.M. El-Amir[1], Ahmed R. Abdel-Aziem[1], Adel Ahmed[2] and Bahgat E. H. El-Anadouli[3]

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In this work, nanoscale single crystalline γ- and α-alumina powders have been successfully prepared from aluminum foil waste precursor via co-precipitation method using NH4OH as a precipitant. The obtained gel after co-precipitation treatment was calcined at different temperatures (500,700, 900, 1050, 1100, 1300 and 1500oC) and the products were characterized by XRD, FTIR and HRTEM. XRD patterns of the powders revealed that the nano-γ-Al2O3 was fully transformed to nanometer-sized α-Al2O3 after annealing at 1100oC. This transformation was further confirmed by FTIR spectra through splitting of the broad double peak of γ-alumina presented at 567 and 835 cm-1 into three significant spectroscopic bands at 639, 590 and 443 cm-1 which are identified to be the characteristic absorption bands of α-Al2O3. The reduction of the formation temperature of α-phase from 1200 to 1100oC inhibited the grain growth rate of α-Al2O3 producing nanocrystallite α-Al2O3 of 36 to 200nm rather than the micron-sized α-Al2O3 produced via the conventional methods. Furthermore, the alumina bodies processed from the calcined powder at 500oC by the uniaxial press under 95 MPa attained >97% of the theoretical density, and provided extra mechanical stability (compressive strength = 707 MPa), when sintered at temperatures as low as 1600oC without using any sintering aid. The morphological and crystallographic characteristics of the fully sintered α-alumina ceramics would allow its use in various applications such as refractory materials, abrasives, electronic packaging materials, composites and corrosion resistant ceramics. Additionally, this route is cost-effective, environmentally friendly, and good large-scale production process of α-alumina nanoparticles.

Chitosan-Pectinate mucoadhesive nanoparticles for the treatment of colorectal cancer

Enas Alkhader

University of Nottingham, Malaysia

According to the WHO media center, colorectal is the fourth commonest worldwide. Despite recent advances in cancer therapy, treatment options remains challenging. Several plants have been extensively studied as a natural source for cancer treatment due to their perceived manifestation of fewer side effects relative to their chemotherapeutic cousins.

Curcumin is a natural polyphenol derived from the rhizome of the plant *curcuma longa* and shown to have anti-cancer activity through researches in the last 50 years. Although curcumin has an effective and safe colorectal cancer anticancer activity, its beneficial effects are limited due to low absorption efficacy, rapid metabolism and elimination. We believe that delivering curcumin in nanoparticles to the colon is a good strategy for increasing the bioavailability at that region. In this regard, the delivery system should have the ability of protecting curcumin from the onslaught of acids and enzymes until it reaches the colon. In the present study we aim to develop mucoadhesive chitosan-pectinate nanoparticles that are able to withstand the variable dynamics of the upper gastrointestinal tract.

Chitosan-pectinate nanoparticles with a z-average of 220 nm (±3.8nm) and zeta potential of +17.3 mV (±1.3 mV) were successfully prepared. SEM images represent spherical shape nanoparticles. The encapsulation efficiency achieved was 90%. The mucoadhesiveness of the nanoparticles were high at alkaline pH and low at acidic pH. 70% release was achieved under in-vitro colonic conditions compared to negligible release in a acidic and non-enzymetic alkaline pH which confirms targeted delivery to the colon.

Biography :

Enas Alkhader has completed her Master's degree in pharmaceutical sciences from Petra University, Jordan. She is a second year PhD student in the University of Nottingham, Malaysia campus and a committee member of the faculty of science health and safety committee.

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Nanotechnology in Regeneration of Skeletal Tissues

Esmaiel Jabbari

University of South Carolina, USA

The structural organization of articular cartilage is rooted in the arrangement of mesenchymal stem cells (MSCs) into morphologically distinct zones during embryogenesis as a result of spatiotemporal gradients in biochemical, mechanical, and cellular factors that direct the formation of stratified structure of articular cartilage. These gradients are central to the function of cartilage as an articulating surface with uppermost superficial zone providing lubrication, the middle zone resisting deformation, and the calcified zone serving as a mechanically-stable interface for load transmission to the underlying bone. Nanotechnologies that mimic zonal organization of the articular cartilage are more likely to create an engineered tissue with more effective clinical outcome. The reconstruction of large bone defects with implanted scaffolds due to resection of tumors, skeletal trauma, or infection remains a significant clinical problem. The high clinical failure rates with allografts and implanted scaffolds are attributed to insufficient vascularization and slow bone regeneration. Osteogenesis and vascularization during bone development and growth are coupled processes. Therefore, nanotechnologies that guide the concerted differentiation of multiple cell types to vasculogenic and osteogenic lineages are promising for the treatment of large bone defects. In my seminar, I will present experimental results on the combined effect of gradients in cell density, matrix stiffness, nanofiber orientation, and zone-specific growth factors on chondrogenic differentiation of human MSCs into phenotypes corresponding to the superficial, middle, and calcified zones of articular cartilage. I will also present experimental results on the effect of spatial and temporal release of recombinant human bone morphogenetic-2 (BMP2) and vascular endothelial growth factor (VEGF) on the extent of osteogenic and vasculogenic differentiation of human mesenchymal stem cells (hMSCs) and endothelial colony-forming cells (ECFCs) encapsulated in a patterned construct. Results demonstrate that osteogenesis and vascularization are coupled by localized secretion of paracrine signaling factors by differentiating hMSCs and ECFCs. Further, fiber orientation plays a major role in phenotypic differentiation of MSCs to the superficial and calcified zones of articular cartilage.

Biography :

Esmaiel Jabbari completed his PhD at Purdue University and postdoctoral studies at Monsanto, Rice University, and Mayo Clinic. He is the Director of Biomimetic Materials and Tissue Engineering Laboratory and Professor of Chemical and Biomedical Engineering at the University of South Carolina. He is internationally known for his work on synthesis and processing of biomimetic polymers and hydrogels for applications in regenerative medicine and growth factor delivery. He received the Berton Rahn Award from the AO Foundation in 2012 and the Stephen Milam Award from the Oral and Maxillofacial Surgery Foundation in 2008. He was elected to the College of Fellows of the American Institute for Medical and Biological Engineering (AIMBE) in 2013. He has published >200 books, book chapters, peer-reviewed journal articles, and conference proceedings, and presented >250 seminars at national and international conferences on biomaterials, tissue engineering, and drug delivery. He has mentored >100 visiting scholars, post-doctoral researchers, doctoral students, and undergraduate students. He is a member of numerous scientific organizations including BMES, SFB, TERMIS, MRS, EMBS, ACS, AIChE, and AACR.

Novel hydrotalicite-like materials derived from slag and ash residues for the metal removal from the aqueous media

Eveliina Repo and Mika Sillanpää

Lappeenranta University of Technology, Finland

Huge amounts of slag and ash residues are formed by many industrial activities. Usually, these residues are considered as waste and discarded to the landfills. Furthermore, ash residues must be stabilized prior to their disposal. However, both ash and slag contain also valuable elements such as metals, which could be utilized as constituents of value added products. In this study, novel hydrotalcite-like adsorption materials will be synthesized by co-precipitation method utilizing metals extracted from the steel slag and ash waste and finally these adsorbents tested for the removal of toxic metals including Pb, Cd and Ni from the aqueous solutions. In this study aspects of green chemistry are considered by enhancing the recycling and especially utilizing waste materials as resources.

Green extraction processes and solvents as tools for biorefinery

Farid CHEMAT

GREEN (Groupe de Recherche en Eco-Extraction des produits Naturels)

UMR408, INRA, Université d'Avignon et des Pays de Vaucluse

ORTESA, Naturex, Université d'Avignon et des Pays de Vaucluse

This presentation will introduce a new and innovative area in the frontiers of chemistry, biology and processing: green extraction with special emphasis on natural products. Green extraction is a part of the sustainable development concept; its history, concept, principles and fundamentals will be described. We will pay special attention to the strategies and the tools available to make biorefinery greener. The representation will present the innovative research in this area these past five years in term of innovative techniques (microwave, ultrasound, pulse electric field...) and alternative solvents (ionic liquids, sub and supercritical fluid, agrosolvents, water...) applied to this new area green extraction of natural products with special examples applied to biorefinery concept.

A general definition of green chemistry is the invention, design and application of chemical products and processes to reduce or to eliminate the use and generation of hazardous substances. In relation of green extraction of natural products, this definition can be modified as follows: "*Green Extraction is based on the discovery and design of extraction processes which will reduce energy consumption, allows use of alternative solvents and renewable natural products, and ensure a safe and high quality extract/product*". The listing of the "six principles of Green Extraction of Natural Products" should be viewed for industry and scientists as a direction to establish an innovative and green label, charter and standard, and as a reflection to innovate not only in process but in all aspects of solid-liquid extraction. The principles have been identified and described not as rules but more as innovative examples to follow discovered by scientist and successfully applied by industry.

Plasma Processing of Nanomaterials synthesis DC Arc discharge for carbon nanomaterils synthesis

Farouk F. Elakshar

Azhar University, Egypt

Plasma Processing of Nanomaterials enables a wide range of academic and industrial applications in many fields such as Nanomaterials , nonaparticles . carbon nanomaterils, micro- electronics, textiles, automotives, aerospace, . biomedical and semiconductor nanowires industry.

In the present work DC Arc discharge is used for the synthesis of carbon nanomaterils which attracted enormous attention due to the ever demand for nanoelectronics, energy conversion and storage, and nanosensors. With the revolutionary discovery of so-called fullerenes and carbon nanotubes, different research fields in the domain of carbon experienced an enormous boom. Fullerenes are spherical molecules, the smallest of which composed of 60 carbon atoms that are arranged like the edges of the hexagons and pentagons on a football. Nanotubes can be described as a rolled-up tubular shell of graphene sheet which is made of benzene-type hexagonal rings of carbon atoms. The body of the tubular shell is thus mainly made of hexagonal rings (in a sheet) of carbon atoms, whereas the ends are capped by half-dome shaped half-fullerene molecules. Due to their special one-dimensional form, they have interesting physical properties like they have metallic or semiconducting electrical conductivity depending on the chirality's of the carbon atoms in the tube.

The carbon arc discharge method, initially used for producing C60 fullerenes, is the most common and perhaps easiest way to produce carbon nanotubes as it is rather simple to undertake. This method creates nanotubes through arc-vaporisation of two carbon rods placed end to end, separated by approximately 1mm, in an enclosure that is usually filled with inert gas (helium, argon) at low pressure (between 50 and 700 mbar).

In this research details of a homemade arc discharge system, used for the synthesis of carbon nanotubes and other carbon nanostructures will be presented. The effect of some experimental parameters like the gas pressure, flow rate, and catalyst material will be presented. Electrical and spectroscopic characterization of the discharge is also studied.

Biography :

Farouk F. Elakshar received his Ph.D. Plasma Phys. Manchester University, England in1978. Prof. Elakshar work in the field of plasma and laser physics and their wide applications in industry, medicine, and environment. He published about 80 papers in the different journals and conferences. Prof Elakshar supervising now a group of researchers at The Center of Plasma Physics at Azhar University. They are concerning in the producing and using of ozone gas by DBD discharge , investigating of atmospheric glow discharge, studying the etching processes., cancer treatment , wastewater treatment, Dentest treatment, hydrogen production from methan, using different plasma diagonostic techniques e.g. spectroscopic and Langmuir probe Techniques. Material science and engineering, nanotechnology , surface treatment , by different and update plasma technology, are also of interest of the group. He is having publications more than 80 publications in the different journals. And he is attended conferences and Work-Shops more than 31 conferences.

Natural self-assembled functional defects in epitaxial complex oxides

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Thin film heteroepitaxy of complex oxides has evolved in recent years to a fascinating platform for the manipulation of materials properties by altering the subtle energy landscape of competing interactions through epitaxial strain and dissimilarity. Such perturbations, however, affect homogeneously the whole area of pristine interfaces and propagate homogeneously through the volume of the films. Any progress in nanotechnology applications, therefore, demands a further step towards miniaturization, which unavoidably faces challenging strategies to control the lateral modulation of lattice distortions at the nanoscale. In this context, strain relieving defects such as twin walls and misfit dislocations emerge as natural self-organized two- and one-dimensional nanometric regions, respectively, where the materials properties are modified by local strain states. In this work we use thin films of the room temperature (T_C ~ 370K) half-metal ferromagnet $La_{0.7}Sr_{0.3}MnO_3$ with perovskite structure, to investigate the formation of both types of defects during epitaxy and the way local strains modify their electrical conduction properties. Our results highlight the relevance of the balance between bond-angle and bond length distortions in determining the bandwidth in perovskite-type manganites, and hold strong promises as spontaneous bottom-up approaches for the development of novel functional nanostructures.

Biography :

Felip Sandiumenge is a senior scientist at Institut de Ciència de Materials de Barcelona (ICMAB-CSIC) since 1995. He earned a PhD in geology (crystallography and materials science) from the University of Barcelona in 1991, followed by postdocs at Institut für Physikalische Hochtechnologie Jena (IPHT e.V) in Germany, and Centre d'Élaboration de Matériaux et d'Etudes Structurales (CEMES-CNRS), Toulouse, in France, during years 1992 and 1993. He has been visiting scientist at the University of Poitiers (France), at CEMES-CNRS and at UC-Davis (USA). He has coauthored more than 150 journal articles covering from crystal growth, crystal structure, epitaxy, self-organization, and the correlation of functional properties with defect structures in complex oxides.

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Graphene Nanostructuring for Devices: An Interface Study

Gargi Raina, T. Gowthami, G. Tamilselvi and George Jacob

VIT University, India

Graphene finds a very important place as a material in various energy applications such as harvesting, storage as well as in sensing. Graphene nanoribbons are promising candidates for generation of waveguides on account of their enhanced and strongly localized plasmonic behavior. Graphene transparent electrodes are important candidates for organic solar cells in place of ITO. Nanostructuring of graphene can be done employing a variety of techniques.

In this work, Atomic Force Microscope (AFM)-based nanolithography has been employed to perform the nanostructuring of graphite and graphene under ambient conditions. It was found that the nanometeric trenches created by AFM-based nanolithography undergo significant changes in the dimensions of created nanometric trenches long after lithography. The changes in the morphology of the nanometric trenches created has been studied using intermittent contact AFM under increasing adsorbed water layers. The impact of the interaction and dynamics of increasing ambient water adlayers on etch patterns on a hydrophobic highly oriented pyrolytic graphite (HOPG) surface, few layer graphene (FLG) and multilayer graphene (MLG) were obtained using atomic force microscopy (AFM) voltage nanolithography in contact mode by applying a positive bias to the sample. The effect of the stored electrostatic energy of a polarized icelike water adlayer, results in changes in the dimensions of the etch patterns long after lithography, whereas liquid like water droplets do not affect the etch patterns.

The role of ice-like water adlayers (IWLs) formed under ambient conditions in between mechanically exfoliated as-prepared and patterned few layer graphene (FLG) and multi-layer graphene (MLG) on hydrophobic Si and hydrophilic SiO2/Si substrates will be also be presented. The dependence of the formation of IWLs under ambient conditions on the affinity towards water, at the interface of graphene on hydrophobic and hydrophilic substrates isreported will be discussed, which has important implications for the performance of graphene-based nanoelectronic devices.

Measurement of serum prostate cancer markers using a nanopore thin film based optofluidic chip

Girish V. Shah[2], Salah Alzghoul[1], Mohammad Hailat[2], Sandra Zivanovic[1] and Long Que[3]

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Prostate adenocarcinoma (PC) affects almost every elderly American man. Currently used cancer marker, serum prostate-specific antigen (PSA) greatly overestimates PC population. Patients with high PSA levels have to undergo unnecessary but physically painful and expensive procedure such as prostate biopsies repeatedly. The reliability of PC test can be greatly increased by finding a protein that is secreted selectively by malignant, but not normal, prostate cells. We have discovered a novel protein, referred as neuroendocrine marker (NEM), secreted only by malignant prostate cells and released in blood circulation. To examine whether the combined NEM-PSA test can improve the reliability for early PC detection, we have developed a unique nanoimmunosensor that can reliably detect PSA as well as NEM in patient samples.

The nanosensor was fabricated from anodic aluminium oxide, and a thin film of gold was coated on it. The surface of the sensor was functionalized chemically, and the specific antisera were conjugated. The samples were then incubated with the antibody, and the concentration of bound antigens was determined optically by measuring average shift in the wavelength. The nanosensors were tested for paradigms such as non-specific binding, accuracy, sensitivity, and the results of nanosensors were compared with traditional ELISA. The results demonstrate that the nanosensor is reliable, extremely sensitive and requires just 1 μl of patient serum (or even less) to measure PSA and NEM even in a non-cancer individual. When compared with the traditional ELISA for PSA, the nanosensor assay was more sensitive, and offered many advantages such as elimination of labeled antigen, preprocessing of samples, the need for sophisticated equipment and highly trained individuals. These advantages, along with the low cost, should make the technology suitable for Point-of-Care application to screen elderly male populations for PC and to monitor the progress of patients undergoing PC treatment.

Mechanical milling as green *top-down* technology to produce novel smart sustainable materials

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[2]CNR, Institute for Polymers, Composite and Biomaterials (IPCB), Piazzale Enrico Fermi 1, I-80055 Portici (Napoli), Italy

Mechanical Milling (MM) can be considered a revolutionary technique for the manufacture of advanced polymer nanocomposite materials. The possibility to avoid solvents and high temperatures in the production of polymer nanocomposites contains within itself several advantages, the most important are: i) absence of environmental disposal; ii) thermo-degradation in biodegradable and natural polymers; iii) possibility to produce composites with thermo-sensitive active molecules (i.e. antimicrobials, oxygen scavengers, antibiotics, anti-inflammatory, etc.). This work focused on the use of MM as an innovative and efficient technique to produce green composites and nanocomposites. Will be demonstrated the possibility to obtain smart materials by combining biodegradable polymers with functional fillers and active molecules. At the same time, the possibility to form in situ the nanoparticles and to promote parallel processes such as surface grafting, embedding, polymerization and compatibilization represents another interesting possibility. Furthermore, surface activation and simultaneous treatment can allow the production of functional fillers from otherwise intractable crop waste materials. For the above, this technology can be considered an interesting option for the fabrication of novel nanostructured materials from environmental friendly resources.

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In vitro synthesis and toxicity engineered nanoparticles and evaluation of their effect on cellular metabolism and tissue specific accumulation in crop plants

Gyan Singh Shekhawat

Jai Narain Vyas University, India

Nano-material has unique chemical properties; optical behavior and functions which are significantly different from bulk due to their small size and large surface area. Synthesis of CdS and ZnO nanoparticles have been done, the adjustments of physico-chemical parameters viz; temperature, pH, ionic strength and rpm regulate the size and shape of synthesized nanoparticles. The method employed includes the formation of metal precursor solution to the surfactant solution, which is added in flocculent to cause the precipitation of solution without permanent agglomerations and adding a hydrocarbon solvent to re-disperse and re-peptize the nanometric particles. Present study deals with the effects of engineered nanoparticles (ENPs) on plant growth, bioaccumulation and antioxidative enzyme activity in *B.juncea*. The seed was germinated under hydroponic condition with a varying concentration of ENPs (0, 200, 500, 1000, 1500 mg/l) for 96 h. Significant decrease in plant biomass was recorded with gradual increase in proline content and lipid peroxidation upto a concentration of 1000 mg/l. Estimation of the antioxidant enzyme [catalase (CAT), ascorbate peroxidase (APX), glutathione reductase (GR) and superoxide dismutase (SOD)] activities in different plant tissues was done. Further, bioaccumulation of ENPs was also recorded. ENPs caused a significant effect due to their accumulation along with the generation of reactive oxygen species in plant tissues, thus signifying its hazardous effect on B. juncea.

B. juncea is known as a potential metal hyperaccumulator. Treatment of nanoparticles at different concentrations ranging from 50 μM to 950 μM was given to hydroponic grown *Brassica juncea* and compared with bulk. Various growth parameters and activity of enzymes like Catalase, Ascorbate Peroxidase and SOD were studied in both the forms, which show significant difference and regulatory effect on plant defense and metabolism.

Recent Advances in Rubber Nanocomposites

Hanna J. Maria, and Sabu Thomas

Mahatma Gandhi University, India

Elastomers are usually reinforced and employed widely because of their extensive and potential applications. The use of nanosized fillers like grapheme, CNT, nanoclay in the development of rubber composite material have become a fascinating area of research because of the dramatic improvement it can produce in the properties at very low filler content and also because of the possibility of tailoring the properties to meet the demands in versatile industrial applications. Polymer-clay nanocomposites are an especially well-researched class of such materials consisting of ~ 1 nm thick aluminosilicate layers surface-substituted with metal cations and stacked in ~ 10 µm-sized multilayer stacks and can dramatically alter the properties of a nanocomposite compared to the pure polymer resulting in increased mechanical strength, decreased gas permeability, superior flame-resistance, and even enhanced transparency when dispersed nanoclay plates suppress polymer crystallization. Graphene is another potential nanofiller for elastomer reinforcement .The excellent combination of different super physical properties of nanofillers like grapheme Young's modulus(1TPa)[1],ultimate strength (130GPa)[2],electrical conductivity(600S/cm)[3],thermal conductivity (5000W/Mk)[4] etc which is not known to be usual to other materials, makes grapheme , one of the promising nanofillers for elastomer reinforcement. In this presentation, the recent advances in the fabrication of nanofiller based elastomer nanocomposites done in our group will be discussed. The dependence of nanofiller loading on the rheological, electrical, mechanical dielectric and barrier properties will be discussed along with detailed examples drawn from the scientific literature.

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Nanoencapsulation of natural products for their enhanced anti-cancer activity

Hasan Mukhtar and Imtiaz A. Siddiqui

University of Wisconsin, USA

Despite promising results in preclinical settings, applicability of the use of bioactive food components for prevention and treatment of human cancer has met with limited success largely due to inefficient systemic delivery and bioavailability of promising agents. We employed the use of nanotechnology to improve the outcome of cancer chemoprevention and introduced the concept of 'nanochemoprevention' (Cancer Res. 2009;69(5):1712-6). In our proof-of-principle study we demonstrated a ten-fold dose advantage of nanoformulated EGCG over native agent against prostate cancer (PCa). Later we designed a formulation of EGCG suitable for oral delivery and reported its effectiveness in a PCa tumor xenograft model (Carcinogenesis. 2014;35(2):415-23). Recently, we proposed targeted NPs for the delivery of EGCG exploiting small molecules able to bind to prostate specific membrane antigen (PSMA). PSMA specific cellular binding and uptake and an increased anti-proliferative activity was detected. Tumor study also revealed a better response of this nanoformulated EGCG preparation. In a parallel study we tested the efficacy of nanoformulated EGCG surface functionalized with RNA aptamers (chit-EGCG-Apt) for PSMA specificity. We detected PSMA specific internalization and accumulation and anti-proliferative activity in PCa cells. Encapsulated EGCG also retained its mechanistic identity for induction of apoptosis, modulation of cell cycle, and inhibition of invasion and migration. We also designed novel polymeric NPs encapsulating resveratrol (nano-RSV) and observed that these NPs were able to control the RSV release (Mol Pharm. 2013;10(10):3871-81). Fluorescence microscopy revealed that NPs were efficiently taken up by all PCa cell lines and nano-RSV significantly improved the cytotoxicity compared to that of free RSV toward PCa cells. In addition to ours, studies from other laboratories have also evaluated the usefulness of nanotechnology for delivery of several other natural products for cancer prevention and therapy. Studies generally carried out in cell culture systems with curcumin, resveratrol, taxanes, docetaxel, doxorubicin etc. are showing promising results. Much additional work is required to make this approach useful in preventing and/or treating cancer in the human population.

Biography :

Hasan Mukhtar completed his PhD from India and postdoctoral studies from Medical College of Georgia, USA. He is Helfaer Professor of Cancer Research and Vice Chair at Department of Dermatology, University of Wisconsin, Madison, Wisconsin where he also serves as the Co-Leader of Chemoprevention Program, University of Wisconsin Comprehensive Cancer Center. He has more than 500 publications in reputed journals and has been serving as an editorial board member of over 30 scientific journals. He also serves on several Scientific Review Committees of different funding agencies. For over 30 years, his major research focus has been to develop novel mechanism-based dietary agents for prevention and treatment of cancer.

In-line Surface Metrology for Roll to Roll Manufacture of Ultra Barrier Film

Hussam Muhamedsalih[1], Liam Blunt[1], Mohamed Elrawemi[1], Haydn Martin[1], Feng Gao[1], X. Jiang[1], Ivo Hamersma[2], David Bird[3]

[1]University of Huddersfield, UK

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[3]Centre for Process Innovation, UK

The growing market of large-area printed electronics and flexible solar cells stimulate the development of commercial nano-scale thin film barriers to limits the impact of environmental degradation. Increasing the yield of Roll to Roll manufacture of nano-scale thin film barriers faces a major challenge of developing in-line detection micro/nano-scale defects on film surfaces. These defects have been shown to have negative impact on the performance of the barriers resulting in reduced efficiency and lifespan of the coated material. This paper introduces wavelength scanning interferometer (WSI) system developed as part of EU funded NanoMend project. The system comprises a full in line opto-mechanical solution for defect detection for Atomic Layer Deposition, ALD, coated vapour barrier films used for photovoltaic (PV) solar modules. The WSI is embedded within a film-rewinder stage and integrated with the substrate translation and kinematic stages. The system has additionally an auto-focus ability to adjust the focal plane on the top surface of the film with an accuracy and repeatability better than 6 μm at optimum optical alignment conditions. As a result, the metrology system allows surface measurement over full substrate widths of approximately 0.5 m and the consequent measurement time required for each area of captured data is less than 1 sec. To ameliorate external vibrations the measurement solution combines a dual path interferometer and a non-contact film holding capability. The roll to roll inspection process and measurement results provide evidence for development of in-line and in-process metrology system that can be used on a shop floor.

Biography :

Hussam Muhamedsalih is a research fellow in the EPSRC Centre for Innovative Manufacturing in Advanced Metrology at the University of Huddersfield. Hussam initially joined the University of Huddersfield to study for an MSc in Control Systems and Instrumentation, graduated in 2008. Continuing his studies at Huddersfield, Hussam was awarded a PhD on May 2013 for the project 'Investigation of wavelength scanning interferometry for embedded metrology'. The aim of his research is to break new ground by delivering solutions in advanced metrology for the next generation of high added-value products to assist industry achieving the paradigm shift toward smart factories.

Recent Applications of Nanotechnology in Advanced Drug Delivery Systems

Hussein O. Ammar

Future University in Egypt, Egypt

Nanotechnology is attracting great attention worldwide in biomedicine. Targeted therapy based on drug nanocarrier systems enhances the treatment of tumors and enables the development of targeted drug delivery systems.

In recent years, theranostics are emerging as the next generation of multifunctional nanomedicine to improve the therapeutic outcome of cancer therapy. Polymeric nanoparticles with targeting moieties containing magnetic nanoparticles as theranostic agents have considerable potential for the treatment of cancer.

The use of directed enzyme prodrug therapy (DEPT) has been investigated as a means to improve the tumor selectivity of therapeutics. Magnetic DEPT involves coupling the bioactive prodrug-activating enzyme to magnetic nanoparticles that are then selectively delivered to the tumor by applying an external magnetic field.

Gene therapy is an attractive method for meeting the needs for curing brain disorders, such as Alzheimer's disease and Parkinson's disease. On the other hand, due to the fact that hepatocellular carcinoma (HCC) is resistant to standard chemotherapeutic agents, gene therapy appears to be a more effective cure for HCC patients.

Ultrasound-mediated drug delivery is a novel technique for enhancing the penetration of drugs into diseased tissue beds noninvasively. This technique is broadly appealing, given the potential of ultrasound to control drug delivery spatially and temporally in a noninvasive manner.

Biography :

Hussein O. Ammar is a holder of the First Class Golden Medal for Sciences and Arts and the recipient of the 2010 Appreciation State Prize in the realm of Advanced Technological Sciences. Professor Ammar is currently the Chairman, Pharmaceutical Technology Department, Faculty of Pharmaceutical Sciences and Pharmaceutical Industries, Future University in Egypt; formerly, Dean of the Pharmacy Division, National Research Centre, Cairo, Egypt. He has 114 research papers published in international scientific journals. These research papers cover most of the areas related to pharmaceutics, biopharmaceutics and pharmacokinetics. Design of new drug delivery systems is not beyond the scope of his interest.

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Magnetic Properties of $Mn_{0.5}Zn_{0.5}Gd_xFe_{(2-x)}O_4$ Ferrite Nanoparticles

Ihab Obaidat

United Arab Emirates University, UAE

Magnetic nanoparticles (MNPs) have many technological applications including their use in data storage devices and in biomedicine such as magnetic resonance imaging, drug delivery and magnetic hyperthermia. Magnetic properties of nanoparticles (NPs) are dominated by two main features; finite-size effects and surface effects. Finite-size effects are a result of quantum confinement and interior structure (single-domain, multi-domain structures). Surface effects appear due several factors including the symmetry breaking of the crystal structure at the surface of the NP, oxidation, and dangling bonds. Because in NPs, larger fraction of the atoms resides on the surface compared to those in the core of the particle, surface effects become significant as the NP size decreases. It is well-established that several magnetic properties of NPs can be different from those of a bulk material. We present and discuss several interesting properties of $Mn_{0.5}Zn_{0.5}Gd_xFe_{(2-x)}O_4$ ferrite NPs. These include; the nonmonotonic behavior of magnetic properties with the addition of Gd^{3+}, the slight deviation from Kneller's and Bloch's laws, the nonmonotonic behavior of the blocking temperature with increasing size of the NPs, and the appearance of a significant negative magnetization in a considerable part of the low-temperature region. Several factors are involved in explaining the results. These include surface-core exchange-bias interaction, inter-particle dipolar interactions, spin-spin exchange interactions between the NPs, the large particle size distribution, the existence of surface spin disorder on the surface of the NPs, and the thermal energy at high temperature.

Biography :

Ihab Obaidat has completed his Ph.D. in Physics from the University of Illinois in 1998. His current research focuses on magnetism of nanoparticles. He has published 90 papers in reputed international journals and has many participations in conferences and workshops. Prof. Obaidat received several research awards including the prestigious "***Khalifa Award for Education***" and the prestigious "***Abdul Hameed Shoman Award for Young Arab Researchers in Physics and Geology***". Prof. Obaidat is a member of the editorial board of 3 international journals. He is also a reviewer for 9 international journals.

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Anti-cancer Nanomedicines: Need of Future Generation

Imran Ali

Jamia Millia Islamia, India

General chemotherapy for cancer treatment has many side and toxic effects. A new approach of targeting nano anti-cancer drug is under development stage and only few drugs are available in the market today. The unique features of these drugs are targeted action on cancer cells only without any side effect. Sometimes, these are called magic drugs. The important molecules used for nano anti-cancer drugs are cisplatin, carboplatin, bleomycin, 5-fluorouracil, doxorubicin, dactinomycin, 6-mercaptopurine, paclitaxel, topotecan, vinblastin and etoposide etc. The most commonly used materials for preparing nano particles carriers are dendrimers, polymeric, liposomal, micelles inorganic, organic etc. The proposed lecture will comprise the-of-art of nano drugs in cancer chemo-therapy including preparation, types of drugs, mechanism, future perspectives etc.

Biography :

Imran Ali is a world recognized academician and researcher. He completed his Ph.D. at the age of 28 years from Indian Institute of Technology Roorkee, Roorkee, India. Prof. Ali is known globally due his great contribution in anti-cancer and chiral drugs development and water treatment. He has published more than 250 papers in reputed journals including papers in Nature and Chemical Reviews of more than 41 impact factors. He has also five books published by Marcel Dekker, Inc., USA; Taylor & Francis, USA; John Wiley & Sons, USA; John Wiley & Sons, UK; Elsevier, The Netherlands. His citation is 8,050 with H index 31.

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Fluorinated graphene for 2D Printed Technology and Other Applications

Irina Antonova

Rzhanov Institute of Semiconductor Physics, Russia

Fluorinated graphene is the most stable graphene derivative and as a result it is very promising for wide spectrum of applications. In the report we consider our latest advanced materials and structures created with the use of graphene covalent functionalization by fluorine. We have proposed a new simple, quick, and technological method of fluorinated graphene fabrication and have created a set of fluorinated graphene materials with significantly different properties. Among them are arrays of graphene quantum dots in the fluorographene matrix, created from graphene or graphene suspension. Fluorinated graphene and films with quantum dots are found to be very promising for resistive memory applications, 2D printed technologies, dielectric and protected coatings. Unlike to other graphene derivatives (oxide graphene and hydrogenated graphene), fluorinated graphene demonstrates the stable resistive effect, good insulated properties of films, low charge density in the films and at the interface with different semiconductors. Fluorination provides a simple and promising technology to create small and thin flakes for graphene based inks.

Biography :

I.V. Antonova defended her PhD theses fat the Institute of Semiconductor Physics, Siberian Branch of the Russian Academy of Science (ISP SB RAS). In 2009 she defended her doctoral dissertation. Presently, she occupies a leading researcher position at the Laboratory of Three-Dimensional Nanostructures, ISP SB RAS. Now, Prof. Dr. I.V. Antonova has more than 240 papers published in leading scientific journals.

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Gold Nanocages as Smart Drug Delivery System

Jayvadan K. Patel

Nootan Pharmacy College, India

Inorganic nanocages are hollow porous gold nanoparticles ranging in size from 10 to over 150 nm. Gold nanocages can be synthesized via a process known as galvanic replacement, in which the difference of electrochemical potential between two different metals in solution is exploited to replace one solid metal surface with another, for example replacing silver (Ag) with gold (Au). While gold nanoparticles absorb light in the visible spectrum of light (at about 550 nm), gold nanocages absorb light in the near-infrared, where biological tissues absorb the least light. Because they are also biocompatible, gold nanocages are promising as a contrast agent for optical coherence tomography, which uses light scattering in a way analogous to ultrasound to produce in-vivo images of tissue with resolution approaching a few micrometres. A contrast agent is required if this technique will be able to image cancers at an early, more treatable stage. Gold nanocages also absorb light and heat up, killing surrounding cancer cells.

Biography :

Jayvadan K. Patel is a Professor of Pharmaceutics and Principal, Nootan Pharmacy College, Visnagar-384315, Gujarat, India. He has more than 19 years of academic and research experience, has published more than 225 research and review papers in international and national Journals and has presented more than 150 research papers at various international and national conferences as author and co-author. Dr. Patel is recipient of Fast Track Young Scientists Award by SERB (Department of Science and Technology), Government of India, New Delhi and Very prestigious "APTI Young Pharmacy Teacher Award-2014" by Association of Pharmaceutical Teachers of India.

Development of Bioartificial Myocardium and Cardiac Support Bioprostheses Using Nanobiotechnologies

Juan Carlos Chachques

University of Paris Descartes, France

Heart failure (HF) leads to ventricular wall thinning and ventricular chamber enlargement, which changes from a natural elliptical to spherical shape. This raises the need to physically assist the pathological heart to decrease ventricular wall deterioration. We developed biohybrid scaffolds using nanomaterials for the creation of "bioartificial myocardium", emerging now as new therapeutic tool to be used as: 1) "ventricular patches" to reinforce ischemic areas or to replace infarct scars, and, 2) "cardiac wrap bioprostheses" for ventricular support and myocardial regeneration in chronic HF. Biohybrids are created using self-assembling peptide nanofibers (associated or not with stem cells) introduced inside porous semidegradable elastomeric membranes. Channeled scaffolds are proposed with the aim to guide the capillary network of the host tissue, a suitable microenvironment that mimics the extracellular matrix.

Devices are designed for the dynamic conditions of left or right ventricular support. Characteristics of biomimetic scaffolds (mechanical, chemical, biological) are adapted for the LV or RV geometry and physiology. Ventricular support bioprostheses are designed with the concept of "helical myocardial bands" following the ventricular anatomy. The role of bioprostheses is to limit ventricular dilatation and to restore elliptical shape, improving systolic and diastolic functions. This approach will reduce the risk of HF progression and the indication for heart transplantation.

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Bioaromatics: 2nd generation feedstock valorization into new performance materials

Marjorie Dubreuil, Kelly Servaes, Pieter Vandezande, Ludo Diels, Metin Bulut and Karolien Vanbroekhoven

Flemish Institute for Technological Research (VITO), Belgium

The depletion of fossil fuels as a source for fuels, chemicals, and energy is driving the transition of our economic model towards a more sustainable bio-based economy. Following this strategy, the use of renewable resources and the production of industrial (bio)chemicals in a biorefinery approach contribute to a large extent to climate change mitigation and environmental protection. Indeed, the conversion of renewable biomass or waste feedstock into a variety of chemical products reduces the dependence on oil imports, preserves fossil resources, and participates to the footprint reduction. Next to this, the pool of functionalities in biomass itself offers great potential. In this transition towards the bio-based economy, VITO's strategy relies on the valorization of 2G feedstocks through transformation of lignocellulose towards bio-aromatics as building blocks for the chemical industry.

The Biorizon shared research center dedicated to the development of bio-based aromatics enables and facilitates the production of this set of aromatics derived from sugar or lignin within different time horizons. In this context, VITO is involved in different running actions regarding lignin depolymerization, lignin being one of the main constituents in different biomass resources, such as wood and grasses. Due to its high functionalization, lignin represents an inherent advantage for producing molecules with greater complexity and wider application scope. Attention is being paid on the adequate conversion of lignin towards monomeric and oligomeric derivatives, followed by the fractionation of the derived mixtures and their purification enabling the further implementation of these molecules in chemical applications and products. In this overall strategy, VITO is principally focused on the application of membrane separation technology to support the whole value chain ranging from feedstock supply to end-products. Some results will be presented regarding the potential of membrane separation for the valorization of hydrolyzed lignin fractions. Some insights will also be given on the techno-economic viability of such processes towards the potential industrial implementation. With the huge potential of functionalities in this biobased chemical and the undiscovered range of applications, the road ahead looks challenging.

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Development of Green Protocols using C-H Activation: Synthesis of Some Privileged Structures

Krishna Nand Singh

Banaras Hindu University, India

In today's world, synthetic chemists in both academia and industry are constantly challenged to think about more environmentally benign methods for generation of the desired target molecules. As a result, green chemistry has presently attained the status of a major scientific discipline. The investigation and application of green chemistry principles has led to the development of cleaner and more benign chemical processes, with many new technologies being developed each year. Microwave has emerged as a novel and benign source of energy for chemical reactions and has been extensively investigated in organic synthesis during recent years.

Catalyst and solvent usage is often an integral part of a chemical or manufacturing process. The unavoidable choice of a specific catalyst or solvent for a desired chemical reaction can have profound economical, environmental, and societal implications. The pressing need to develop alternative reaction conditions originates from these implications and constitutes an essential strategy under the emerging field of green chemistry.

In view of the above and as a part of ongoing research interest, our recent results on the development of green and novel protocols including C-H activation and decarboxylative coupling will be discussed.

Biography :

Krishna Nand Singh obtained his M. Sc. and Ph. D. (Organic Chemistry) from BHU, Varanasi, India. After a short post-doctoral tenure, he joined the Department of Applied Chemistry, Institute of Technology (Now IIT), BHU as Lecturer/Assistant Professor in 1993, where he was elevated to the post of Associate Professor in 2002. He moved to the Department of Chemistry, Banaras Hindu University as Full Professor of Organic Chemistry in the year 2007 and is continuing there. His current research interests include green chemistry, C-H activation, cross dehydrogenative coupling, metal catalyzed/metal-free reactions and multi-component reactions. Altogether ten students have been awarded Ph. D. degree under his supervision and his research work has resulted in the publication of over one hundred research papers in journals of international repute.

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Novel Nanofiber Anisotropic Conductive Films (ACFs) for Fine Pitch Electronic Assembly

Kyung-Wook Paik

Korea Advanced Institute of Science and Technology (KAIST), Korea

Anisotropic Conductive Films (ACFs) have been widely used as excellent interconnection materials in semiconductor and display applications for chip-on-glass (COG), chip-on-flex (COF), chip-on-board (COB), flex-on-glass (FOG), flex-on-board (FOB), flex on flex(FOF) interconnections due to their fine-pitch capability, simple process, and cost effectiveness. However, less than 20 um COG and COF and less than 100 um FOF assemblies become challenging because of the electrical short between neighboring electrodes by agglomerated conductive particles in ACFs. Therefore, it is necessary to restrict the conductive particles movement during ACF bonding, and solve the short problem at fine pitch electronic assembly.

For this purpose, novel nanofiber ACFs have been invented by the Paik et al, and successfully achieved the electrical short problems at the fine pitch COG, COF, and FOF applications. For nanofiber ACFs, about 200 ~ 500 nm diameter polymer nanofibers with coupled conductive particles are fabricated using an electro-spinning of polymer solutions mixed with conductive particles, and then nanofiber ACFs are successfully made by laminating NCFs (nonconductive films) on top and bottom side of the nanofibers with coupled conductive particles. This novel nanofiber ACFs show excellent electrical bump contact resistance and electrical short free fine pitch handling capability. Nanofiber ACFs can completely solve the electrical shortage problems at 7 μm bump-to-bump gap and 20 micron ultra-fine bump pitch of COG and COF electronic packaging applications. It is because the movement of conductive particles during ACF assembly is completely limited by the nanofiber anchoring effect resulting in about 3 times higher conductive particles capture rate compared with conventional ACFs. The effects of nanofiber materials properties such as melting temperature and tensile strength are very important to obtain the best performance of nanofiber ACFs such as joint and insulation resistances. Detailed processes and materials information of nanofiber ACFs will be presented.

Biography :

Kyung W. Paik received the Ph.D. degree from the Cornell University at the department of Materials Science and Engineering in 1989. After the Ph.D. degree, he worked at the General Electric Corporate Research and Development from 1989 to 1995 as a Senior Technical Staff. And then, he joined the Korea Advanced Institute of Science and Technology (KAIST) as a professor at the department of Materials Science and Engineering in 1995, and served as the Dean of Student Affairs during 2008 ~ 2000 and the VP of Research during 2011 ~ 2013. In his Nano-Packaging and Interconnect Laboratory (NPIL), he has been working in the areas of ACFs materials and processing, 3-D Semiconductor chip interconnect materials, solders, and MEMS & display packaging technologies, and has published more than 160 SCI journal papers and has more than 40 issued and pending US patents.

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New Generation of Nano-Structured Polymers for LCDs' Alignment Layers

Lachezar Komitov

University of Gothenburg, Sweden

The material for alignment layer plays a very important role for the properties as well as for the quality of liquid crystal alignment in Liquid Crystal Displays (LCD) and their performance. In the conventional LCD, the alignment layer is made usually from polyimide material, which is widely used as a material promoting uniform and highly stable with temperature and time liquid crystal alignment. However, the preparation of alignment layers made from polyimides is energy demanding process since it requires high curing temperatures. Moreover, the polyimides for alignment layers have limited storage time and quite demanding transportation conditions.

In this talk will be presented alignment layers made from a new generation of nano-structured side-chain polymers with focus on the materials for vertical, planar and tilted alignment as well as on the photoalignment materials. All these alignment materials do not require any curing, i.e. hight temperature processing, therefore they are proper candidates for LCDs with flexible substrates, considered as the next generation LCDs. The nano-structured polymers for alignment layers in LCDs have also practically unlimited storage time and are easy to be transported. It was found that the alignment layers made from these nano-structured polymers possess properties comparable or even better than those made from polyimides.

Biography :

Lachezar Komitov has completed his PhD from Bulgarian Academy of Science, 1987. He is Associate Member of Bulgarian Academy of Science since 1995. Full Professor of Physics, University of Gothenburg, Gothenburg, Sweden, since 2002. Author of more than 200 scientific papers and over 60 patents and pending patent applications. Invited speaker at a number of International Conferences, Symposiums and Meetings, University and Companies around the world. Supervisor of a number of PhD students. Served as referee for a number of highly ranked International journals. Professor Komitov is founder and co-founder of two companies dealing with LCDs.

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Molecular and genomic impact of large and small lateral dimension graphene oxide sheets on human immune cells from healthy donors

Lucia Gemma Delogu[1], Marco Orecchioni [1], Dhifaf Jasim [2], Mario Pescatori [1,3], Davide Bedognetti [4], Alberto Bianco[5] and Kostas Kostarelos[2]

[1] University of Sassari, Italy
[2]University of Manchester, UK
[3]Heath-E-Solutions, Netherlands
[4]Research Branch, Sidra Medical & Research Centre, Qatar
[5]CNRS-IBMC, France

Graphene oxide (GO) is gaining the interest of the scientific community for its revolutionary future applications i.e. for drug delivery [Geim AK et al. Nature Materials 2007]. In this context, the possible immune cell impact of GO is a fundamental area of study for a translational application in medicine [Orecchioni M. et al. JTM 2014, Pescatori M et al. Biomaterials 2013]. We focused on the effects, on human lymphomonocytes (PBMCs), of two types of GOs, deeply characterized, which differed in lateral size dimension (GO-Small and GO-Large). To clarify the immune impact of GOs we provided a wide range of assays looking at cells viability, cell activation, cytokines release and genome expression. We let in lights also the impact of GOs on immune response-related 84 genes. A whole genome analysis was conducted on T cells and monocytes to deeply evaluate the GO-cell molecular interactions. GOs didn't impact the cell viability. We identified 37 upregulated genes in the GO-Small samples compared to 8 genes for GO-Large, evidencing a clear lateral dimension-dependent impact on cell activation. We confirmed the size-related effect at the protein level by multiplex ELISA. Results were supported also by microarray analysis. Data evidenced the GO-Small-induced downregulation of oxidative phosphorylation followed by a glycolitic switch-on in both cell types giving future perspectives for anticancer nano-graphene systems. Our work represents a comprehensive characterization of different sized GOs on immune cells giving crucial information for the chemical and physical design of graphene for biomedical applications.

Biography :

Lucia Gemma Delogu has been an Assistant Professor at the University of Sassari (UNISS), Sardinia, Italy since 2012. She received the title of Ph.D. in Biochemistry and Molecular Biology from the UNISS in Italy. She has worked as a postdoctoral fellow at the University of Southern California, Los Angeles USA (2007-2009) and was a visiting researcher at the Sanford-Burnham Institute of San Diego, CA USA in 2008 and at the Department of Health and Human Services at the NIH in Bethesda, MD USA in 2013. Today, Dr. Delogu leads the Laboratory of Bionanotechnology in the Department of Chemistry and Pharmacy, UNISS Italy.

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Metal oxide nanomaterials and their preparation through benign approach

M. A. Shah

National Institute of Technology, India

Chemical synthesis of nanomaterials has been reviewed by many authors and improvements and better methods have been reported continually in the last few years [Shah and Tokeer, 2010]. An overview of those methods, however, shows that they involve multistep process and frequent use of amines and other structure directing reagents which pollute the atmosphere. In addition, most of the pathways suggested involve harmful chemicals which are toxic and not easily degraded in the environment. Other techniques (physical) are technically complex, requires high temperature, harsh growth conditions, expensive experimental set up and complicated control process. A simple approach that can avoid organics or amines for large scale production and controlled growth of versatile nanomaterials is, therefore, highly desired. Toxicologist, Gunter reported that when his lab exposed rats to air containing nanoparticles for 15 minutes, most of the animals died within 4 hours. Gunter in his report suggested that the technique for making smaller particles could have altered them chemically [Gunter, 2004].

In response to the above concerns, we have discovered and explored a new bio-safe and bio-compatible route for the synthesis of oxide nanomaterials using water as solvent as well as source of oxygen. The use of water as a reagent is particularly attractive because it is safe, inexpensive, environmentally benign and bestowed with many virtues especially under supercritical conditions. The simple and straightforward route is based on simple reaction of water and metal powder at relatively low temperature. Since water is regarded as a benign solvent and non toxic, the product (nanostructures) could be used safely for biomedical and other applications.In addition, the method is simple, straightforward, fast, economical, environmentally benign, involves green chemistry, which can make it suitable for scale large production. The prospects of the process are bright and promising particularly in energy sector.

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Revealing Secrets of Lithium-Ion Battery Operation by Neutron Scattering

Martin Johann Mühlbauer

Helmholtz-Institute Ulm (HIU) and Karlsruhe Institute for Technology (KIT), Germany

Powering innumerable portable devices lithium-ion batteries are part of our everyday life. An increasing number of applications related to electromobility and energy storage calls for further improvements of their life span, energy/power density and rate capability. But still some of the processes inside lithium-ion batteries are not understood completely. Therefore single cells or even integrated batteries have to be investigated under real operating conditions to unravel details occurring in the millimetre to micrometre domain and reaching down to a nanometre or even atomic length scale. Neutrons offer a capability to investigate large objects, because due to their nature they are capable to penetrate many materials much easier than other kind of radiation. It is therefore possible to conduct in operando investigations on standard size Li-ion cells. Neutron radiation interacting with atomic nuclei enables to differentiate between neighbouring elements and even isotopes via large variations of the corresponding scattering and absorption cross sections. Light elements like lithium and other cations may be traced during intercalation and deintercalation providing information about structural changes, phase transitions and cation exchange reactions, e.g. in cathode materials. Spatially resolved neutron diffraction and neutron imaging are used to investigate effects on a macroscopic length scale, e.g. checking for possible inhomogeneities in the state of charge inside Li-ion.

Biography :

Martin Johann Mühlbauer is a research scientist at the Heinz Maier-Leibnitz Zentrum (MLZ) near Munich (Germany). Since 2015 he is employed at the Helmholtz-Institute Ulm for Electrochemical Energy Storage founded by the Karlsruhe Institute of Technology, where he worked as a postdoc from 2013 to 2015. He received his Ph.D. degree in physics from Technische Universität München in 2013. From 2011-2013 he was part of the Research collaborative Center 595 “Electrical Fatigue in functional Materials” at Darmstadt University of Technology. He is author/co-author of more than 30 articles in the field of neutron imaging and diffraction with the latest articles being focused on battery research.

Mechanical property enhancement of the gelatin nanofibers through optimization of electrospinning process conditions by response surface methodology (RSM)

M.E. Hoque[1*], T. Nuge[1], T.K Yeow[1], N. Nordin[2]

[1]University of Nottingham Malaysia Campus, Malaysia

[2]University Putra Malaysia, Malaysia

Electrospinning is considered to be the most useful technique to produce polymeric nanofibers by applying electrostatic forces. In this study, the biomimetic nanofibrous structure (also called nanomatrix) of gelatin is fabricated by the electrospinning technique. The gelatin nanomatrix offered interesting characteristics (e.g. non-immunogenicity, biocompatibility) and could enhance cell activities for tissue formation. Effect of some process parameters on the morphology and mechanical properties were experimentally investigated. Nanofibers with diameters ranging from 27 nm to 527 nm were fabricated depending on gelatin solution concentration and applied potential. A more systematic understanding of process parameters was achieved and a quantitative relationship between electrospinning parameters and the mechanical property (e.g. tensile strength) was established by using response surface methodology (RSM). The findings suggest that the mechanically superior gelatin nanomatrix with tensile strength of 13 MPa could be obtained using 14% gelatin solution and 17 kV applied potential. The strength was further increased up to 26 MPa upon post-treatment with GTA.

Biography :

Md Enamul Hoque is an Associate Professor in the Department of Mechanical, Materials & Manufacturing Engineering and served as founding Head for the Bioengineering Research Group at the University of Nottingham Malaysia Campus. He received his PhD in Mechanical Engineering (major in Bioengineering) from NUS, Singapore in 2007. He has graduated 3 PhD Students and currently supervising 6 PhD students in collaboration with some local as well as global academics/ researchers. He has also served as an external examiner for 8 post graduate theses. So far, he has applied for 2 Malaysian patents out of his research innovations, authored 3 books, edited 3 books and co-authored 7 book chapters. He has also published more than 125 technical papers in high impact referred journals and international conference proceedings. He serves as an editor for 5 journals, as member of editorial board for 5 journals, and technical reviewer for about 25 journals. His research interests include the areas of Rapid Prototyping Technology, Nanotechnology, Biomaterials, Tissue Engineering, Stem Cells, Nanomaterials, Biocomposites, Bioenergy and Food Technology.

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Nanomaterials for Energy and Environment

Mohamed Azaroual

BRGM – Water, Environment & Ecotechnologies, France

Nanomaterials (NMs) are used in various industrial technologies including energy, water and environment applications. These NMs possess very specific physical, physico-chemical and electrostatic properties due to their nanometer size giving them a very high surface / volume ratio (large proportion of atoms exposed on the surface) allowing them to have a very high surface area and a strong chemical and physico-chemical reactivity with the surrounding fluids. Nanomaterials thus contribute to reducing the environmental footprint of human activities in particular for the storage and recovery of CO_2. In geological microstructures they offer special dynamics of multiphase systems (CO_2 - brine) interacting with silica surfaces resulting in extreme confinement conditions that can be exploited for the capture and geological storage of carbon dioxide. The capture process / CO_2 release is controlled by the activation/ deactivation of the charges by these NMs. CO_2 molecules interact weakly with uncharged nanomaterials. These interactions become strong with NMs negatively charged and CO_2 molecules are closely related and the surface. These nano-objects can be used for CO_2 capture and its purification allowing separation the carbon dioxide impurities (SO_x, NO_x, etc.). Indeed, some NMs (ie, zeolites, ...) are particularly attractive adsorption properties with a high CO_2 absorption selectivity. Boron nitride nano-sheets and nanotubes of different charge states allow differentiated adsorption of CO_2, CH_4 and H_2.

Recent developments in the field of nanotechnology and green chemistry are considering also the use of certain NMs as catalysts electrochemical conversion reactions of CO_2 valuable organic compounds (ie, methanol). CO_2 conversion rate per unit area of silver NMs, for example, is about 10 times higher compared to the use of microcrystalline silver. These results demonstrate that the nanoparticle-based catalysts have unique properties / performance in recoverable chemicals. Other NMs (ie, CuO, CeO_2, ...) are used to study the steps (products) intermediates of the overall reaction conversion of CO_2 to methanol. These aspects dealing with fluid interactions - NMs for energy and environment will be presented at this conference.

Biography :

Mohamed AZAROUAL is a Senior Geochemist – Scientific Program Leader at Water, Environment & Ecotechnologies in BRGM (French Geological Survey). He obtained his PhD in Geochemistry at the University René Diderot, Paris 7, in 1993 on geothermal exchangers and his HDR (Accreditation to Supervise Research) in 2014. His areas of interest are the reactive transport modeling and mass and energy transfers between phases (water – gas – rock – "microorganisms") including complex hygrogeological complex systems and high temperature, high pressure and high salinity aqueous and multiphase systems. Mohamed is currently developing various industrial partnership projects aimed mainly at development of new concepts, new technologies and studying the interactions between reactive phases of complex hydrosystems. He manages as well research projects integrating industrial processes (mine extraction, water desalination, artificial recharge of underground aquifers, etc.) in the framework of partnership projects with TOTAL, OCP, Mitsubishi Chemical, Veolia, Suez, etc. Mohamed is also a policy officer for industrial partnership and innovation at "Water, Environment & Ecotechnologies Direction" of BRGM.

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Development of Advanced Semiconductor Materials and Devices For Next Generation Photovoltaics: Opportunities And Challenges

Mohamed Henini

University of Nottingham, UK

Renewable energy production is a key component in the drive towards a safe, secure energy supply for future low-carbon economies. Using energy from the sun to generate electricity provides a sustainable source of free, abundant, safe, clean energy, without use of any fossil fuels and without waste or pollution.

Existing 'three junction' solar cells, which utilise three different semiconductors, are capable of converting sunlight from three regions of the spectrum into electrical energy. The drawback is that state of the art solar cells currently only convert 33% of solar energy into electricity. There is a great interest worldwide into developing innovative semiconductor materials capable of converting sunlight from a fourth specific portion of the solar spectrum into electrical energy. Retrofitting this fourth generation material onto current solar cells should significantly improve solar cell efficiency to >60%.

Currently a wide range of semiconductors is explored for their potential use in photovoltaic applications. However, solar cells are already an important part of our lives. The simplest systems power many of the small calculators and wristwatches. The complicated systems provide electricity for pumping water, powering communications equipment, and even lighting our homes and running our appliances. With the growth of the satellite industry and the increase of power requirements, larger solar arrays are needed to produce the required power. The familiar wings of most modern satellites are made solar arrays.

In this talk, I will give an overview of the principles of solar cells, the properties of semiconductors suitable for solar cells, and some selected recent achievements in III-V solar cells.

Biography :

Mohamed Henini obtained his first degree at the University of Oran, Algeria. He went to Nottingham University and was awarded the PhD degree in 1984. Mohamed has over 25 years of experience in Molecular Beam Epitaxy (MBE) growth. His particular speciality is the physics and technology of MBE growth for III-V electronic and optoelectronic devices. He has authored and co-authored over 800 papers in international journals and conference proceedings. He has an h-index of 47. He edited five books which were published by Elsevier and serves on the Editorial Board of several scientific journals.

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Heat Transfer Analysis of GO-Water Nanofluid Flow in a Porous Medium between Two Coaxial Cylinders

Mohammadreza Azimi

University of Tehran, Iran

In this article, Heat transfer and flow analysis for a non-Newtonian third grade nanofluid flow in porous medium of a hollow vessel in presence of high magnetic field are simulated analytically and numerically. At first a similarity transformation is used to reduce the partial differential equations modeling the flow, Heat and concentration of nanofluid, to three coupled nonlinear differential equations containing the thermophoresis parameter, Brownian motion parameter, third grade parameter, Hartman number ,and viscosity power index as parameters. The approximate analytical method called Reconstruction of Variational Iteration Method (RVIM) is used to solve the problem. The effect of key parameters on temperature profile and nanoparticle concentration have been studied for different cases. The high validity and accuracy is observed. The results show that increasing the thermophoresis parameter (Nt) caused an increase in temperature values in whole domain but it makes an increase in nanoparticle concentration near the inner cylinder wall.

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Sodium dodecyl sulphate supported nanocomposite cation exchange material: Removal and recovery of copper metal from synthetic, pharmaceutical and alloy samples

Mu Naushad

King Saud University, Saudi Arabia

A new surfactant based nanocomposite cation exchanger, sodium dodecyl sulphate Th(IV) tungstate (SDS–TT) was prepared by mixing sodium dodecyl sulphate with its inorganic counterpart Th(IV) tungstate (TT) using the sol-gel method. This modified material was characterized by Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD) analysis, thermal analysis (TGA), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and energy dispersive analysis (EDS). The distribution studies for various metal ions on SDS–TT were performed in different acidic solvents. On the basis of distribution coefficient values, SDS–TT was found to be selective for Cu^{2+} metal ion. SDS-TT was successfully used for the quantitative separation of Cu^{2+} from the synthetic mixture, pharmaceutical formulation and brass sample. The regeneration studies were carried out which demonstrated a decrease in the recovery of Cu^{2+} from 88% to 70% after seven consecutive cycles.

Biography :

Mu. Naushad is currently working as Associate Professor in the Department of Chemistry, King Saud University (KSU), Saudi Arabia. He received his Ph.D degree in Analytical Chemistry, from A.M.U. Aligarh, India in 2007. He is the author of more than 90 research articles and several book chapters of international repute. He is the Editor of several books entitled "A book on ion exchange, adsorption and solvent extraction, Nova, USA" and "Ultra performance liquid chromatography mass spectrometry: Evaluation and applications in food analysis, CRC press, Florida, USA".

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Nano and Photonics Integrated Lab-On-Chips (LOCS) for Bio-detection

Muthukumaran Packirisamy

Concordia University, Canada

The necessity for increased level of integration with Lab-On-a-Chip (LOC) devices have been growing for enhancing performance, functionalities, and packaging. As the fully integrated devices favour portability and disposability they would be useful for *in-situ* biomedical diagnoses and Point-of-Care testing applications. This work will present the integration of some novel technologies such as the microphotonics, microfluidics, nano elements with microsystems for biosensing applications. The paper would cover many examples on biosensing and integration techniques such as hybrid and monolithic. In this work, a microfluidic Lab-on-a-Chip device on silicon platform hybrid and monolithically integrated with Echelle grating based Spectrometer-on-Chip will be presented along with results on fluorescence based biodetection. The paper will also cover many examples on micro-nano integration along with case studies.

Biography :

Muthukumaran Packirisamy is a Professor and Concordia Research Chair on Optical BioMEMS in the Department of Mechanical and Industrial Engineering, Concordia University, Canada. He is the director of micro-nano-bio integration center. He is the recipient of Fellow of American Society of Mechanical Engineers, Fellow of Institution of Engineers, Fellow and I.W.Smith award from Canadian society for Mechanical Engineers, Concordia University Research Fellow, Petro Canada Young Innovator Award and ENCS Young Research Achievement Award. His research interest includes Optical BioMEMS, Integration of Microsystems and Micro-Nano integration. As an author of more than 300 articles published in journals and conference proceedings, Professor Packirisamy has nine patents in the area of micro-systems.

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Modeling and simulation of CO_2 capture via hollow fiber membrane contactor

Nayef Ghasem, Mohamed Al-Marzouqi, Nihmiya Abdul Rahim

UAE University, UAE

A two-dimensional mathematical model has been employed to predict concentration profiles in the liquid, membrane and gas phases. CFD technique was used in solving the model equations. The model was based on “non-wetted mode” in which the gas mixture filled the membrane pores for countercurrent gas-liquid contact. Axial and radial diffusion inside the hollow fiber membrane, through the membrane skin, and within the shell side of the contactor were considered in the model. Furthermore, the model was validated with the experimental results obtained for carbon dioxide removal from CO_2/N_2 gas mixture using custom made polyvinylidene fluoride (PVDF) membrane contactor. Experiments on carbon dioxide capture from flue gas using polyvinylidene fluoride (PVDF) hollow fiber membrane contactors were also conducted in this study. Absorbent including aqueous amine solution is used for separation of CO2 from flue gas because of its high surface tension than water and hence lower potential of membrane wetting. The effect of inlet gas and liquid temperature on the membrane performance was investigated. The model simulation results predictions matches well with the experimental data. Accordingly, the validated model can be used to find the optimal values of module dimensions and operating parameters to achieve high CO_2 removal performance.

Biography :

Nayef Ghasem is associate professor in the Department of Chemical and Petroleum Engineering, United Arab Emirates University. Before joining United Arab Emirates University he was a faculty member in the University Malaya, Malaysia for five years. He taught various chemical engineering courses at both undergraduate and graduate levels. He supervised master students and PhD students’ thesis until completion. Nayef is active in research, he has more than 100 articles published in international journals and local and international conferences. He published two books: “Principles of Chemical Engineering Processes, Material and Energy Balances” and “Computer methods in Chemical Engineering”. His area of research is on the kinetics of polyamide hot melt adhesives, advanced control of polyethylene bubbling fluidized bed reactor and batch polystyrene reactor, modeling, simulation and control of multizone circulating reactor. Currently, his research focuses on fabrication of polymeric hollow fiber membrane and utilizing these fabricated hollow fibers in the CO2 capture from flue gas and natural gas using in lab constructed gas-liquid hollow fiber membrane contactor process.

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Phase Transformation and Twinning – Detwinning Relations in Shape Memory Alloys

Osman Adiguzel

Firat University, Turkey

Shape memory effect is based on a solid state phase transformation, martensitic transformation, and shape memory properties are intimately related to the microstructures of the alloy, especially the orientation relationship between the various martensite variants. Twinning and detwinning processes can be considered as elementary processes activated during the transformation, and the reorientation of the twinned martensite structures is essential as well as martensitic transformation in reversible shape memory effect.

Thermal induced martensite occurs as martensite variants in self-accommodating manner with the cooperative movement of atoms in two opposite directions, <110 > -type directions on the {110}-type plane of austenite matrix which is basal plane of martensite. By applying external stress, the martensitic variants are forced to reorient into a single variant, and deformation of the material in martensitic state proceeds through a martensite variant. The material lattice cycles between the parent phase structure and reoriented state on heating and cooling in reversible shape memory effect; in contrast, it cycles between parent phase and self-accommodated structures in irreversible case. Therefore; the reorientation process has great importance in reversible memory effect.

On the other hand, shape memory alloys exhibit another property called superelasticity, which is performed in only mechanical manner in the parent austenite phase region. Shape Memory Effect is performed thermally in a temperature interval depending on the forward (austenite → martensite) and reverse (martensite → austenite) transformation, on cooling and heating, respectively. Superelasticity is performed in the parent austenite phase region, just above the austenite finish temperature. Superelastic materials are deformed in the parent phase region and, shape recovery is performed instantly and simultaneously upon releasing the applied stress.

Copper based alloys exhibit this property in metastable β – phase region which has B2 or DO_3 –type ordered structure at high temperature parent phase. The lattice twinning is not uniform in copper based ternary alloys, and the ordered parent phase structures martensiticaly turn into layered complex structures, like 3R, 9R or 18R, depending on the stacking sequences on the basal plane, on cooling from high temperature parent phase region.

In the present contribution; x-ray diffraction and transmission electron microscopy and differential scanning calorimetry (DSC) studies were carried out on two copper based CuZnAl and CuAlMn alloys.

Biography :

Osman Adiguzel was born in 1952, Nigde, Turkey. He graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey in Solid State Physics with experimental studies on diffusionless phase transformations in Ti-Ta alloys in 1980. He studied at Surrey University, Guildford, UK, as a post doctoral research scientist in 1986-1987, and his studies focused on shape memory alloys. He worked as research assistant, 1975-80, at Dicle University, Diyarbakir, Turkey. He shifted to Firat University in 1980, and became professor in 1996, and He has already been working as professor. He published over 45 papers in international and national journals; He joined over 60 conferences and symposia in international and national level as participant, invited speaker or keynote speaker with contributions of oral or poster. He served the program chair or conference chair/co-chair in some of these activities. He supervised 5 PhD- theses and 3 M.Sc theses.

Dr. Adiguzel served his directorate of Graduate School of Natural and Applied Sciences, Firat University in 1999-2004. He received a certificate which is being awarded to him and his experimental group in recognition of significant contribution of 2 patterns to the Powder Diffraction File – Release 2000. The ICDD (International Centre for Diffraction Data) also appreciates cooperation of his group and interest in Powder Diffraction File.

Scientific fields of Dr. Adiguzel are as follow: Martensitic phase transformations and shape memory effect and applications to copper-based shape memory alloys, molecular dynamics simulations, alloy modeling, electron microscopy, x-ray diffraction and crystallography, differential scanning calorimetry (DSC).

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Computer-aided clinical diagnosis: Convergence of nanotechnology and Big Datamethods

Osvaldo N. Oliveira Jr.

University of São Paulo, Brazil

Experimental and theoretical methods akin to physics and nanosciences are increasingly used in applications stemming from innovative therapies to natural language processing. Such convergence of technologies, which may bring varied benefits to society, is illustrated by a computer-aided diagnosis system, in which machine learning and other computational methods are used to treat data from biosensors. The use of biosensing and information visualization for clinical diagnosis involves a variety of methods. These include immobilization of biomolecules in nanostructured films fabricated with self-assembly and layer-by-layer techniques, detection of biomarkers with impedance spectroscopy, characterization of interfaces with vibrational spectroscopy and data treatment with several computational methods. An overview will be given of the combination of nanotech-based methods and computational techniques for various biomedical applications. For example, impedance spectroscopy data in electronic systems can be correlated with human perception of taste, through the use of information visualization and artificial intelligence methods. The latter have also been useful to enhance biosensing to detect biomarkers for early detection of breast cancer and pancreatic cancer, in addition to a more fundamental application in single molecule detection via surface-enhanced Raman scattering. I shall also exemplify how text analytics can be exploited to extract information from written medical records, which is crucial for computer-aided diagnosis. The convergence of nanotechnology and Big Data is required in order to investigate the mechanisms behind biosensing and to process the large amounts of clinical data acquired in real-world applications.

Biography :

Osvaldo N. Oliveira Jr. is a physics professor at the University of São Paulo, Brazil. He received his PhD from Bangor University in 1990, and since then has led research into the fabrication of novel materials in the form of ultrathin films obtained with the Langmuir-Blodgett and self-assembly techniques. He published over 460 papers in refereed journals, which have received over 8,400 citations. In recent years, Prof. Oliveira has pioneered the combined use of methods from distinct fields of science, with the merge of methods of statistical physics and computer science to process text, and use of information visualization to enhance the performance of sensing and biosensing.

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Supercapacitors based on mixtures of graphene related nanomaterials fabricated using spray-gun deposition method

Paolo Bondavalli

Thales Research and Technology, France

Supercapacitors are electrochemical energy storage devices that combine the high energy-storage-capability of conventional batteries with the high power-delivery-capability of conventional capacitors. In this contribution we will show the results of our group recently obtained on supercapacitors with electrodes obtained using mixtures of carbonaceous nanomaterials (carbon nanotubes (CNTs), graphite, graphene, oxidised graphene, carbon nanofibers). The electrode fabrication has been performed using a new dynamic spray-gun based deposition process set-up at Thales Research and Technology (patented). This technique constitute a real breakthrough compared to the classical filtration method because electrodes can be deposited over large areas in a completely automated way, using different kinds of substrates and with a thickness between some nm and up to hundredth of μms. After first tries using NMP and mixtures of CNTs and graphite/graphene, we decided to test water as a solvent in order to reduce the heating temperature and to obtain a green type process without toxic solvents. To achieve stable suspensions we oxidised the graphene and the CNTs before putting them in water. In this way we were able to fabricate stable suspensions in less than one hour compared to three days using NMP. Finally we will show recent results obtained using graphene exfoliated by IIT, that allows us improving the power of the supercapacitors in a dramatic way, thanks to its high conductivity. Results on mixtures of graphene and carbon nanofibers suing ionic electrolytes will also be shown. All these results demonstrate the strong potential to obtaining high performance devices using an industrially suitable fabrication technique.

Biography :

Paolo Bondavalli is the Head of Nanomaterial team at Thales Research and Technology (CNRS/Thales, UMR137) and he is a member of the Nanocarb Lab. (joint team Ecole Polytechnique/Thales). Presently his work is focused on the development of new materials (e.g. graphene, cnts, nanowires) for the new generation of electronics devices and for energy storage applications and memristor. Dr Bondavalli has received his Hdr in 2011, at Paris-Sud on a work on "devices based on random network of carbon nanotubes". During the last ten years, he has participated, also as coordinator, in several EU projects (concerning MEMS, MOEMS, CNTs, graphene, spintronics) and ANR projects. He is involved in the Graphene Flagship initiative and he is EU expert for different panels (H2020, EUREKA…).

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Importance of Size and Elasticity in the Selective Complexation of Alkali Metal Ions of Calix[4]arenes for Nuclear Waste Cleanup

Pedro Derosa[1,2] and Ramu Ramachandran[1]

[1]Louisiana Tech University, USA
[2]Grambling State University, USA

The relative importance of different factors affecting the selectivity of calix[4]arene crown-6 ethers in the complexation of alkali metal (i.e., Na+, K+, Rb+, and Cs+) that could be found in nuclear waste are elucidated using a systematic computational analysis based on Density Functions Theory. Three different contributions, namely binding energy of the ion to the crown, the elastic energy of the crown, and the solvation effect, were separately studied and it is shown that the size of the crown, although it plays some role, it is not the determining factor in ion selectivity of crown-6 ethers, as it was believed. Four different molecules with a different crown size were compared and it was observed that the gas phase absorption preference increases as the ion's size decreases. Calix[n]arene crown-6 ethers show their well-known selectivity towards Cs+, the larger ion, only in the condensed phase, and only due to the larger solvation energy of smaller ions in the aqueous media that makes their extraction thermodynamically less favorable. From the lessons learned, a new design for the crowns with larger stiffness was tested.

Biography :

Pedro Derosa is currently an Associate Professor of Physics in a Joint position between Louisiana Tech University and Grambling State University and the recipient of the Larson #1 endowed professorship at Louisiana Tech University. He is currently the president elect of the Louisiana Academy of Science. Dr. Derosa has a highly multidisciplinary profile having worked throughout his carrier in a variety of topics in 4 different departments (Physics, Chemical Engineering, Chemistry and Biochemistry, and Electrical Engineering). He developed, implemented, and used a number of computer models, including a model to study intercalation of Li-ions in graphite that was licensed to Mitsubishi, inc. Dr. Derosa has 35 peer-reviewed publications, 19 conference papers, 3 book chapter and 1 edited book (multiscale modeling: From atoms to Devices, Pedro Derosa and Tahir Cagin editors); in addition he produced 5 reports of inventions. He delivered 38 invited talks and has over 100 presentations to scientific meetings. Dr. Derosa received three teacher's award, in 1994 from the University of Córdoba in Argentina and in 2004 and 2012 from Louisiana Tech University. He also received an award for outstanding achievements from Louisiana Tech in 2011. In 2014, he received a certificate of excellence for outstanding performance and research and in 2015 a certificate of recognition for contributions towards research, scholarship, and creativity, both from Grambling State University.

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A challenging route towards 3D-integrated all-solid-state Li-ion batteries

P.H.L. Notten

Eindhoven University of Technology, The Netherlands

Planar thin-film Li-ion batteries nowadays reveal excellent reversible electrochemical performance. To increase the energy density of these thin-film batteries, novel approaches have been proposed. One of the new concepts is based on the etching of deep 3D-structures into a silicon substrate, increasing the effective surface area significantly. In combination with advanced materials new opportunities are obtained to increase the energy density further. Silicon and Germanium turned out to be excellent candidates for Li-storage electrode materials. About 4 Lithium atoms can be stored per Si/Ge atom. The volume expansion is, however, tremendous inducing material deterioration. In order to cope with this, various approaches has been adopted. Nano-wires were found to be mechanically too sensitive to be applied in all-solid-state battery stacks. Honeycomb structures have also been suggested. Although striking reversible materials deformation has been reported for these structures upon (de)lithiation it seems not be very practical for battery application. Thin films, on the other hand, turned out to extremely stable.

To gain more insight into the (de)lithiation processes of Li-ion batteries a new in situ analytical technique has been developed denoted as Neutron Depth Profiling (NDP). NDP is applied to in situ investigate the movements of Lithium ions inside Li-ion batteries upon operation, i.e. upon charging and discharging. The initial NDP results were found to be in good agreements with electrochemical results. Strikingly, it has been shown that detailed insight in the exchange of lithium ions between the electrodes and electrolyte can be obtained when one of the films is enriched with 6Li, the isotope responsible for the in situ detection of Lithium by NDP. The results of these investigations demonstrate that NDP is a powerful method to obtain detailed insight into the transportation phenomena taking place inside Li-ion batteries.

Biography :

Peter H.L. Notten was educated in analytical chemistry and joined *Philips Research* in 1975. While working at these laboratories on the electrochemistry of etching of III-V semiconductors he received his PhD from the *Eindhoven University of Technology* in 1989. Since then his activities have been focusing on the research of hydride-forming (electrode) materials for application in rechargeable NiMH batteries, switchable optical mirrors and gas phase storage, and Lithium-based rechargeable battery systems. Since 2000 he has been appointed as professor at the *Eindhoven University of Technology* where he is heading the group *Energy Materials and Devices*. Recently he has been appointed as advisor at the Forschungszentrum Jűlich, Germany. His main interest includes the development of (*i*) advanced battery and hydrogen storage materials, (*ii*) new battery technologies, (*iii*) modelling of energy storage materials and complete rechargeable battery (NiMH and Li-ion) systems and (*iv*) the development of sophisticated Battery Management Systems (BMS). He is member of the Editorial Board of *Advanced Energy Materials* and *International Journal of Electrochemical Science*. He has published as (co)author about 200 scientific papers and contributions to scientific books and owns many patents.

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Recent Advances in Nanotechnology: A Reference to Ocular Drug Delivery System

Pravin Pawar

Shivaji University, India

Eye is the most simply accessible site for topical administration of a medication. Drugs are commonly applied to the ocular system for a localized action on the surface or in the interior of the eye. Many of novel strategies have been developed to overcome the disadvantages with the conventional ophthalmic preparations as in the form of controlled ocular drug delivery. Among the conventional dosage forms such as solutions, suspensions and ointments account for almost 90% of the currently available ophthalmic formulations on the market. These conventional dosage forms suffer from the problems of poor ocular bioavailability, because of various anatomical and pathophysiological barriers prevailing in the eye. Nanotechnology represented as an exceptional carrier system to conventional colloidal carriers, such as emulsions, lipid emulsion, liposomes and polymeric microparticles etc. Today, nanotechnology is a commonly used buzzword in numerous fields of pharmaceutical sciences, everyday life and drug delivery system. In addition; the nanoparticle have fascinated a lot of interest of the pharmaceutical scientist in the drug delivery system due to versatility in targeting tissues, accessing deep molecular targets and controlling drug release. Nanoparticulate technology is advocated as an ophthalmic drug delivery approach that may enhance dosage form acceptability while providing sustained release in the ocular milieu. Particle size, particle size distribution, and stability constitute a major issue considered by formulation scientists when formulating dispersed systems, especially those intended for parenteral or ocular administration. Very small particles such as nanoparticles are well tolerated and possess adhesive properties, which could prolong the residence time of the drug in the cul-de-sac, prevent tear washout (due to tear dynamics), and increase ocular bioavailability. So, consider this various benefits of nanotechnology in the field of ocular drug delivery system ,its necessary to discuss the variety of approcehes in the terms of dosage form like nanopartticles, nanosuspention, solid lipid nanoparticles , microemulsion and liposomes used for the ophtlamic medication.

Biography :

Pravin K. Pawar, Ph.D. is currently Asso. Prof. & Head, Department of Pharmaceutics (M. Pharmacy) at Gourishankar Institute of Pharmaceutical Education & Research, Limb, Satara, Affiliated Shivaji University, Kolhapur, MS, India. Dr. Pawar is guided of about 18 post graduate students & 3 Ph.D. students in the areas of pharmaceutics like nanotechnology, in situ gelling system, matrix tablets for colon drug delivery system & particulate drug delivery. Dr. Pawar holds Masters (2004) from Govt. College of Pharmacy, Karad, MS, India & doctorate from Delhi University, Delhi (2009) in pharmacy under one of the prestigious fellowship i.e. National Doctoral Fellowship funded by All India Council for Technical Education. Dr. Pawar Served as Asso. Prof. & Head in Chitkara University, Punjab, India for Master Course in Pharmaceutics.

At Chitkara University Dr. Pawar coordinate the various activities related Master course development, arrange the faculty development programs funded by different funding agencies. Dr. Pawar also worked on the novel carrier like nanosuspension, microemulsion, in-situ gel, nisosomes for ocular drug delivery system.

He is member of various professional bodies like IPA, SPEAR, APTI & IPGA. Actively engaged in research on ocular drug delivery & colon drug delivery system has over 20 publication in various reputed peer reviewed journals, 1 patent (filed) and more than 30 abstracts papers presented in scientific forums to his credit. He is reviewer of many international journals in the field of Pharmaceutics and has chaired scientific sessions in various conferences.

Reaction-Induced Phase Separation of Multicomponent Polymers as a Route to Design Specialty Polymers

Qui TRAN-CONG-MIYATA

Kyoto Institute of Technology, Japan

It is well-known that polymers are mutually immiscible and as a result, undergo phase separation upon mixing. Depending on the experimental conditions, there exist two mechanisms for this phase separation process: *nucleation-and-growth* and *spinodal decomposition processes*. Compared to the random spherical structures generated by the former, the latter mechanism is more significant and important because of the resulting co-continuous morphologies which could provide useful methods for designing polymer materials with excellent mechanical and transport properties. In this talk, we will show that by coupling the chemical reactions, particularly photopolymerization to the phase separation process, polymers with various *bi-continuous* and *tri-continuous* morphologies ranging from micro- to sub-micrometer scales can be obtained and controlled. Furthermore, in the process of using photopolymerization to induce phase separation, polymers with spatially gradient morphology can emerge under specific conditions, suggesting a way to produce materials with *spatially gradient structures*. Formation of polymer membranes possessing two surfaces with different solubility, i.e. *Janus-type membranes*, can be produced by this photopolymerization-induced phase separation. Finally, examples of using polymers with bi-continuous and tri-continuous morphologies to induce insulating-conducting transition in synthetic polymers will be demonstrated by using carbon nanotubes (CNTs) as a filler.

Biography :

Qui Tran-Cong-Miyata was born in Saigon (South Viet-Nam) and is currently a full professor at the Department of Macromolecular Science and Engineering, Kyoto Institute of Technology, Kyoto, Japan. After finishing bachelor, master and doctor at the Polymer Chemistry Program at Faculty of Engineering, Kyoto University, he joined the Polymers Division, National Bureau of Standards (currently NIST), Department of Commerce, USA, as a guest visiting scientist. Since 1986 he has been teaching and doing research at the Department of Macromolecular Science and Engineering, Kyoto Institute of Technology, Kyoto, Japan. He has been serving as an editorial board member of Polymer Journal (Tokyo), Advances in Natural Science: Nanoscience and Nanotechnology (IOP). Professor Tran-Cong-Miyata has published more than 100 articles in peered-reviewed journals and more than 10 book chapters and review articles. He also co-edited 4 books from Marcel Dekker, Amer. Chem. Soc. and Wiley-VCH.

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April 21-23, 2016, Dubai, UAE

Global Nanotechnology

Quirino Piacevoli
Department of Anaesthesia and Intensive Care, Italy

The next event to venture is entry of robots into human body made possible by a culmination of intricate medicine and fine technology that is Nanotechnology. This article briefly introduces the field of nanotechnology in relation to its potential benefits to the field of anaesthesiology. As with any new technique or application, nanotechnology as applied to anaesthesiology has tremendous potential for research and exploration. This article highlights the present and future advances possible in anaesthesiology and its branches, with utilization of nanotechnology.

A detailed description of medical nanorobots was first published by Robert A Freitas. Once injected, the nanorobots would freely float inside the body, detecting and attaching to very specific receptors, for example, gamma-amino butyric acid (GABA), opioid and neuromuscular junction receptors. Thus, they would perform a highly focused task. In the brain, by attaching to GABA receptors they produce loss of consciousness and amnesia, at the neuromuscular junction they provide full muscle relaxation giving good intubating conditions and activation of opioid receptors causes profound analgesia.

The desirable characteristics of a nanorobot are an optimal size of 0.5–3 to enable passage through capillaries, nonagglutinability with blood cells and recognisability of very specific receptors only.

As the nanorobots are no biological entities and do not generate any harmful activities, there shall be no side effects They are useful in both general as well as regional anaesthesia Being highly specific and target oriented, they reduce the anaesthesia-associated mortality and morbidity

Since they reach specific receptors, lesser drug dosage is required, limiting the side effects

As they bind the terminal receptors, there shall be no peaks and troughs in effect.

The only disadvantage associated with nanorobots is the initial high cost and complicated fabrication, but with time, these drawbacks would definitely be overcome.

The concept of nanotechnology was first propounded by Nobel Laureate Richard Feynman in 1959. Later, Prof. Norio Taniguchi and Dr. K. Eric Dressler in 1970s and 1980s, respectively, had important contributions in the initial propagation of the concept. It involves structures of one to several hundred nanometers in size. With nanotechnology, a specific set of materials and improved products can be designed by some changes in the microphysical structure. The biological and medical research communities have exploited the unique properties of nano materials for various applications. Functionalities can be added to nano materials by interfacing them with biological molecules. The size of nano materials is similar to that of most biological structures, therefore useful for both in vivo and in vitro applications.

Nanotechnology has been a boon in the medical field by delivering drugs to specific cells using

Nano particles. The principle exploited is that overall drug consumption and side effects can be lowered significantly by depositing the active agent only in the morbid region and in no higher dosage than needed. This highly selective approach reduces the side effects and cost, at the same time targeting its goal efficiently.

These implantables are advantageous over injectables because they do not follow first-order kinetics as injectables. Drugs displaying first-order kinetics have a rapid rise in their concentration and an exponential drop. This rapid rise can cause difficulties with toxicity and side effects, and drug efficacy can diminish as the drug concentration falls below the targeted range.

such cases might be unpredictable. If computers could control the nervous system through neuro electronic interface, problems that impair the system could be controlled so that effects of coexisting diseases and injuries impairing anaesthesia could be overcome.

Regional anaesthesia

Bupivacaine overdose: Sometimes anaesthesiologists encounter complications due to local anaesthetic overdose such as high spinal. At present, there is little to do in such cases as there are no antidotes and one has to wait for the drug to metabolise. With nanotechnology, an antidote to bupivacaine overdose is possible. There is a formation of pi–pi complexes between bupivacaine and a pi-electron–rich injectable nanoparticle. This complex would be devoid of the clinical effects of bupivacaine and would thus render toxic bupivacaine harmless. So, it could be possible in the future to counteract high spinal as soon as it is realised.

Future advances in the subspecialties of Anaesthesiology

Pain and palliative care is another upcoming superspeciality of anaesthesiology. Commonly narcotics are used for managing chronic pain. But these have systemic effects and also have significant addiction potential. To overcome this, sustained release anesthetics have been tried in the past,

but unsuccessfully as the anesthetics and their preservatives caused local toxicity. The solution to this is reflected in the use of saxitoxin, a potent anesthetic, bundled with liposomes. This slow-release formulation can produce a nerve block lasting from days to weeks and even months, at the same time being nontoxic to the nerves or the surrounding tissue. This formulation possible with nanotechnology can potentially revolutionize the treatment of chronic and even acute pain.

Critical care: Most of the Intensive Care Units (ICUs) the world over are under the domain of anaesthesiologists and critical care is emerging as a superspeciality in anaesthesiology. Be it infection control, ventilator dependence, antibiotic resistance or any other issue, nanotechnology provides the hope to find a solution to the problems. Few future concepts are vasculoids, respirocytes and clottocytes.

Biography :

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Engineered nanoparticles: Preparation, functionalization and applications

Rabah Boukherroub

University Lille1, France

The field of nanotechnology is related to the production and application of nanostructured materials, and has been recognized as one of the fastest developing fields. Nanotechnology manipulates matter at the nanoscale (1–100 nm) producing nanoproducts and nanomaterials that display novel and size-related physico-chemical properties differing significantly from those of their bulk counterparts. The novel properties have been exploited widely in diverse areas such as electronics, biomedicine, pharmaceuticals, cosmetics, environmental analysis and remediation, catalysis, and material sciences.

In this talk, I will focus on the preparation and functionalization of diamond nanoparticles, lipid nanocapsules and gold nanorods for applications in drug and gene delivery, photodynamic therapy (PDT), photothermal therapy (PTT), but also I will highlight in a few examples the potential of the functionalized particles to inhibit hepatitis C viral entry and biofilm formation.

Biography :

Rabah Boukherroub received a PhD in chemistry from the University Paul Sabatier in Toulouse, France. He is currently a CNRS research director at the Institute of Electronics, Microelectronics and Nanotechnology, University Lille1, France. His research interests are in the area of functional materials, surface chemistry, and photophysics of semiconductor/metal nanostructures with emphasis on biosensors and lab-on-chip applications, and development of new tools for studying molecular dynamics *in vivo*. He is a co-author of 340+ research publications and wrote 26 book chapters in subjects related to nanotechnology, materials chemistry, and biosensors. He has 8 patents or patents pending.

Nanocomposites with Nano TiO_2 – a Step in Improved Restorative Dentistry

Ramesh S. Chaughule

Ramnarain Ruia College, Mumbai, India

The ultimate goal of dentistry and dental technology is to maintain or improve the quality of life of the dental patient. The early generation of composites proved to be failure for posterior restorations due to their poor wear resistance, rough surface and high rate of polymerization shrinkage. This was due to large particles size of fillers. A study of the modification of dental nanocomposites with nanosized fillers is presented. The properties are improved drastically by reducing the size of fillers based on nanotechnology. The composite resins consist of three basic phases - the organic phase (matrix), the dispersed phase (filler) and the interfacial phase (coupling agent). The resin matrix is a mixture of methacrylate/acrylate monomers. During the application, the monomers of resin matrix are polymerized to crosslinked polymer structure by free radical nonlinear polymerization process. In order to achieve a strong covalent interaction in between the organic matrix and inorganic fillers, coupling agents are used. The coupling agents tend to promote bonding or adhesion between the filler particles and matrix and helping in the transfer of load and stresses. A commonly used coupling agent is gamma methacryloxy propyl trimethoxysilane (MTPS). One side of the coupling agent tends to bond with hydroxyl groups of silica particles and other is copolymerized with polymer matrix.

Non-toxic TiO_2 has good antibacterial properties and is selected as an additive to the dental nanocomposite material. The incorporation of TiO_2 (titania) nanoparticles, via a silane chemical bond, to a standard dental acrylic resin matrix showed an increase in the wear resistance, flexural strength and surface hardness properties of the dental nanocomposites. Flexural strength and modulus of the nanocomposite resin with modified nano TiO_2 is studied and shows there is an increase in these properties with increase in nano TiO_2-resin wt%. For comparison, a commercially available dental resin was reinforced with untreated and treated nano-TiO_2 particles with various sizes. The enhancement of mechanical properties is mainly attributed to the resin-mediated covalent linkage and the strong physical interaction between matrix and nano-filler, together with the uniform dispersion and/or moderate aggregation of the nano-filler. The nanocomposite resins filled with surface-modified TiO_2 nanoparticle shows a great potential as dental restorative material.

Biography :

Ramesh Chaughule has completed his PhD from Tata Institute of Fundamental Research, Mumbai, India, and a pioneer institute in India. Also he graduated in Electronics and Telecommunication Engineering. Presently he is an Adjunct Professor at Ramnarain Ruia College, Mumbai, India. Dr. Chaughule has pioneered in the field of NMR and MRI. He was deputed to Indonesia by IAEA several times as an IAEA expert in the field of NMR. He is an awardee of many international Fellowships to carry out research programs in different countries. Besides number of research publications and book chapters to his credit, Dr. Chaughule has edited several books on MRI and Nanotechnology published by American Scientific Publishers, USA. He has organized several international conferences in India.

Engineering at the Nanoscale: State of the Art, Challenges and New Opportunities

Sabu Thomas

Mahatma Gandhi University, India

The talk will concentrate on various approaches being used to engineer materials at the nanoscale for various applications in future technologies. In particular, the case of clay, carbon nanostructures (e.g. nanotubes, graphene), metal oxides, bionanomaterials (cellulose, starch and chitin) will be used to highlight the challenges and progress. Several polymer systems will be considered such as rubbers, thermoplastics, thermosets and their blends for the fabrication of functional polymer nanocomposites. The interfacial activity of nanomaterials in compatibilising binary polymer blends will also be discussed. Various self assembled architectures of hybrid nanostructures can be made using relatively simple processes. Some of these structures offer excellent opportunity to probe novel nanoscale behavior and can impart unusual macroscopic end properties. I will talk about various applications of these materials, taking into account their multifunctional properties. Some of the promising applications of clay, metal oxides, nano cellulose, chitin, carbon nanomaterials and their hybrids will be reviewed.

Biography :

Sabu Thomas is a full Professor of Polymer Science and Engineering at the School of Chemical Sciences, as well as the Director of International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, Kerala, India. He received his Ph.D. in 1987 in Polymer Engineering from the Indian Institute of Technology (IIT), Kharagpur, India.. He is a Fellow of the Royal Society of Chemistry. Prof. Thomas has (co-)authored more than 650 research papers in international peer-reviewed journals in the area of polymer composites,nanocomposites, IPNS, membrane separation, polymer blends and alloys, polymeric scaffolds for tissue engineering and polymer recycling. Prof. Thomas has been involved in a number of books (50 books), both as author and editor. The h index of Prof. Thomas is 72 and he has more than 21500 citations. Prof. Thomas has 4 patents to his credit. Prof. Thomas received many awards which include Fellowship of the Royal Society of Chemistry,(FRSC), London, Distinguished Professorship of the Josef Stefan Institute, Slovenia. CRSI, MRSI and , Nanotech Medals, Sukumar Maithy award, Distinguished Faculty Award, He is in the list of most productive researchers in India and hold a position of No.5. Very recently, Prof. Thomas has been awarded Honoris Causa, DSc by the University of South Brittany, France. Prof. Thomas has supervised 70 PhD theses and has delivered more than 200 invited /plenary and key note talks over 30 countries.

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Copper-Oxide nanoparticles and organic polymer: preparation and applications for harmful gas sensors

Saleh Thaker Mahmoud

UAE University, UAE

Hydrogen sulfide (H_2S) gas is a colorless, poisonous, and corrosive gas that generates harmful effect on the nervous system of human-being at low concentrations and causes death at higher concentrations. H_2S often results from the bacterial breakdown of organic matter in the absence of oxygen, thus, it exists in natural gas with a percentage up to 90%, and by far the largest industrial route to H_2S occurs in petroleum refineries.

In this work, novel H_2S gas sensor has been fabricated using copper-oxide (CuO) nanoparticles embedded in polymer membranes of poly-vinyl-alcohol (PVA) and glycerol ionic liquid (IL). The copper-oxide nanoparticles are fabricated by colloid microwave-thermal method that enables a precise size control. Different concentrations of nanoparticles and 5% IL are added to a solution of PVA to produce polymer membranes. The produced membranes are flexible and having semiconducting properties. The membrane is encapsulated between two electrical electrodes where the top electrode exhibits a grid structure. While applying a constant voltage across the electrodes, the electrical current response signal is measured. The measurements reveal that at low temperatures these sensors are highly sensitive to H_2S gas with low concentrations of 0.0025%. The fabricated sensors are very selective to H_2S, and exhibit fast response of 20.4 ± 12.8 s. Moreover, these sensors are cheap and easy to manufacture. Thus, they have the potential to be used for industrial applications in petroleum refineries.

Biography :

Saleh has completed his PhD from IIT-Delhi-India and joined UAE University as an assistant professor in 2002. He is an active researcher in the field of materials science and laser plasmas. He has published more than 40 papers in reputed journals and 20 conference papers. He supervised several postgraduates' students and has been serving as a referee in many reputed journals.

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Electrical Resistance Switching in Nano-Graphite Films

Sergey G. Lebedev

Institute for Nuclear Research of Russian Academy of Sciences, Russian

The effect of electrical resistivity switching in nano – graphite films is described. In difference with cases published elsewhere the switching in nano – graphite films occurs from stable high conductive to metastable low conductive state. Critical current of switching varies in the range 10-500 mA and is believed to increase up to values of 100 -1000 A appropriate for using of nano - graphite samples in power grids as contact-less current limiters and circuit breakers. The possible mechanisms of switching phenomenon in nano – graphite films are discussed.

Peltier cooling using monoatomic layer materials

Serhii Shafraniuk

Northwestern University, USA

We study the thermoelectric cooling using graphene and transition metal dichalcogenides stripes and nanotubes. A theoretical model describes different components of the thermal transport involving of flows the electrons, holes and phonons. This allows optimizing the figure of merit of the thermoelectric devices based on the monoatomic materials. The experimental part of our research involves studying of the Peltier effect measured using two sequentially-connected carbon nanotube (CNT) field-effect transistors (FETs), each with charge carriers of opposite sign, either electrons or holes, whose concentration is controlled by the side gate electrodes. A change ΔT of the intrinsic temperature, T, inside the CNT owing to the thermoelectric effect is determined from the change of the position and width of spectral singularities manifested in the experimental curves of the source-drain electric conductance. We deduce an impressive Peltier effect $\pm\Delta T \simeq 57$ K inside the CNT associated with cooling and heating, depending on the direction of the electric current. The effect can be utilized for building thermoelectric devices having a figure of merit up to $ZT_{\text{cold}} = 7.5 >> 1$ and an appreciable cooling power density P_{cooling}~80 kW/cm^2. Obtained parameters of the CNT Peltier cooler allow to suggest a new solution to the problem of creating the highly efficient thermoelectric devices.

Biography :

Serhii Shafraniuk has completed his Ph.D at the age of 26 years from Kiev State University and postdoctoral studies from Academy of Sciences of Ukraine. He is the Research Associate Professor at Physics and Astronomy Department, Northwestern University, a premier educational and research institution. He has published more than 100 papers in reputed journals and serving as an organizer of various International Conferences.

Self Aligned SWCNT/ ssDNA homopolymer

Seyedeh Maryam Bnaihashemian

University of Farhangian, Iran

An anisotropic parallel structure of nano material in nano -and mesa scale system is the challenge of developing nanoelectronic device. Here we report a rapid prototype method for generate an anisotropic array of single wall carbon nanotube (SWCNT) with assistance of short 20 base of Single strand DNA homopolymers (poly (dT)20). Scanning electron microscopy, High resolution tunneling electron microscopy and profile meter geometry analysis provide evidence for well aligning SWCNT. Anisotropic parallel structure of SWCNT purpose wide application and link micro and nano scale biomaterial with SWCNT for utilizing biological component and nano electronic device.

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Nanoemulsion Based Intranasal Delivery of Risperidone for Nose to Brain Targetting

Shailesh T Prajapati, Sarjak P Pathak, Chhaganbhai N. Patel

Shri Sarvajanik Pharmacy College, India

Risperidone nanoemulsion using different mucoadhesive agent, as nasal drug delivery system was prepared to produce quick effect compare to oral route. Solubility of drug was determined in different vehicles. Pseudo ternary phase diagram generated using Acrysol K 150 as oil, Tween 80 as a co-surfactant, and Caproyl PGMC as a surfactant. The four formulations were prepared by the spontaneous emulsification method and were further characterized for their percentage transmittance, droplet size and zeta potential. *Ex vivo* Diffusion study of the optimized batch was carried out using goat nasal mucosa. Histpathological study of the optimized batch was studied. Optimized formulation having the mean globule size 149 nm and zeta potential -17.3 mV. *Ex vivo* study revealed that at the end of 4 hrs 93.76% of the dose was diffused successfully. In Histpathological study formulation treated mucosa did not shown any damage to the epithelium layer.

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Gold Core Silver Shell Nanoparticles as Novel Bacterial Biofilm Disruptors and Antileishmanial Agents

Sougata Ghosh

SP Pune University, India

Unique phytochemistry of medicinal plants like *Dioscorea bulbifera* has made it a novel nanobiotechnological model apart from its wide applications in both Indian and Chinese traditional medicine. Phenolics, flavonoids, starch, saponins like diosgenin make it most suitable biomaterial to synthesize as well as stabilized the bioreduced nanopaticles. Novel $Au_{core}Ag_{shell}$ nanoparticles were rapidly synthesized by *D. bulbifera* tuber extract (DBTE) within 5 h showing a prominent peak at 540 nm. 9 nm inner core, as revealed by HRTEM was found to be of elemental gold while silver formed the shell giving a total particle diameter upto 15 nm. $Au_{core}Ag_{shell}$NPs were comprised of 57.34 ± 1.01 % gold and 42.66 ± 0.97 % silver of the total mass. $Au_{core}Ag_{shell}$NPs showed highest biofilm inhibition upto 83.68 ± 0.09 % against *A. baumannii*. Biofilms of *P. aeruginosa, E. coli* and *S. aureus* were inhibited upto 18.93 ± 1.94 %, 22.33 ± 0.56 % and 30.70 ± 1.33 %, respectively. Scanning electron microscopy (SEM) and atomic force microscopy (AFM) confirmed unregulated cellular efflux through pore formation leading to cell death. Potent antileishmanial activity of $Au_{core}Ag_{shell}$NPs (MIC = 32 μg/mL) was confirmed by MTT assay. Further SEM micrographs showed pronounced deformity in the spindle shaped cellular morphology changing to spherical. This is the first report of synthesis, characterization, antibiofilm and antileishmanial activity of $Au_{core}Ag_{shell}$NPs synthesized by *D.* bulbifera.

Biography :

Sougata Ghosh has pursued his PhD from SP Pune University, India. He is assistant professor at Modern College of arts, Science and Commerce, Pune, India. He is in the editorial board of peer reviewed International Journals like Chemotherapy Research and Practice, International Journal of Advances in Engineering Research and International Journal of Research in Science and Technology. He has been working on nanomedicine against cancer, diabetes, infectious diseases and oxidative stress which have been published in more than 34 international papers and 3 patents with 352 citations.

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Antibacterial Efficacy of Biosynthesized Silver Nanoparticles by the Fungus Humicola gresia

Tawfik M. Muhsin and Ahmad K. Hachim

University of Basra, Iraq

The objective of this study was to explore the fungus Humicola gresia for its capability to biosynthesize silver nanoparticles (AgNPs) and to examine their activity against five strains of human pathogenic bacteria namely; Escherichia coli, Proteus mirabilis, Pseudomonas aeruginosa, Salmonella typhi and Staphylococcus aureus using agar well diffusion technique. The efficacy of biosynthesized AgNPs in a combination with commercial antibiotic Gentamycin against the selected pathogenic bacteria was also tested. The biosynthesized silver nanoparticles from fungal free-cell filtrate were characterized by using UV-Vis spectrophotometer analysis, Fourier transform infrared spectroscopy (FTIR) and scanning electron microscope (SEM). The results showed a varied growth inhibition activity of synthesized AgNPs at 50 ul/ml concentration (10-18 mm inhibition zones dim) and at 100 ul/ ml (13-21 mm inhibition zones diam) against the tested pathogenic bacterial strains was detected. The activity of AgNPs was highest against S. aureus (20.5 mm diam inhibition zone) and lowest against P. mirabilis (10 mm diam). However, a remarkable increase of bacterial growth inhibition zones (25-35 mm diam) was observed when a combination of silver nanoparticles and Gentamycin was used. The minimal inhibitory concentration (MIC) value of the biosynthesized silver nanoparticles was 0.078 ug/ml against the bacteria E.coli and S.aureus. Nonetheless, Silver nanoparticles synthesized by the selected fungus did not exhibit toxicity against human blood. Changing the color of the fungal free cell filtrate from pale yellowish to dark brown after being treated with silver nitrate solution indicate the synthesis of silver nanoparticles. UV-Vis spectrophotometer analysis revealed a peak at 430 nm confirming the biosynthesis of silver nanoparticles, FTIR analysis verified the detection of protein capping of biosynthesized AgNPs while SEM images showed that the synthesized silver nanoparticles are dispersed and mostly with spherical shape and their size ranging between 26-90 nm. The biosynthesized silver nanoparticles by the fungus H. gresia are a promising for future medical therapy as antibacterial agent.

Green Chemistry and Consumer Products – The Role of Exposure Assessment in Reducing Health Risks

Treye A. Thomas

US Consumer Product Safety Commission, USA

The U.S. Consumer Product Safety Commission (CPSC) is an independent regulatory agency created in 1973. CPSC's jurisdiction includes thousands of types of consumer products used in or around the home. The potential safety and health risks of compounds that are incorporated into consumer products can be assessed under the Federal Hazardous Substances Act (FHSA). Under the FHSA, a hazardous substance may cause substantial illness or injury through reasonably foreseeable handling and use. The FHSA uses a risk based approach where chemicals are identified as "toxic", and exposure to these compounds are estimated to determine whether consumer will be exposed to this "toxic" compound in amounts that exceed acceptable limits. Green chemistry seeks to identify chemicals that are lower in toxicity and thus minimizing risks to the population. The approaches in the FHSA can be used to identify chemicals with lower toxicity. Understanding methods for incorporating chemicals into products and product matrices that will minimize exposure is also an approach to minimizing risks from chemicals in products. This talk will discuss the need for evaluating chemicals in consumer products and the relevance for existing regulatory guidelines in identifying safer alternatives. Examples from the emerging use of nanomaterials in consumer products will be discussed.

Application of Magnetic Metal–Organic Frameworks (MOFs) in Water Remediation

Vahid Jabbari and Dino Villagran

The University of Texas at El Paso, USA

Metal–organic frameworks (MOFs) are among the most rapidly growing and important class of the porous materials. MOFs are highly porous materials made of metal ions or metal clusters and coordinating ligands (linkers). The specific interest in MOFs porous materials is due to some reasons such as versatile tunability of their shape and pore size from microporous to mesoporous scale, depending on connectivity of central metal and ligands along with nature of the linkers. Due to their promising features, MOFs have been widely used in various applications such as electrode materials, drug delivery, polymerization, catalysis, carriers for nanomaterials, luminescence, magnetism, membranes, imaging, and especially adsorption of small molecules in gas and liquid phases. Adsorptions in liquid phase using MOFs also are applied and water remediation using MOF materials is attracting large attention every year. Additionally, due to its surface chemistry, iron oxide magnetic nanoparticles (Fe3O4 MNPs) show great potential in pollutant adsorption. As consequences, combinations of Fe3O4 MNPs with MOFs and MOFs composites have great advantages in pollutant adsorption and separation in liquid media.

Biography :

Vahid Jabbari research covers vast range of science and technology including Nanomaterials, Nanostructures, Polymer, Carbon Nanostructures, Semiconductor, MOFs, Energy and Water Remediation. He published around 40 papers in peer-reviewed journals, national and international conferences, and several book chapters. He has served as a member of technical, scientific, and organizing committee of numerous international conferences, symposiums and expos in Turkey, UAE, Tunisia, Mexico, France, China, India, Thailand, Greece, Singapore, Spain, UK, and USA. He also is reviewer and editor for numerous prestigious scientific journals.

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Intensification of (bio)processes –A variety of solutions rendering your (bio)process more viable

Heleen De Wever, Wouter Van Hecke, Yamini Satyawali, Dominic Ormerod, Anita Buekenhoudt, Roel Vleeschouwers and Karolien Vanbroekhoven

Flemish Institute for Technological Research (VITO), Belgium

Process intensification is defined as any chemical engineering development that leads to a substantially smaller, safer, cleaner and more energy-efficient technology. VITO focuses on 2 aspects related to process intensification: (i) selective product recovery from enzymatic or microbial processes and (ii) reduced solvent use in reactions requiring high dilutions.

A growing predilection towards utilization of sustainable resources and an ambition to reduce import of oil are the impetus for the implementation of biotechnological production processes. Despite the progress made, several bio-based processes are still plagued by limited product titers and volumetric productivities due to product inhibition. Other processes still suffer from side reactions decreasing the yield of the process. All this leads to substantial downstream processing costs, high waste water volumes, high fermentor costs and an increased substrate cost in the case of a decreased yield. Therefore, it can be advantageous to invest in a recovery technology that allows the selective separation of the product during fermentation or biocatalysis: 1. To enrich the product leading to a decrease in downstream processing costs; 2. To improve the volumetric productivity by alleviation of product inhibition; 3. To reduce the process flows (decrease amount of wastewater per unit of product); 4. To improve the yield by removing the target product from the fermentation broth and rendering it unavailable for side reactions. These are the rationale behind *in-situ* product recovery (ISPR) technologies and intensification of the processes in general (resulting in less water used, less energy consumption, …). This is the key technology platform we developed and applied during the last years to several bioprocesses to overcome low productivities and yields and has much more potential given the exponential growth in biocatalysts & microorganisms. Specific cases will be presented and the benefits for the selected processes explained both in technical and economic terms: continuous fermentation processes with integrated separation technology for whole cell fermentations (butanol, succinic acid), concepts for integration with organic acid fermentations (short to medium chain fatty acids, itaconic acid) and the proof of concept for enzymatic production of (chiral) amines.

Triggered by process intensification another process integrating reaction and separation was developed. This process is particularly valuable for reactions needing high dilution to prevent the formation of unwanted impurities as e.g. macrocyclisations, or reactions with substrate inhibition. This VID-process (volume intensified dilution) allows to get similar yields and purities as the standard high dilution batch process, however with a considerable reduction of solvent use, up to 75%, due to in-line solvent recycling. This process was recently demonstrated in a real case of peptide cyclization, in collaboration with industrial partners from the pharmaceutical industry.

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Valorization of CO_2-rich off gases to monomers and polymers through biotechnological processes

L. Garcia-Gonzalez[1], Md.S.I. Mozumder[2], E.I.P. Volcke[2], Roel Vleeschouwers, K. Vanbroekhoven[1], H. De Wever[1]

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CO_2 is considered to be the major cause of climate change by its accumulation in the atmosphere and its greenhouse properties. To counteract climate change, most research focused in the past on Carbon Capture and Storage (CCS). Nowadays it is recognized that rather than just storing it, emitted CO_2 can be a valuable source of carbon for the production of commercially valuable products. This Carbon Capture and Utilization (CCU) approach provides much needed additional capacity in the move towards a low carbon economy. Clearly, CO_2 is the ultimate sustainable resource, available everywhere, in unlimited quantities, and forever. Though more and more novel CCU technologies are being reported, there is still a great need to develop viable CCU value chains.

This works aimed to apply CCU by converting CO_2 from industrial point sources into the monomer lactic acid (LA) and the polymer polyhydroxyalkanaote (PHA) through biotechnological processes for their application in 3D printing and aquaculture.

The fermentative production of polyhydroxybutyrate (PHB) and PHA copolymers with the right characteristics for the defined high-end applications from CO_2 was optimized at lab-scale using pure culture. Test work encompassed the use of both synthetic gases and real offgas streams. Moreover, the experimental work was complemented with and supported by model-based approaches. Secondly, the enzymatic production of LA, precursor of polylactic acid, from CO_2, was investigated at bench scale. The process was optimized in terms of LA productivity and yield.

In this presentation, both processes will be presented, discussed and complemented with experimental and modelling results.

Knowledge-Based Systems are a Future of Nanomaterial World

Victor S. Abrukov

Chuvash State University, Russia

There are several important challenges related to analysis and modeling of experimental data in the nanotechnology area. These are as follows:

- What is the best way to generalize experimental data?

- What is the best way of generalization which allows solving direct and inverse problems?

- What is the best way of generalization which allows predicting results of an experiment which was not carried out?

- What is the best way of generalization which allows determining a technology of object creation with required properties and characteristics?

We do believe that all these issues can be solved by creating a Knowledge-Based System.

Under the Knowledge-Based System, we mean the analytical and calculation tool that contains all relationships between all variables of the object, allows calculating the values of any part of variables by means of others, and thus allows solving all above mentioned problems.

This paper presents the methodology and techniques for a creation of the Knowledge-Based System of nanomaterials based on nanofilms of linear-chain carbon by means of artificial neural networks.

All steps of the creation of the Knowledge-Based System and illustrations are presented on our Web-site http://amf21.ru/biblioteka/meroprijatija-provodimye-associaciei/proekt-rffi-sozdanie-bazy-znanii-nanom as the autonomous computer modules of the Knowledge-Based System.

We are ready to help to any researcher to create a Knowledge-based System of his own experiment. If you have a data base (a table) of experimental measurements we will be able to create yours Knowledge-based System.

We have to mark here that the direction of our work is near the well-known USA Materials Genome Initiative. However we are ahead of the real works that exist in this area, approximately two years.

Biography :

Victor S. Abrukov, male, graduated from Physics Faculty of Leningrad State University in 1974. He works for Chuvash State University from 1974 till now. Since 1996, he became the head of Department of Thermo Physics (since 2012 - Department of Applied Physics and Nanotechnology) of the Chuvash State University. Now he has published more than 150 papers. He is honored scientist of the Chuvash Republic.

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Nanosensor systems. e-bra, e-bro, e-band-aid, e-bedsheets, and mobile wireless platform for monitoring and control of cardiovascular diseases and neurological disorders

Vijay K. Varadan

Pennsylvania State University, USA

Health and long term care is a growth area for wearable heath monitoring systems. Recent progress in nanosensors, printable electronics and mobile platforms developed by Varadan and his group has resulted in novel wearable health monitoring systems for neurological and cardiovascular disorders, including congestive heart failure and irregular dancing heart, and diabetes. Wearable diagnostic and therapeutic systems can contribute to timely point-of-care of patients with chronic health condition, especially chronic neurological disorders, cardiovascular diseases and strokes that are leading causes of mortality worldwide. Diagnostics and therapeutics for patients under timely point-of-care can save thousands of lives. However, lack of access to minimally-intrusive monitoring systems makes timely diagnosis difficult and sometimes impossible. Existing ambulatory recording equipment are incapable of performing continuous remote patient monitoring because of the inability of conventional silver-silver-chloride-gel-electrodes to perform long-term monitoring, non-reusability, lack of scalable-standardized wireless communication platforms, and user-friendly design. Recent progress in nanotextile biosensors and mobile platforms developed by Varadan and his group has resulted in novel wearable health monitoring systems for neurological and cardiovascular disorders. This talk discusses nanostructured-textile-based dry sensors for long-term measurement of electrocardiography (ECG), electroencephalography(EEG), electrooculography(EOG), electromyography(EMG), heart rhythm, heart rate, pulse rate, spo2 and bioimpedance with very low baseline noise, improved sensitivity and seamless integration into garments such as undershirts, bra, headband, socks, bed sheets, etc., of daily use. Combined with state-of-the-art embedded wireless network devices to communicate with smartphone, laptop or directly to remote server through mobile network (GSM,4G-LTE,GPRS), they can function as wearable wireless health- diagnostic systems that are more intuitive to use. Moreover they are developed to monitor early warning of concussion and cardiac arrest of football players.

The author's research team has also developed a wireless neural probe using nanowires, nanotubes and magnetic nanotubes for monitoring and control of Parkinson's and Alzheimer's diseases. They have demonstrated that magnetic nanotubes combined with nerve growth factor enable specific cells to differentiate into neurons. The results from in vitro studies show that magnetic nanotubes may be exploited to treat neurodegenerative disorders such as Parkinson's disease and Alzheimer's disease because they can be used as a delivery vehicle for nerve growth factor.

Selected videos will be presented to show the efficacy of our nanosensor system network for athletes and patients.

Some physical parameters of PEG-modified magnetite nanofluids

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The development of the synthesis of stable aqueous suspensions of superparamagnetic iron oxide nanoparticles stabilized with unmodified polyethylene glycol (PEG) at two molecular weights (4000 and 6000 Da) and several PEG/iron ratios has been reported. The obtained biocompatible polymer (polyethylene glycol -PEG) coated nanoparticle dispersive solution with pH $\approx$ 6.5 and iron content ranging from 0.1-0.5 % w/v has been investigated for optical and magnetic properties.

A new particle processing device for making high performance nanomaterials as well as their applications in medicine has been developed by applying electrohydraulic technique for nano homoganization. Biomedical application requires the biocompatible superparamagnetic iron oxide nanoparticles (SPIONs), which are stable and well dispersed in water at physiological pH or in physiological salinity. In order to obtain biocompatible SPIONs, particles of 10-15 nm size have been synthesized and these SPIONs have been coated with ascorbic acid and polyethylene glycol (PEG). Vibrating Sample Magnetometer studies (VSM) were carried out to study the effect of phase transformations on the magnetic properties of the nanoparticles. The samples were analyzed by VSM at room temperatures into high and low magnetic fields. The ascorbic acid coated iron oxide nanoparticles were found to be well dispersed in water as they have a hydrophilic outer surface containing hydroxyl and amine groups. This hydrophilic outer surface is likely to enhance their bioactivity. Therefore they may become a very good drug carrier for biomedical applications.

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Mg/HA particulate nanocomposites: fabrication and characterization

Yan Huang

BCAST, Institute of Materials and Manufacturing, Brunel University London, UK

Mg alloy matrix and hydroxyapatite (Mg/HA) nanoparticle reinforced composites for biomedical applications was fabricated by combining a novel high shear solidification technology and equal channel angular extrusion (ECAE). High shear treatment was performed immediately prior to casting at ~680°C using a rotor-stator mechanism. The as-cast composites ingots were processed by ECAE at 300C using a 120° die to various strains. Experiments showed that the high shear treatment effectively reduced the HA particle agglomeration and produced a fine grain structure with a globally uniformly distributed HA particle aggregates for all HA contents. ECAE processing resulted in further grain refinement and substantially reduced HA particle aggregate size. A desirable dispersoid of HA particles formed after ECAE, depicting the formation of true nanoparticulate composites. The mechanical properties of the nanocomposites were assessed by compression tests. The yield strength increased with increasing HA contents. However, the composites with low HA contents exhibited higher ductility and work hardening capacity, giving rise to higher ultimate strength before fracture. The best combination of strength and ductility is considered to be for the Mg-3Zn-0.5Z/3wt%HA with yield strength of ~155MPa and a compressive reduction of ~13% before fracture. Additionally, the cooling rate for solidification showed a strong impact on the microstructure and particle distribution. The effect of high shear treatment and ECAE for the development of microstructures and HA particle distribution is discussed in the paper.

Biography :

Dr Yan Huang is faculty member in the Institute of Materials and Manufacturing, Brunel University, Hydro/Qatalum Chair Professor and Quest Professor of Dalian Jiaotong University. Prior to this he worked as a Technical Director at Confae Technology Ltd from 2004 to 2010, and as a Senior Research Fellow at the University of Manchester from 1996 to 2004. He has extensive experience in the combined solidification and deformation processing, with particular interest in light alloys and metal matrix nanocomposites. His current research interest is in the development of novel alloys and composites for structural and medical applications.

Nanostructured Hybrid Materials for Lithium-based Batteries

Yanglong Hou

Peking University, China

Presently, safe energy storage is one of the most demanding technologies by the developing society. In this regard, lithium-based batteries (LBs) have got tremendous attention due to their high energy and power densities and have been considered as promising power source for future electric vehicles (EVs). Thus, most of the present research is focused to develop new electrode materials that can bring the realization of these devices for EVs. However, structural disintegration, limited access to redox sites and loss of electrical contact have long been identified as primary reasons for capacity loss and poor cyclic life of these materials. Here, we have developed different hybrid nanostructures of metal oxides, nitrides, sulfides, hydroxides and metal alloys with doped graphene to control above mentioned problems and to achieve the goals set by USABC. All these composites possess extraordinary performances as electrodes of LBs with long cyclic stability and excellent rate capability. The high performance of the composites based on the synergistic effect of several components in the nanodesign. These strategies to combine the different property enhancing factors in one composite with engineered structures will bring the realization of these devices in broad markets.

Biography :

Yanglong Hou obtained his Ph.D. in Materials Science from Harbin Institute of Technology (China) in 2000. After a short post-doctoral training at Peking University, he worked at University of Tokyo from 2002-2005 as JSPS foreign special researcher and also at Brown University from 2005-2007 as postdoctoral researcher. He joined the Peking University in 2007, and now is the Chang Jiang Chair Professor of Materials Science. His research interests include the design and chemical synthesis of functional nanoparticles and graphene, and their biomedical and energy related applications.

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Multifunctional Nano Particle systems and their applications

Y C Goswami

ITM University, India

In the recent years, the core-shell nanostructures have become one of the most important areas of research due to their potential applications in various fields like catalysts, industrial, biomedical and other biologically relevant molecules. They represent different and more powerful properties than bulk materials. The properties can be varied from material to another on the basis size and shape. The preparation and use of systems with multifunctional properties like bioconjugation with superparamagnetic, fluorescent or targeting molecules is positioned to become a innovative tool for application in various clinical and optoelectronic devices and energy related fields. The design and synthesis of novel core-shell nanostructures are one of the major challenges in polymer semiconductor research. Recently, much attention has been focused on core-shell metal /metal oxide nanoparticles and polymer-semiconductor systems. Other nanostructured systems like nanocages and bio-degradable nanoparticles, are emerging as potential innovative systems that could be exploited as multifunctional delivery vectors. The Present talk will be based on the preparation and use of multifunctional nanoparticles, nanocages and degradable nanoparticles in biomedicine other electronics applications.

Biography :

Y C Goswami is working as Prof in Physics and Dean R& D at ITM University, Gwalior. Leading a research group working on Synthesis and characterization of Chalcogenide, metal oxide core shell, nanocomposites and nanostructures for optoelectronic and sensors applications. Received AICTE Young teacher Career award for the year 2010. Carried out his post doctoral work as Academic visitor in School of Chemistry and Material Science University of Manchester UK on core shell synthesis of various optoelectronic materials with Prof O'Brian. So far published more than 50 research papers in various referred journals/ proceedings and presented 40 papers in various national /international seminars/symposia. Shouldering the responsibility of central facilities for material characterization P C Ray centre of Research. Completed two research projects and working on another two research projects funded by IUAC, Delhi; AICTE and MPCST. Member of editorial board Nanotechnology and Nanoscience, member of scientific advisory board of INPOSO and reviewer panel various referred journals of Elsevier and Springer. Life member of various professional bodies like ISTE, IACS, Institute of Nanotechnology, Electrochemistry forum.

Highly sensitive fiber-optic fluorescent sensor for Cu2+ ions based on silica-coated CdSe/ZnS nanoparticles

Yu-Lung Lo and Ti-Wen Sung

National Cheng Kung University, Taiwan

In this paper, we demonstrated the monodisperse hydrophobic CdSe/ZnS nanoparticles capped with silica shell though microemulsion method. The core-shell CdSe/ZnS nanostructure exhibits very interesting photoluminescent behaviors after interactions with Cu2+ ions. The mechanism of the fluorescence quenching is presumed to be the adsorption of the metal ions by the trap sites and the resulting surface passivation of the CdSe/ZnS. The porous silica shell of the nanostructure also plays a key role in the process of fluorescence quenching, which helps to protect the surface characteristics of CdSe/ZnS, prevent the aggregation of the particles, and promote the adsorption of Cu2+ ions. The obtained CdSe/ZnS/SiO2 nanoparticles are water soluble. Quenching of fluorescence intensity of the CdSe/ZnS/SiO2 nanoparticles allow the detection of Cu2+ concentration, thus affording a very sensitive detection system for this chemical species.

Biography :

Yu-Lung Lo received his Ph.D. degree in Mechanical Engineering from University of Maryland, College Park, USA, in 1995. He has been faculty of the Mechanical Engineering Department, National Cheng Kung University, since 1996, where he is now a Department Head and distinguished professor.

Dr. Lo received the Outstanding Award for Professor in Engineering from Chinese Society of Mechanical Engineers in 2013, Outstanding Award for Professor in Engineering from Chinese Institute of Engineers in 2012, First-Class Research Award from NSC in 2005/2006, A-Class Research Award by NCKU in 2006, and the Dr. Ta-You Wu Award for Young Researchers from NSC in 2002. Now Dr. Lo is included in the Who's Who in the World, Who's Who in Science and Engineering lists, and the International Directory of Distinguished Leadership.

He was invited to be an invited speaker, keynote speaker, and plenary speaker in the international conferences, also serves as editorial board members in several journals. Currently, he is also Chairman of Asian Committee for Experimental Mechanics (ACEM). His research interests include QD nanoparticle for sensors, optomechatronics, experimental mechanics, fiber-optic sensors, optical techniques in precision measurements, and biophotonics. He has authored over 150 journal publications and has filed for several patents.

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Schiff based ligand containing nano-composite adsorbent for optical copper(II) ions removal from aqueous solutions

Zeid A. ALOthman

King Saud University, Saudi Arabia

Introduction: Clearly state the purpose of the abstract

Methods: Describe your selection of observations or experimental subjects clearly

Results: Present your results in a logical sequence in text, tables and illustrations

Discussion: Emphasize new and important aspects of the study and conclusions that are drawn from them

A novel Schiff base ligand based nano-composite adsorbent was prepared for the detection and removal of copper (Cu(II)) ions in wastewater samples. Upon the addition of Cu(II) ions to nano-composite adsorbent at optimum conditions, the clear color was visible to the naked-eye in the detection system. This nano-composite adsorbent exhibited an obvious color change from yellowish to dark green in the presence of Cu(II) ions in aqueous solution. The limit of detection was found to be 0.16 μg/L by optical detection. The nano-composite adsorbent could detect the Cu(II) ions over other foreign ions with high sensitivity and selectivity. For adsorption behaviour, influences several factors such as solution pH, contact time, concentration for Cu(II) ion adsorption was investigated by batch experiment in detail. The results showed that neutral solution pH was suitable to get optimum Cu(II) ions adsorption. Also an extending contact time was favourable for improving adsorption efficiency. The adsorption process of Cu(II) ions by the nano-composite adsorbent was followed the Langmuir adsorption isotherm model. The maximum adsorption capacity of Cu(II) ions by the NCA from the Langmuir isotherm model was 173.62 mg/g. The mesoporous adsorbent exhibited higher adsorption capacity compared with some other reported diverse materials. In the multi-component system, the competing ions did not significantly interfere in the adsorption of Cu(II) ions. The adsorbed Cu(II) ions was effectively eluted with 0.25 M HCl and remain the almost same functionality for many cycles use. Even in seven consecutive cycles, the adsorbent showed great potential in the optical Cu(II) ions removal from wastewater. The proposed nano-composite adsorbent also could be used a promising adsorbent for the clean-up of Cu(II) ions in wastewater treatment.

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Nanosilica and Polyacrylate/Nanosilica: A Comparative Study of Acute Toxicity

Yingmei Niu

Capital Medical University, China

Objective: To document and compare the acute toxicity of nanosilica and polyacrylate/nanosilica in a rat model.

Methods: Healthy 8-week-old male Wistar rats (n = 60) were randomly divided into 2 exposure groups or a saline control group. Animals were exposed to either nanosilica, or a polyacrylate/nanosilica composite emulsion via intratracheal instillation. Blood was drawn and analysed at 2 time points, 24 hr. and 72 hr. post exposure. For each group pH, PO2 and PCO2 of arterial blood were measured, as well as white blood cell count (WBC), neutrophil, and monocyte count. In addition, serum alanine aminotransferase (ALT) and lactate dehydrogenase (LDH) were measured in each group to monitor liver function. To assess pulmonary injury, ultrasound imaging was performed 120 hr. post intratracheal instillation.

Results: Exposure to nanosilica and polyacrylate/nanosilica showed a 30% mortality rate with no changes in mortality observed in the saline group. When compared with saline-treated rats, animals in both exposure groups exhibited a significant reduction of PO2 ($P<0.05$) at both 24 and 72 hr. post exposure. Both exposure groups exhibited a significant reduction of neutrophils in arterial blood compared to saline controls ($P<0.05$) 24 hr. post exposure. Additionally, the level of ALT and LDH measured in the blood of both exposure groups was found to be significantly increased ($P<0.05$) over control animals 24 hr. post exposure. As an indication of injury, the pleural cavity of exposed and control animals was examined using ultra sound imaging. There was no evidence of pleural effusion or pericardial effusion in the rats treated with saline. The nanosilica exposed group exhibited bilateral pleural effusion and pericardial effusion, while animals exposed to polyacrylate/nanosilica exhibited only left pleural effusion as well as pericardial effusion indicating injury in both exposure groups

Conclusions: Respiratory exposure to polyacrylate/nanosilica and nanosilica is likely to cause multiple organ toxicity and their toxicities are comparable in exposed animals.