2308th Conference

Materials Science & Crystallography 2018

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November 07-08, 2018 | Atlanta, USA

Scientific Tracks & Abstracts

Day 1

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Transient expression of monoclonal antibody and bispecific fragments and fragment/antigen complexes for pharmaceutical discovery research

Ramesh Iyer
AbbVie Inc., USA

Fragments, such as F(ab) and $F(ab')_2$ and fragment complexes are widely required for various research and development activities in biopharmaceutical discovery. We describe the production of fragments (F(ab) and $F(ab')_2$) from a variety of parent molecules (monoclonal antibody and DVD-Ig) and frameworks (mIgG1, mIgG2a, huIgG1, huIgG4) by transient expression in HEK293 cells. The method eliminates the need to use enzyme digestion of parent molecules. We have also developed a route for the production of fragment/antigen complexes by direct co-expression in HEK293 for crystallization purpose that allows for higher throughput screening of F(ab) and/or antigen constructs. The resulting products were characterized by biophysical techniques and crystallization experiments demonstrated that the fragments and fragment/antigen complexes produced diffraction quality crystals suitable for X-ray crystallographic analysis.

Biography

Ramesh Iyer has completed his PhD from the University of Kentucky (Lexington, KY) and Postdoctoral studies from the University of Georgia (Athens, GA). He is a Sr Scientist in the Global Biologics group at AbbVie Inc. His group supports the research and development of biologics for various therapeutic areas within AbbVie Discovery.

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Notes:

Gen Long, Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C8-035

X-ray diffraction and nanostructures based third generation solar cell

Gen Long
St John's University, USA

Nanostructures based third generation solar cell presents a promising future of inexpensive, highly-efficient and scalable new generation of solar cell industry. Various nanostructures, materials systems and device architecture have been extensively studied; yet in all of the advantages and disadvantages co-exist. XRD, as a characterization tool, provides unique insight into the materials compositions, device and device performance and stability, etc. In this talk, an overview of the recent progress in nanostructures based third generation solar cell will be given. Different approaches to overcome the limits in the nanostructures based solar cell will be discussed as well.

Biography

Gen Long received his BS in Physics from Shandong University, China and his PhD in Physics from University at Buffalo. He worked in Global Foundries (US) as senior integration engineer on 14nm FinFET technology before joined St John's University as Assistant Professor in Physics. His research area mainly focuses on the synthesis, characterization and device applications of novel metal and semiconductor nanostructures (nanoparticles, nanowires, nanorods, nanodiscs, nanoplatelets, etc. made by solution-phase or gas-phase growth). He is an active member of APS, MRS and AAPT.

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Notes:

Lance Hubbard, Res. Rev. J Mat. Sci. 2018, Volume 6
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Rugged nanoparticle tracers for mass tracking in explosive events

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Pacific Northwest National Laboratory, USA

Tracing the flow of solid matter during explosions requires elements with uniquely identifiable signatures. Pigments tagged with luminescent core-shell nanoparticles (CSNPs) can have tunable photoluminescence (PL) depending on the material composition and core/shell thicknesses. The particles can be ruggedized with thick silica encapsulate to protect the luminescent inner architecture during finite periods of elevated temperatures. Incorporation of the CSNPs into a matrix allows for identification (ID) of debris originating from the tagged material. Five types of zinc sulfide quantum dots were synthesized and isolated in silica shells. The shelled dots were molecularly bound to five commercially obtained luminescent powders. The combination of 5 dots and 5 powders enables a matrix of 25 unique pigments that can be applied for mass tracking and model confirmation. The 25 pigments have spectral components that luminesce under different wavelengths. The use of commercial pigments enables field identification for collection and CSNPs allow for laboratory confirmation of the origin of the mass. The bound powders and luminescent CSNPs were suspended in a hydrated silica gel pending incorporation into materials. Finally, the mass tracking pigments were incorporated into temperature resistance paints, synthetic stone and controlled porous glass. The incorporation of temperature resistant CSNPs and commercial pigments has enabled unique identifiers, which allow for the tracking of mass through explosive events and other inaccessible environments.

Biography

Lance Hubbard has completed his PhD in Chemical Engineering from the University of Arizona. He is currently a staff materials scientist at Pacific Northwest National Laboratory focusing on nanomaterial integration and semiconductor-based detector design. He has papers and patents related to nanomaterials integration into semiconductor processes, corrosion of ceramics under monatomic oxygen, electroless deposition of metals and Raman/radio interference based spectroscopy for industrial process control. Current research includes studies on nanoparticles for mass tracking, production modeling of uranium fuel foils and AlGaN avalanche photodiode structures.

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Heterospin crystal: New sensor to the external pressure

Victor Ovcharenko
International Tomography Center, Russia

Stable organic radicals are valuable tools for solving a wide variety of fundamental problems. Among these, nitroxides are the most persistent organic paramagnets which widely used in the synthesis of heterospin compounds. Reactions between the transition metal and nitroxides are convenient and effective methods for the synthesis of different multispin molecules. The sensitivity of their magnetic properties to the local environment and intramolecular effects, as well as long half-lives, make them attractive tools in various fields, especially in molecular magnetism, biochemistry, biophysics and materials science. They are promising as contrast agents for magnetic resonance imaging. They have always attracted the attention of researchers as multispin building blocks, which were used for the synthesis of heterospin molecular magnets. Recently, Cu(II) complexes with nitroxides were used to create breathing crystals. When the temperature or/and pressure changes, the solid compounds undergo structural rearrangements accompanied by magnetic effects similar to spin crossover. The observed anomalies are caused by the reversible spatial dynamics of Jahn-Teller coordination units containing heterospin exchange clusters. The high mechanical stability of the multispin crystals, i.e., their ability to be reversibly compressed and expanded in the temperature range of phase transition, underlies the term 'breathing crystals'. Reversible single crystal to single crystal polymerization–depolymerization coordination reactions for a transition metal complex with stable organic radicals initiated by variation of temperature was found too. It was found that transition metal complexes with kinetically stable nitroxides are promising compounds that can serve as a new type of highly sensitive sensor to the external pressure. Noteworthy, structural rearrangements in breathing crystals can be essentially different. It depends on which parameter i.e. temperature or pressure was changed.

Biography

Victor Ovcharenko has his expertise in design of molecular magnets and investigation of spin transitions, "breathing crystals" and magneto-structural correlations in heterospin compounds. He developed new methods of selective synthesis of highly dimensional heterospin systems based on metal complexes with stable organic radicals, investigated magneto-structural correlations inherent in heterospin compounds, created a new type of breathing crystals and explained mechanical activity of these crystals (breathing crystals, jumping crystals, dancing crystals).

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Notes:

James Kennedy, Res. Rev. J Mat. Sci. 2018, Volume 6
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Multinational rare earth materials value chain and research facility

James Kennedy
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The United States, Japan, Korea, the EU and the rest of the world have found themselves entirely dependent on China for rare earths. The Chinese global rare earth monopoly dominates at all levels, from resource production, to metallurgy, to new applications, to new patent applications. With China dominating the production and internal consumption of at least 85% of all value added rare earth materials, in a politically saturated environment of material science and techno-economic leadership, it will continue to lead the world in future material science developments. The non-Chinese world's contribution to rare earth related material science developments will shrink in China's rear view mirror. Non-Chinese efforts to compete in the production of rare earth resources have mostly ended badly. Resources like rare earth oxides have no meaningful technology or defense application. China dominates the world in resource, oxide and post-oxide materials production. China has used its multi-level monopoly to capture much of the world's rare earth dependent technology and industry. This is a significant problem because advances in material science are largely stimulated by the competitive economic pull of a vibrant technology sector. Today most of the world's advanced rare earth technology applications happen in China. How does the non-Chinese world compete with this state sponsored juggernaut? The current administration is considering the establishment of a multi-national rare earth resource and value chain that could act as a modern Bell Laboratory for its non-Chinese members. The proposal calls for a privately owned and operated facility that would act as a cooperative for all of its owner/end-users: diverse technology companies from around the world. The cooperative would utilize rare earth resources that are currently mined, but disposed of to avoid the 1980 NRC & IAEA regulations which helped create China's monopoly and would be impervious to Chinese price manipulation.

Biography

James Kennedy has spent nearly 10 years working on this issue at the federal and international level. He was an invited expert speaker at the United Nations IAEA conference, the European Union rare earth conference and has had meetings with the current and previous Administration, the Pentagon and the House and Senate Armed Services Committees. His proposal is currently under consideration with the current Administration. He earned a Master's degree in Political Economics and Public Policy from Washington University, St. Louis.

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Notes:

Orly Dym, Res. Rev. J Mat. Sci. 2018, Volume 6
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The impact of crystallization conditions protein constructs and space groups on structure based drug design

Orly Dym
Structural Proteomics Unit, Israel

The 3D structure of apo proteins and proteins with inhibitors provide the basis for structure-based drug design studies and is also utilized in docking procedures to search for more potent drug. Specific examples for drug design of Acetyl Cholinesterase (AChE) and Phosphotriesterase (PTE) using X-ray crystallography will be presented. Comparative analysis between the computational docking drug design approach and the AChE crystal structures reviled that the position of the ligands within the active-site gorge of the enzyme is influenced by the crystallization conditions. Spectroscopic evidence and thermal stability results supported such a difference in ligand positioning. These results have implications for structure-based drug design using docking procedures. We also analyzed nineteen crystal structures of the apo and several phosphonate (OP) analogs bound to few highly evolved PTE variants. In addition to providing insights into the binding modes of OPs into the active site of the different PTE variants, the data reveal the importance of tags used for protein expression, the 'choice of the appropriate' crystallization conditions, the protein constructs and the space groups and their implications for structure-based drug design.

Biography

Orly Dym completed her PhD in 1994 from the Weizmann Institute of Science, Israel under the supervision of Prof Joel Sussman and postdoctoral studies from the University of California Los Angeles, under the supervision of Prof David Eisenberg. Since 2003 she is the Crystallographer at the Structural Proteomics Unit (SPU), Weizmann Institute of Science, Israel. For the last 15 years she has been a member of the SPU where she lead the unit of protein crystallography which include protein crystallization, elucidating the three-dimensional (3D) structure of proteins. She had determined the 3D structure of 350 proteins and protein complexes, some related to human disease and others including engineered non-natural enzymes and non-natural protein complexes. Some has contributed to the development of drugs, while one has directly benefited enzyme replacement therapy for a human disease. In addition, she has carried out detailed structural analysis on many of these structures, which has greatly aided the understanding the correlation between 3D structure, function, selectivity and stability. She has published more than 50 papers in reputed journals, 10 of which as first author.

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Notes:

Olga Tsurtsumia et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Microstructure and high temperature properties of Al rich diffusion zone on the surface of 9% Cr steel P92

Olga Tsurtsumia[1], **Elguja Kutelia**[1], **Maria Mosquera**[2], **Nicole Wollschläger**[2], **Benjamin Gregoire**[3], **Tengiz Kukava**[1], **Fernando Pedraza**[3], **Axel Kranzmann**[2] and **Sayavur Bakhtiyarov**[4]
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[2]Bundesanstalt fur Materialprufung und Forschung, Germany
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[4]New Mexico Institute of Mining and Technology, USA

The state of the art steam power plants operated on fossil fuels as well as renewable power generating systems require the wide range of the parts and the unites made of the high temperature resistant materials. It is known that one of the possible ways of increasing the overall efficiency of the plants in the course of reduction in the emission of carbon containing pollutants in the atmosphere is the rising of working temperatures in some of their critical segments. This, in its turn, requires modernization and optimization of the already existing HT materials. P92 is a commercially available ferritic/martensitic 9% Cr steel which is widely used in the power plants at the temperatures up to 600^{O}C, meeting all crucial requirements from the mechanical- and corrosion resistance standpoints. But the foreseen increased operating temperatures in the future power plants are envisaged to be far beyond those P92 steel was designed for. Improvement of the high temperature oxidation resistance of this steel through the application of Al coating by slurry method was successfully accomplished. HT discontinuous oxidation tests were performed on slurry aluminized and uncoated P92 samples in the laboratory atmosphere for 3000 hours at 650^{O}C and 750^{O}C. In contrast to the uncoated P92, which is a chromia former material, TGO on slurry aluminized steel P92 was found to be alumina. The considerable decrease in the oxide growth rate was detected on the aluminized samples at both oxidation temperatures. The microstructure of the Al diffusion zone and that of the protective oxide scale developed during long term HT experiments was comprehensively studied from the top surfaces and cross sections of samples. For that the SEM/EDS, FIB (slicing tomography mode), XRD and EPMA methods were complexly utilized.

Biography

The presenting author is research professor at the Republic Center for Structure Research of the Georgian Technical University, Georgia. She has a proven track record in the field of materials science and is well known in high temperature corrosion community. She has a very wide international working experience and longtime collaboration with the researchers in the materials field from Germany, France, USA and Spain. She has more than 50 publications and has been PI of many national and international scientific research projects already accomplished or ongoing. Dr.Tsurtsumia is an Alexander von Humboldt fellow and two fold Fulbright scholar.

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Notes:

Juan Carlos Salcedo Reyes, Res. Rev. J Mat. Sci. 2018, Volume 6
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SERS stem cells bio-sensor based on Au/ SiO_2 colloidal crystals substrates

Juan Carlos Salcedo Reyes
Pontifical Xavierian University, Colombia

Colloidal crystals (CC) are self-assembled metamaterials with a periodic refractive index fabricated from colloidal SiO_2 or polystyrene spheres. Lately, different structured porous films template by CCs are being used as substrates in Surface-Enhanced Raman Spectroscopy (SERS). Taking into account that, due to the localized surface plasmon resonance phenomenon, SERS substrates should satisfice conditions of nanoscale structure (porosity), periodicity and chemical stability, in this work, we use a thin film (50 nm) of gold sublimated on a 250 nm SiO_2 based CC in order to detect changes of cellular biochemistry of stem cells by SERS.

Biography

Juan Carlos Salcedo Reyes has completed his PhD at Cinvestav, México D.F., postdoctoral research at University of Texas at Dallas and Instituto de Ciencia de Materiales, Madrid, Spain. More than 30 scientific papers, 1 Colombian patent and 1 US patent. Editor in chief, Universitas Scientiarum (Scientific journal of the faculty of sciences, Universidad Javeriana, Bogotá D.C., Colombia)

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Notes:

Renal Backov, Res. Rev. J Mat. Sci. 2018, Volume 6
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Inorganic, hybridized and living macrocellular foams: "Out of the box" heterogeneous catalysis through the integrative chemistry input

Renal Backov[1,2]
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[2]Massachusetts Institute of Technology, USA

We will show how when combining chemistry and the physical chemistry of complex fluids, we can trigger the design of highly efficient heterogeneous catalysts. We will thus focus the topic on 3D-Macrocellular monolithic foams bearing hierarchical porosities and applications thereof toward heterogeneous catalysis where both activities and mass transport are enhanced. We will first depict the overall synthetic path, focusing on concentrated emulsions and lyotropic mesophases, acting as soft templates at various length scales. We will see how we can design cellular materials being either, inorganic, carbonaceous, hybridized or living ones where heterogeneous catalysis applications are addressed while considering respectively acidic, metallic, enzymatic or bacterial processes. Along, we will demonstrate how the fluid hydrodynamic, the low molecular hindrance and the easiest accessibility occurring within these foams are offering advanced "out of the box" heterogeneous catalysis whatever acting in batch, on-line or when dedicated toward cascade-type chemical reactions. Finally, we will depict the first CO_2 photo-reduction process acting in volume and not on the surface anymore, enhancing electronic density, minimizing foot-print penalty as well as back-reactions.

Biography

Renal Backov obtained his PhD in 1997 at the University of Montpellier II, France. After being Associate Researcher at the University of Florida, to address inorganic chemistry, he was hired as Associated Professor at the University of Bordeaux in 2001 while being full Professor since 2010. He is currently invited Professor at the MIT. With more than 140 articles, 35 patents and 350 contributed papers, his field of research encompasses the domains of energy conversion (hydrogen storage, batteries, biofuel cells), drug delivery, sensors, heterogeneous catalysis (enzymatic, metallic, bacteriologic), photocatalysis, photonics and beyond.

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Notes:

Bruce S Hudson, Res. Rev. J Mat. Sci. 2018, Volume 6
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Polymorphic hydrogen bonded, disordered and photoreactive crystals

Bruce S Hudson
Syracuse University, USA

Studies in hydrogen-bonded molecular crystal polymorphism will be presented with emphasis on the effect of replacement of the exchangeable H by D on the relative stability of polymorphic forms due the zero point and thermal vibrational effects, the use of periodic density function computations of crystalline state vibrations to understand the observed isotope effects and the use of spectroscopic methods, Raman and vibrational inelastic neutron scattering, to test the computations. The case of barbituric acid will be emphasized. In this case, it has been found that the most stable crystal is the monoenol rather than triketo despite the fact that the enol in isolation is much higher in energy (Angew. Chem. Int. Ed. 2016, 55, 1309 –1312 and cited work.) Urea channel inclusion host guest crystals (UIC's) containing 1,4-diiodobutadiene as the guest is found (Cryst. Growth Des. 2013, 13, 3852–3855) to be commensurate and fully ordered, a rare but not unknown observation for this class of materials. The terminal iodine atoms are in contact in the channel. If these crystals are irradiated with UV light the iodine atoms are cleaved and oligo-diiodopolyenes are formed as indicated by Raman spectra. (Mater. Res. Soc. Symp. Proc. Vol. 1799 DOI: 10.1557/opl.2015.486). The crystal mass shows progressive loss of weight as the reaction proceeds. The product of this process will be polyacetylene. It has been anticipated that this material will be metallic without doping due to the lack of bond alternation. (J. Mol. Struct. 1032 (2013) 78–82). It may exhibit room temperature superconductivity.

Biography

Bruce S Hudson received his Bachelor's and Master's degrees from the California Institute of Technology in Chemistry and Biophysical Chemistry respectively and his PhD in Physical Chemistry from Harvard University in 1972. His thesis research with Roy Gordon involved the computation of inelastic neutron scattering spectra and that with Bryan E Kohler involved the electronic spectroscopy of linear conjugated polyenes. He is the author of over 200 publications and has served on NIH and NSF review panels.

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Notes:

Filip Prusa et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Properties of mechanically alloyed Fe-Al-Si alloys compacted by spark plasma sintering

Filip Prusa, Jakub Sestak, Oceane Alicia Gillet and **Slawomir Cygan**
University of Chemistry and Technology Prague, Czech Republic

The Fe-Al-Si alloys are of interest due to their excellent properties including high hardness, strength, wear resistance and resistance against high-temperature oxidation. In many cases, the properties of such alloys are comparable or even outperforms the stainless steels or nickel super alloys. Since the chromium can be again considered as a critical raw material which shortage might influence a wide range of possible applications, the Fe-Al-Si-based alloys can be utilized as a viable substitution. The $Fe_{80}Al_{20}Si_{20}$ (wt. %) alloys were prepared by mechanical alloying (MA) and compacted by spark plasma sintering (SPS) technique. The influence of either the conditions of MA and consequential compaction via SPS on the resulting microstructure, phase composition and mechanical properties was evaluated. For the mechanical alloying, the amount powder batch 5 or 20 g was tested in relation to the kinetics of phase's formation as well onto the overall character of microstructure and mechanical properties. The compaction via SPS combined pre-loading prior to reaching compaction temperature and vice versa while current flow characteristic variations were also tested. Moreover, the high-temperature high-pressure compaction (HTHP) done at several orders of magnitude higher pressures of approximately 6 GPa was also tested. Based on the results, the proper conditions for mechanical alloying and consequential compaction were chosen to yield maxima of the materials.

Biography

Filip Prusa has completed his PhD at the age of 30 years from University of Chemistry and Technology Prague. He is working at the Department of Metals and Corrosion Engineering as the assistant professor. He has published 64 papers in reputed journals and conference proceedings and has been serving as a reviewer for several journals.

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Day 2

Ali Al-Mafarage et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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The properties of multifunctional two dimension nanocomposite produce by Langmuir-Blodgett technique base on using single-walled carbon nanotubes

Ali Al-Mafarage and **Maher S Amer**
Wright State University, USA

A real single layer (monolayer) films of unmodified zigzag (18,0) single-walled carbon nanotubes by using Langmuir Blodgett (LB) technique have been processed. Measurements of their properties in bundles which include stress-strain behavior (mechanical properties) and optoelectrical properties that related to the structural of tubes are applied. Both theoretical and experimental methods are applied together to confirm the results. The produced films were highly oriented as determined by polarized Raman spectroscopy and shown by scanning tunneling microscopy (STM), High Resolution Transmission Electron Microscopy (HRTEM). None of the chemical or surfactant treatments are applied in this study. The produced films are tested separately, then they use with matrix which is Poly (methyl methacrylate) (PMMA) to form nano composite by using two methods. Direct mixing method and insitu polymerization technique. The behaviors of the produced composites are discussed also, and the main characterizations and properties for those composites are observed.

Biography

Ali Al-Mafarage has an MSc in Civil Engineering (structure) from AL-Nahrain University in 2005 from Iraq. Also, earn MSc in Material Science in Engineering (nanotechnology) 2018 from Wright State University in the USA. His advisor is Professor Maher Amer at Wright State University. This work is a fellowship received from Higher Education Council of Iraq (HCED) to him to pursue his PhD degree at Wright State University in Material Science and Nanotechnology. He has submitted a paper, but it still under the reviewer section. He has represented in (AIAA) conference held in Dayton Ohio, 2018 as Speaker.

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Notes:

Tatsuya Shishidou, Res. Rev. J Mat. Sci. 2018, Volume 6
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Magnetic fluctuations in single layer FeSe

Tatsuya Shishidou
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Single layer FeSe films grown on $SrTiO_3$(001) (STO) have been an extensive focus because of their reported high superconducting critical temperature of 40-100K. Despite a lot of work done already, the nature of the paramagnetic state and the origin of superconductivity remains puzzling. Here we use density functional theory (DFT) spin-spiral calculations to address the paramagnetic and superconducting nature of the monolayer FeSe/STO. The spin-spiral energy dispersion E(q) is found to be extremely flat around the q=0 checkerboard (CB)-antiferromagnetic (AFM) configuration. Those q states in the plateau share similar electronic band structure. Mapping E(q) onto (extended) Heisenberg models places this S=1 spin system in a region of parameter space where CB-AFM quantum fluctuations lead to a magnetically disordered paramagnetic state. Modeling the paramagnetic state as an incoherent superposition of spin-spiral states arising from thermal/quantum fluctuations, the electronic spectrum around the Fermi level closely resembles that observed by angle-resolved photoemission spectroscopy. A superconducting theory is developed within a symmetry-based $k{\cdot}p$ like method with the electrons coupled to CB-AFM type spin fluctuations; this model provides a robust prediction of nodeless d-wave superconductivity and naturally explains the experimental finding of fully-gapped yet anisotropic order parameter.

Biography

Tatsuya Shishidou, a native of Japan, received his Master degree in Physics (1996) from Osaka University and his PhD in Physics (1999) from Hiroshima University. He was a Research Associate at Northwestern University, Illinois with Prof AJ Freeman from 2000 to 2003. He was an Assistant Professor at Hiroshima University from 2003 to 2016. In 2016, he joined the University of Wisconsin-Milwaukee. He is currently an Associate Scientist working with Prof M Weinert. He is author and co-author of over 50 scientific publications.

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Notes:

Ming Yue Lee, Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C8-035

Serial crystallography of a G-protein coupled receptor using polychromatic synchrotron radiation source

Ming Yue Lee
Arizona State University, USA

Since the first successful serial crystallography (SX) experiment at synchrotron radiation sources, the popularity of this approach has continued to grow, showing that 3rd generation synchrotrons can be viable alternatives to scarce X-ray free electron laser sources. Synchrotron radiation flux may be increased about 100 times by a moderate increase in bandwidth ("pink beam" conditions) at some cost in data analysis complexity. Here, we report the first high-viscosity injector-based pink beam SX experiments. The structures of A_{2A} adenosine receptor (A_{2A}AR) and proteinase K (PK) were determined to 4.2Å and 1.8Å resolution using 24 and 4 consecutive 100 ps X-ray pulse exposures, respectively. Strong PK data were processed using existing Laue approaches, while weaker A_{2A}AR required an alternative data processing strategy. This demonstration of the feasibility presents new opportunities for the time-resolved experiments with micro-crystals to study structural changes in real-time at pink beam synchrotron beamlines worldwide.

Biography

Ming Yue Lee is an expert in macromolecular crystallography with focus on technology development and implementation in novel membrane protein crystallization and diffraction methods. He has made contributions in the field of GPCR structural biology in the forms of active participation and validation of serial femto-second crystallography using XFEL sources, as well as being involved in validation of delivery mechanisms for various cutting-edge diffraction experiments both at XFEL and synchrotron radiation sources. He is actively leading and driving the effort to develop and implement technology that can enhance and optimize serial crystallography at polychromatic synchrotron radiation sources. His current focus is building up a system approach to study membrane protein structure-function relationships between different components of the cellular membrane environment with an emphasis on spatial and temporal resolution of proteomic interactions.

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Hybrid photoresists based on organic metals clusters and ligands

Davoud Dastan and **Hamid Garmestani**
Georgia Institute of Technology, USA

Hybrid photoresists were prepared based on organic metal clusters decorated with organic ligands on silicon substrates using sol-gel and spin coating techniques. The resist was spun on a silicon substrate at 3000rpm for 30 seconds and then dried at ambient condition. The size of nanoparticles and hybrid materials was measured using Zetasizer. These films were annealed at different temperatures for 30 seconds so as to remove the possible solvent on the surface and develop hybrid photoresists. The resists were exposed to extreme ultraviolet (EUV) irradiation and deep ultraviolet irradiation (DUV). The structural, thermal, molecular, elemental/compositional, morphological and physical properties of metal nanoclusters and hybrid photoresists were investigated using X-ray diffraction (XRD), Raman spectroscopy, nuclear magnetic resonance (NMR), electrospray ionization-mass spectrometry (ESI-MS), Fourier transform infrared (FTIR) spectroscopy, energy-dispersive X-ray diffraction spectroscopy (EDS), X-ray photoelectron spectroscopy (XPS), selected area electron diffraction (SAED) and field emission scanning electron microscopy. The parameters such as phase development, thermal stabilities, nature of chemical reactions, elemental/compositional analysis before and after ozone treatment, ligand cleavage under EUV exposure, surface morphology, particles size, surface area, cluster's ligands contribution to the solubility difference between exposed and unexposed areas triggered under EUV radiation, molecular weight and distribution of the different molecular species present in photoresists, mechanism of patterning EUV hybrid photoresists, lithography performances of the hybrid photoresists were evaluated using the above characterization techniques.

Biography

Davoud Dastan is a Research Associate at Georgia Institute of Technology. Prior to his appointment at George Tech., he was a Post-doc fellow at Cornell University, Ithaca, New York, USA. He is working on nanomaterials for energy applications. He has published several papers and has been serving as an Editorial Board Member of repute.

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Facile one-step synthesis of porous graphitic carbon nitride nanosheets/oxidized multi-wall carbon nanotubes composite for simultaneous anodic stripping voltammetric detection of heavy metals in food samples

Vinoth Kumar Ponnusamy and **Ramalingam Manikandan**
Kaohsiung Medical University, Taiwan

We demonstrate a facile one-step synthesis of three-dimensional (3D) porous graphitic carbon nitride nanosheets (P-g-C_3N_4-NSs)/oxidized multi-wall carbon nanotubes (O-MWCNTs) composite by simultaneous chemical oxidation of bulk g-C_3N_4-NSs and bulk MWCNTs. This one-step chemical oxidation method results in the simultaneous formation of acid functional groups on the basal surfaces of both g-C_3N_4 and MWCNTs and also the formation of the porous structure of P-g-C_3N_4/oxidized MWCNTs composite at the same time. The acid functionalization and surface morphology of the prepared P-g-C_3N_4-NSs/O-MWCNTs composite were examined using attenuated total reflectance infrared spectroscopy (ATR-IR), X-ray diffraction methods (XRD) and high-resolution transmittance electron microscopy (HR-TEM). The electrochemical properties of the P-g-C_3N_4/O-MWCNTs composite modified screen-printed electrode (SPE) was studied using cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS) and differential pulse voltammetry techniques (DPV). P-g-C_3N_4/O-MWCNTs/SPE exhibits excellent sensitivity and selectivity towards the simultaneous detection of heavy metals (Cd, Hg, Pb & Zn) in food samples with the detection limits (S/N=3) ranging between 8 to 60ngL^{-1} under stripping analysis. The practical feasibility of the developed sensor was examined for simultaneous detection of heavy metals in various food samples and the obtained results exhibit good accuracy and good reproducibility. These results imply that the developed composite might be an alternative sensor material for practical applications in electrochemical detection of heavy metals in foods.

Biography

Vinoth Kumar Ponnusamy has completed his PhD at the age of 26 years from NCHU, Taiwan and Postdoctoral studies from NCHU School of Chemistry. Currently, he is an Assistant Professor in Department of Medicinal and Applied Chemistry, Kaohsiung Medical University, Taiwan. He has published more than 25 papers in reputed journals and has been serving as an Editorial Board and peer-review member of repute.

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Self-healing PMMA nanocomposites

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Poly (methyl methacrylate) (PMMA) is a wiedly used thermoplastic polymer material because of its advantages including light weight, easy processability, high impact resistance, chemical stability, high resistance to weathering and excellent heat resistance etc. PMMA is an ideal candidate for aerospace, automotive, marine applications. However, long-term durability and reliability of polymeric materials are still problematic when they serve for structural application. Hence, in this study we added several nanomaterials to improve the weak properties of PMMA. PMMA was synthesized by Atom Transfer Radical Polymerization (ATRP) technique; nanofillers are dispersed at 5 different concentration levels such as 0.1, 0.25, 0.5, 1.0 and 2.0 wt. % via *in situ* polymerization method. The changes in the properties of PMMA nanocomposites examined by SEM, TGA/DSC tensile, impact and hardness tests. PMMA nanocomposite with the low nanofiller loading ratio showed noticeable enhancements in their mechanical and thermal aspects. In this study, we also synthesised self-healing PMMA nanocomposite. Encapsulate GMA was served as self-healing agent. Emulsion polymerization was applied to encapsulate GMA with poly (melamine-formaldehyde) (PMF) as the wall substance. GMA was added to PMMA nanocomposite solutions via melt compounding method. Self-healing performance of the PMMA nanocomposites was evaluated via impact test.

Biography

Maihemuti Maimaitituersun completed his Master study in 2017 from department of Physics Engineering, Istanbul Technical University. Now he is continuing his Ph.D. Study in department of Physics Engineering, Istanbul Technical University.

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Milissa Kate, Res. Rev. J Mat. Sci. 2018, Volume 6
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The optimized PV-UPFC hybrid network for power quality improvement load by an improved distribution algorithm: A best performance from combination of the proposed PV systems and unified power quality controllers

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Combining active filters and renewable sources, in particular photovoltaic systems, allows us to take advantage of power enhancers in delivering high quality pollution free power to consumers. Due to the numerous applications of the solar system, the present study has taken into consideration a different type of its applications, so that by combining UPQC and PV systems in areas nearby loads, which have high potential of radiation, one can improve the quality of electrical energy delivered to consumers. Therefore, the present study aimed to design a proposed system (UPQC-PV) considering control of the active filter, the photovoltaic system's maximum power point tracking and DC-link voltage control strategy. The results obtained from the present study indicated that compensating the parallel active filter leads to remove the unwanted current at the end of the network and also compensating the series active filter leads to compensated voltage drop in the network.

Biography

Milissa Kate is a young and now PhD candidate in Department of Automatics, electronics and Telecommunications, University of Bejaia and received her PhD degree in September, 2016 at the age of 25 years. Her current research interests include Robotics, Automatics, adaptive and robust control, Photovoltaic and its Controls, Artificial Neural Network and Fuzzy Logic Theory. She is author of many research papers published at both International and National journals, Conference proceedings.

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High entropy CoCrNiFe-X alloys prepared by mechanical alloying

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High entropy alloys (HEAs) have been the most studied group of materials in recent years. HEAs are usually composed of five or more principal elements whose concentration varies from 5–35%. These alloys exhibit exceptional mechanical properties, including high strength and plasticity and good corrosion and wear resistance. They are typically characterized by four effects comprising the high entropy effect, the lattice distortion effect, the sluggish effect and the cocktail effect. Up to this time, HEAs have been produced mainly by traditional melt-metallurgy processes especially by arc or induction melting, followed by the final processing techniques to achieve desired microstructure, mechanical properties and shape. Current researches have been focused on powder metallurgy routes combining mechanical alloying and appropriate compaction technique that may mitigate the undesirable microstructural coarsening. In this work, equiatomic CoCrNiFe-X (X-Mn, Nb) alloy was prepared by a combination of mechanical alloying and spark plasma sintering. Further, the same alloy was also prepared by conventional induction melting for comparison. The effect of sintering temperature and of the preparation on microstructure and mechanical properties was studied.

Biography

Andrea Skolakova has studied as a PhD student at the Department of Metals and Corrosion Engineering of University of Chemistry and Technology, Prague (UCT Prague). She was awarded by prestigious Votocek's stipend associated with publication activity that is granted to the most talented students. She is an author and co-author more than 25 papers indexed by Web of Science and Scopus.

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Facile synthesis of Ni-doped $ZnFe_2O_4$ nanoparticles supported on carbon black as an efficient electrocatalyst for oxygen reduction reaction in fuel cells

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Novel nanocomposite system Ni-doped $ZnFe_2O_4$ with carbon black was efficiently synthesized for oxygen reduction reaction (ORR) by a simple, scalable hydrothermal synthesis route. Face Centered Cubic (FCC) phase of the Ni-doped $ZnFe_2O_4$ nanocomposite was confirmed by X-Ray Powder Diffraction (XRD) analysis. The average particle size is calculated at 20nm. The as-synthesized Ni-doped $ZnFe_2O_4$/C nanocomposite displays enhanced ORR catalytic performance than pure $ZnFe_2O_4$, $ZnFe_2O_4$/C and Ni-doped $ZnFe_2O_4$/C, which mostly favors a desired direct 4e- reaction pathway in the ORR. The improved electrocatalytic performance of the Ni-doped $ZnFe_2O_4$/C nanocomposite is ascribed to the doping of Ni atoms in zinc ferrite with carbon black, which affects the lattice parameter of crystal structure, particle size and specific surface area and the strong coupling of with carbon black.

Biography

Maryam Kiani obtained her MPhil degree from National University of Science and Technology (NUST) Islamabad, Pakistan. She is currently doing PhD at College of Material Science and Engineering Sichuan University China and doing research on Energy Materials and Devices under the supervision of Prof Ruilin Wang. Her research is focused on the non-noble metal catalyst for fuel cells.

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Fiber reinforced magneto polymer matrix composites

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Magneto polymer matrix composites (MPMC) are a new class of magnetic polymer materials which have evolved as potential materials for tomorrow's aircraft structures. They encompass magnetic, particulate strengthening (dispersion strengthening) as well as fiber reinforcement/strengthening characteristics which are sought out to be utilized toward making efficient future aerospace composite materials. Various types of ferrites including barium, cobalt, iron and strontium were explored for being used in making new composites. In the present talk, I will present a general overview of the synthesis, structure, properties, thermodynamics, surface chemistry and phase transformations of individual ferrites and clusters of ferrites as fillers. A discussion about control of properties with the surface functionalization, modification, emulsification/compounding/blending, heat treatment (phase transformation and separation) and control of processing conditions (temperature, pressure and geometry of mold) will be presented. These smart materials have a wide range of potential applications in medicine, drug delivery, bioimaging, biomarking, tissue engineering, electromagnetic interference (EMI) and electromagnetic force (EMF) shielding and as competent materials for aerospace structural applications.

Biography

Muhammad Musaddique Ali Rafique has completed his PhD in 2018 from RMIT University, Melbourne, Australia. His areas of expertise are; metallurgy, materials science, additive manufacturing and modeling and simulation. He is a member of MRS, TMS and other reputable societies. He has authored and coauthored more than 14 papers in reputed journals and has been serving as Reviewer and Editorial Board Member of reputed periodicals as well.

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