SMSE

World Symposium on Smart Materials Sciences and Engineering 2022

SMSE2022

Time: Oct. 28th–30th, 2022
Place: Hilton Munich City, Germany
Format: Hybrid

Conference Book

Committee

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Hosting Organization
Life and Medical Sciences Innovation Institute

Operating Organizations
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Welcome Remark

Dear Friends and Colleagues,

On behalf of the Organizing Committee, it is our great pleasure to welcome you to the World Symposium on Smart Materials Sciences and Engineering 2022 (SMSE), which is held during Oct. 28th-30th, 2022 in Munich, Germany.

The program of SMSE 2022 includes Plenary Forum, 7 Breakout Sessions with 30 Oral Speeches, Posters & Papers, and with main topics of Sensors & Sensing Technology, High-Precision Manufacturing and 3D Printing Technology, Frontier of Smart Materials and Biomaterials, Composite Materials and Polymer, Electronic Materials, Conductor and Semiconductor, Smart Materials & Technologies for Energy Conversion and Storage, Nano, Optoelectronic Materials and Optics Technology, and so on.

SMSE 2022 brings together the best scientists from universities, research institutes and the materials industry worldwide to share exciting results and to build new collaborations. Great ideas and top discoveries from participants will help develop novel aspects of materials development.

We hope you can join your peers in a highly interesting and engaging hybrid event with online and offline. Your presence and deliberation will make this congress remarkably successful.

Organizing Committee of SMSE 2022

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01:30 PM-03:15 PM	Online Session: High-Precision Manufacturing and 3D Printing Technology
03:30 PM-05:40 PM	Hybrid Session: Frontier of Smart Materials and Biomaterials (Room Lachner, Ground Floor)

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Program

Time: Oct. 28th-30th, 2022
Venue: Hilton Munich City, Germany

Online Session: Sensors & Sensing Technology
Chaired by **Dr. Nan Lv,** School of Chemical Engineering, Northeast Electric Power University, China
Time: 09:00 AM-10:20 AM, Oct. 28th, 2022 (Friday), Time Zone: GMT+2

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09:55 AM-10:20 AM	**Online Speech:** Time-Resolved Color Tunable Mechanoluminescence Materials for Anti-Counterfeiting Device and Stress Sensor **Dr. Jing-Tai Zhao,** Guilin University of Electronic Technology, China

Online Session: High-Precision Manufacturing and 3D Printing Technology
Chaired by **Dr. Tao Lai,** National University of Defense Technology, China
Time: 01:30 PM-03:15 PM, Oct. 28th, 2022 (Friday), Time Zone: GMT+2

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02:00 PM-02:25 PM	**Online Speech:** High-Precision Manufacturing of Metal Aluminum Reflector Mirror Surfaces **Dr. Tao Lai,** National University of Defense Technology, China
02:25 PM-02:50 PM	**Online Speech:** The Effect of Yttrium on Mechanical Properties of Hastelloy-X Fabricated by Selective Laser Melting Process **Mr. Banoth Santhosh,** Tokyo Metropolitan University, Japan
02:50 PM-03:15 PM	**Online Speech:** Influences of Post-Heat Treatment on the Microstructure Evolution and Creep Properties of Ni-Based Superalloy IN718 Fabricated by Electron Beam Melting **Mr. Thaviti Naidu Palleda,** Tokyo Metropolitan University, Japan

Hybrid Session: Frontier of Smart Materials and Biomaterials

Chaired by **Dr. Jie Xu,** Tianjin University, China

Co-Chaired by **Dr. Madleen Busse,** Munich Institute of Biomedical Engineering, Germany

Time: 03:30 PM-05:40 PM, Oct. 28th, 2022 (Friday), Time Zone: GMT+2

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Online Session: Plenary Forum

Moderator: **Dr. Ameersing Luximon,** EMEDS Ltd. (Hong Kong), China

Time: 07:30 AM-08:35 AM, Oct. 29th, 2022 (Saturday), Time Zone: GMT+2

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08:05 AM-08:35 AM	**Online Speech:** Functional Cement Composites with Nanoparticles for Sustainable Construction in the Prospect of Their Synthesis, Properties and Application **Dr. Agnieszka Slosarczyk,** Poznan University of Technology, Poland

Hybrid Session: Composite Materials and Polymer

Chaired by **Dr. Gideon Ayim-Mensah,** The University of the West of Scotland, UK

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Hybrid Session: Electronic Materials, Conductor and Semiconductor

Chaired by **Dr. Sepideh Akhbarifar,** The Catholic University of America, USA

Time: 09:30 AM-11:40 AM, Oct. 29th, 2022 (Saturday), Time Zone: GMT+2

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11:15 AM-11:40 AM	**Online Speech:** Synthesis of Zinc Oxide Semiconductor Nanoparticles for Light Absorption and Photocatalytic Activity **Dr. Gurjinder Singh,** Sri Guru Granth Sahib World University, India

Online Session: Smart Materials & Technologies for Energy Conversion and Storage
Chaired by **Dr. Shenghao Wang,** Shanghai University, China

Time: 09:00 AM-10:20 AM, Oct. 30th, 2022 (Sunday), Time Zone: GMT+2

Time	Presentations and Presenters
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09:55 AM-10:20 AM	**Online Speech:** Direct Evaluation of Charge-Carrier Mobility of Organic Semiconductor Thin-Films with Dynamic Charging Map **Dr. Wen-Shan Zhang,** Ruprecht-Karls University Heidelberg, Germany

Online Session: Nano, Optoelectronic Materials and Optics Technology
Chaired by **Dr. Peter Belobrov,** Siberian Federal University, Russia

Time: 12:30 PM-02:15 PM, Oct. 30th, 2022 (Sunday), Time Zone: GMT+2

Time	Presentations and Presenters
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01:00 PM-01:25 PM	**Online Speech:** Smart Diamond 2-5 nm **Dr. Peter Belobrov,** Siberian Federal University, Russia
01:25 PM-01:50 PM	**Online Speech:** Philosophical Issues Concerning the Sense of Movement **Dr. Maria Teresa Alvarez Mateos,** Universidad Complutense, Spain; Penn State University, USA
01:50 PM-02:15 PM	**Online Speech:** Light-matter Interactions in Low-dimensional Structures and Molecules **Dr. Mousumi Upadhyay Kahaly,** Scientific Application Division, ELI-ALPS, ELI-HU Nonprofit Ltd., Hungary

Online Session: Sensors & Sensing Technology

Chaired by **Dr. Nan Lv,** School of Chemical Engineering, Northeast Electric Power University, China

Time: 09:00 AM-10:20 AM, Oct. 28th, 2022 (Friday), Time Zone: GMT+2

Title: Application and Prospect of the Construction Technique for Nanoresistance Networks in Flexible Sensing Materials

Nan Lv[a*], Kongsen Hu[a], and Zhiwei Lyu[b]

Associate Professor

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[b]Shenzhen Wenirune Electronic Technologies Co., Ltd., Shenzhen 518172, P. R. China

Abstract

Flexible sensors have a wide range of applications in different fields, including human-machine interfaces, smart electronics, and robotics. The design and fabrication of these sensors usually have higher demands on the flexibility of the sensing materials and have strict technical requirements for miniaturization and easy processing of the sensing materials. However, most flexible nanofiber piezoelectric sensing materials rely on bottom and top planar electrodes or lattice electrodes to realize the electricity signal conduction, resulting in flexibility limitations, difficult-to-control sensor volumes, complicated structures, high cost and time-consuming manufacturing process, which limits their practical application. Here, we report the construction technique of nanoresistance networks via fabricating integrated eletrospun nanofibers to realize flexible miniature sensors. The nanoresistance network is composed of nanoscale conductive paths and piezoelectric elements. For the first time, the voltage signal generated by the piezoelectric material is collected and output based on the Wheatstone bridge principle through the nanoresistance network. Therefore, the flexible integrated nanofibers as an integrated sensing system without layer electrodes can directly generate voltage signals under repeated press-release actions. The integrated structure facilitates the collection of induced charges, enabling the material to have low-pressure detection limits and high linear sensitivity. At the same time, the conductive-piezoelectric nanoresistance networks can be used as a new feasible alternative material to replace the sensor array and lattice electrodes of traditional devices, and realize force localization by detecting the output voltage distribution of each section. In addition, the multifunctional sensing properties of integrated piezoelectric sensing materials based on nanoresistance networks are also explored.

Key Words: synchronous construction, nanoresistances networks, flexible piezoelectric sensors, Wheatstone bridge, electrospinning

Biography

Nan Lv is an Associate Professor of Northeast Electric Power University, China. She received her Ph.D. degrees from University of Chinese Academy of Sciences in 2017. Her research interests include the synthesis of functional materials with optical, electrical and magnetic properties, the development of smart electronic materials, physical and chemical sensors. She currently focuses on the design and synthesis of integrated functional materials for flexible touch sensor based on three-point electric potential method.

Title: Research on Target Parameter Estimation Method of Distributed MIMO Radar Under Non-Ideal Conditions

Haibo Song
Lecturer
College of Aerospace Science and Engineering
National University of Defense Technology
China

Abstract

Distributed multiple input multiple output (MIMO) radar shows great potential in high-precision measurement of target parameter by introducing MIMO diversity technology in wireless communication. As one of the key technologies of distributed MIMO radar, target location technology is still in its infancy. Compared with the direct localization method, the indirect localization method has higher efficiency and less data transmission, so it has attracted much attention in the field of distributed MIMO radar target localization technology. However, most of the existing indirect localization methods require the ideal situation that the position and speed of the transmitting/receiving node are accurately measured and the time and frequency between the nodes are synchronized. The problem of target localization in non-ideal situation, such as the measurement error of the position and speed of the transmitting/receiving node on the mobile platform, and the time and frequency synchronization error of the wide-area distributed transmitting/receiving node, is seldom studied. The author carry out the research on the indirect target localization method of distributed MIMO radar in terms of the non-ideal conditions. Specifically, the target localization problem when there are measurement errors in the position and velocity, the target localization problem in wide-area distributed transmitting/receiving nodes under satellite time synchronization of transmitting/receiving nodes, and the target localization problem in wide-area asynchronous distributed transmitting/receiving nodes are studied.

Key Words: Distributed MIMO radar, nonideal conditions, target parameter estimation, satellite time synchronization, cooperative target

Biography

Haibo Song received the B.S., M.S., and Ph.D. degrees from the National University of Defense Technology, Changsha, China, in 2014, 2016 and 2021, respectively. Now, he is a lecturer with College of Aerospace Science and Engineering, National University of Defense Technology. His research interests include target localization, radar signal processing and estimation theory.

Title: Time-Resolved Color Tunable Mechanoluminescence Materials for Anti-Counterfeiting Device and Stress Sensor

Jing-Tai Zhao
Guilin University of Electronic Technology
China

Online Session: High-Precision Manufacturing and 3D Printing Technology

Chaired by **Dr. Tao Lai,** National University of Defense Technology, China

Time: 01:30 PM-03:15 PM, Oct. 28th, 2022 (Friday), Time Zone: GMT+2

Title: Additive Manufacturing Technologies in the Development Chain of Microwave Components and Systems

Alex Shoykhetbrod
Research Scientist
Fraunhofer Institute for High Frequency Physics and Radar Techniques
Germany

Abstract

Additive manufacturing is a commonly used term for a manufacturing process where an object is created gradually layer-by-layer. Unlike conventional machining processes, material is selectively added instead of being removed. This particular feature allows fabrication of very complex shapes, which were not possible to fabricate with traditional machining processes. Furthermore, this technology has made a significant step forward in terms of used materials, tolerances and surface quality. The combination of all the above listed factors makes this manufacturing technology a strong candidate for rapid prototyping of mm-wave components. This talk discusses the use of state-of-the-art techniques such as selective laser melting and sintering at Fraunhofer FHR for manufacturing waveguides, dielectric antenna lenses, electromagnetic meta-surfaces and periodic structures.
As the density of electronic components increases due to miniaturization, the optimization of heat sinks has become a particularly important subject. In addition, weight reduction and size constraints of thermal management components are critical factors for applications with strict mass limitations, such as airborne systems. This talk will highlight the potential optimization strategies using additive manufacturing technology.
Key Words: additive manufacturing, 3D printing, lens antenna, radar, waveguide, periodic structures, SLS, SLM

Biography

Alex Shoykhetbrod was born in 1983 in Odessa, Ukraine. Alex received his Dipl.-Ing. Degree in Communication Engineering from the University of Applied Sciences Koblenz, Germany in 2009. In 2012, Alex received his Masters of System Engineering from the University of Applied Sciences Koblenz, Germany. In 2009, Alex joined Fraunhofer Institute for High Frequency Physics and Radar Techniques's Team in Wachtberg, Germany where his research interests have included development of FMCW Radar Systems, PCB Design and Application of Additive Technology in mm-Wave field.

Title: High-Precision Manufacturing of Metal Aluminum Reflector Mirror Surfaces

Tao Lai*, Junfeng Liu, Xiaoqiang Peng, and Chunyang Du
Assistant Researcher
School of Intelligent Science
National University of Defense Technology
China

Abstract

The surface of metal mirrors is often polished after single-point diamond turning. In practice, however, improvements in mirror quality are closely related to the polishing environment, polishing medium, and polishing force. If not adequately controlled, processing defects such as visible scratches can lead to the deterioration of surface roughness. Based on the surface of a metal reflector mirror, this study optimizes the configuration of magnetorheological figuring (MRF) fluid and polishing process parameters so that MRF high-efficiency surface modification can be realized and the scratch problem can be resolved. The processing method of a high-performance metal mirror is developed by studying the high-efficiency and high-precision processing technology based on small head smoothing. The main work and innovations are as follows: The motion error model of ion beam polishing machine tool is established and provides a basis for improving the machining performance of ion beam polishing machine tool. The evolution law of the surface quality of turned aluminum mirrors directly polished by ion beams is revealed, and the smoothing process is introduced to achieve effective recovery of the surface quality. The process constraints of ion beam polishing of aluminum mirrors are obtained, and a method for precise ion beam modification of free-form aluminum mirrors based on surface filtering is proposed to realize the manufacture of free-form aluminum mirrors with visible light diffraction limit accuracy.
Key Words: Processing technology; MRF; Metal reflector mirror; Sub-nanometer accuracy

Biography

Lai Tao received the Ph.D. degree in mechanical engineering from National University of Defense Technology in 2020. He is currently an assistant researcher of the school of intelligent science of the University of national defense science and technology. He is mainly engaged in research in ultra-precision machining and measurement, mechanical system dynamics, intelligent equipment design and support, etc. In the past five years, he has presided over or implemented more than 5 projects such as the National Natural Science Foundation of China, key R & D Program projects, national defense basic scientific research challenge plan, etc. He has published 17 papers, including 10 articles indexed by SCI and 4 papers indexed by EI as the first or corresponding author, and 12 patents as the chief author.

Title: The Effect of Yttrium on Mechanical Properties of Hastelloy-X Fabricated by Selective Laser Melting Process

Banoth Santhosh[a],Thaviti Naidu Palleda[a], Takuma Saito[b], Hideyuki Murakami[b,c], Koji Kakehi[a]

[a]Department of Mechanical Systems Engineering, Tokyo Metropolitan University, 1-1, Minami-Osawa, Hachioji-City, Tokyo 192-0397, Japan.

[b]Research Center for Structural Materials, National Institute for Materials Science, 1-2-1, Sengen, Tsukuba-City 305-0047, Japan.

[c]Department of Nanoengineering and Nanoscience, Waseda University, Tokyo 169-8555, Japan.

Abstract

Hastelloy X is a solid-solution-strengthened Ni-base superalloy commonly used in critical parts of aero-engines such as the combustor chamber. The hot cracking and elimination of cracks were studied by fabricating three different yttrium levels in mass %: 0 (Y-free), 0.046 (Ylow), and 0.12 (Y-high). These alloys were all processed using selective laser melting. To obtain the desired mechanical properties, the post-heat treatment was carried out at 1177 ℃ for 2 h in air. Creep tests were conducted in vertical and horizontal directions at 900 ℃/ 80 MPa. While the Y-free specimen exhibited fewer cracks, the Y-high specimen exhibited more cracks due to the excessive addition of Y and Si, primarily due to segregation of Y, Si, W, and C, resulting in SiC, W6C, and YC-type carbides at grain boundaries and interdendritic regions. However, in the Y-low specimen, the optimal amounts of Y and Si prevented cracks; conversely, creep and tensile properties were enhanced. By stabilizing contaminated solute oxygen, the formation of Y2O3 oxide also improved tensile elongation and creep properties.

After solution treatment, the grain morphologies of the Y-free and Y-low specimens changed to equiaxed, resulting in a lower creep strength than the Y-high specimen. In the Y-high specimen, grain morphology remained columnar even after solution treatment, and the creep life was longer (8 times) in the vertical direction than in the Y-free specimen. Additionally, M6C carbides, Y2O3, and SiO2 are formed. Y addition mainly induced the formation of M6C carbides in Y-low and Y-high specimens, resulting in better creep and tensile properties than Y-free specimens. Because cracks were eliminated from the Y-low specimen, creep-rupture and tensile elongation were superior. Additionally, in the Y-low specimen after ST heat treatment, grain morphological change and the formation of oxides at the grain boundary also contributed to improved mechanical properties.

Key Words: Yttrium, Silicon, Selective laser melting, Hastelloy-X, Hot cracking, Creep, Tensile, Oxygen-embrittlement

Biography

I am Banoth Santhosh, and I am currently working as a Post-Doc Researcher at Tokyo Metropolitan University in Tokyo, Japan. I have just finished my doctoral study at the same university on 25th March 2022. I am working on the additive manufacturing of Ni-based superalloys for high-temperature applications using additive manufacturing. So far, many of my scientific papers have been published in peer-reviewed journals. Additionally, I have also had the opportunity to participate in several conferences in Japan and outside Japan. The Indian Institute of Technology, Hyderabad, where I did my Master's in Materials Science and Metallurgical Engineering, graduated with a Master's Degree. My undergraduate degree is in Mechanical Engineering. In school and college, I gained professional and personal skills that helped me grow into a researcher.

Title: Influences of Post-heat Treatment on the Microstructure Evolution and Cree Properties of Ni-Based Superalloy IN718 Fabricated by Electron Beam Melting

Thaviti Naidu Palleda*, Banoth Santhosh, and K.Kakehi

Department of Mechanical Systems Engineering

Tokyo Metropolitan University

Japan

Abstract

Developed in the early 1960s, the nickel-iron based IN718 alloy features high-temperature strength and outstanding corrosion resistance up to 700 ℃. IN718 derives its high-temperature strength from the ordered body-centered tetragonal γ" phase (Ni3Nb, D022, ordered BCT) and face-centered cubic γ' phase (Ni3 (Al, Ti), L12, ordered FCC), which are both coherent to the matrix. However, when exposed to a temperature higher than 700 ℃, the meta-stable γ" precipitates tend to transform into the thermodynamically stable δ phase (Ni3Nb, orthorhombic) rapidly. The formation of the δ phase, which is incoherent to the matrix, lowers the strength of IN718 by depleting the major strengthened γ" phase, thereby limiting the operating temperature range of IN718 [1]. Nevertheless, the controlled grain boundary δ phase offers some advantages, such as improved grain stability and resistance to creep deformation [2]. As an age-hardenable alloy, IN718 possesses excellent weldability due to its retarded γ" precipitation-hardening rate and low cracking susceptibility, thus making IN718 suitable for Electron beam melting (EBM) processes. The EBM is typically a micro-welding process involving melting metallic powders in a layer-by-layer fashion under vacuum with a geometry-directed electron beam to build complex components. In recent years, researchers have tried to optimize the microstructure and the precipitates for EBM-built IN718 by tailoring the post-heat-treatment to meet requirements for various mechanical properties. However, little emphasis has been placed on elucidating the influence of heat treatment grain boundary δ phase formation and its related effect on the δ phase on the creep properties. In this research, we focus on the creep properties of EBM-fabricated IN718 heat-treated at various conditions.

For this study, a cubic block of IN718 was fabricated by electron beam melting and heat treated at various conditions named as DA, STA, HSA, HA. The details of heat treatment conditions are listed in Table 1. Tensile creep tests were carried out on heat treated specimens at 650 ℃/650MPa. Fig.1. presents the creep curves of various heat treatment specimens along the building directions. The creep rupture life of the AB specimen is approximately 296 h. The DA specimen shows a rupture life of 617 h, which is twice that of the AB specimen. Both AB and DA specimens displayed conventional creep curves with a short primary creep regime and a longer steady-state regime followed by an accelerated tertiary regime. In contrast, both the SA and HSA specimens show early tertiary regimes with shorter creep rupture lives of 124 h and 116 h, respectively. The HA specimen exhibits a creep life of 239 h with elongation of 9.66%. The directaged (DA) specimen possessed the lowest steadystate creep rate, 0.15 x 10-8 s-1 . The superior creep resistance in DA specimen can be attributed to the higher volume fraction of γ'/γ" strengthening precipitates within the grain and fine δ precipitates along the grain boundaries. Being coherent to the γ matrix, the nano-sized γ" precipitates effectively hindered the dislocation motion in the grain interior. In addition, controlled grain boundary δ precipitates inhibited grain boundary sliding and decelerated the steady-state creep strain rate during creep deformation.

Table 1. Details of the heat-treatment conditions for the EBM

Specimen	Solutionization/Homogenization	Aging
AB	-	-
DA	-	2-step aging
SA	980°C/1h/AC	2-step aging
HSA	1095°C/1h/AC+ 955°C/6h/AC	2-step aging
HA	1095°C/1h/AC	2-step aging
C&W	980°C/1h/AC	2-step aging

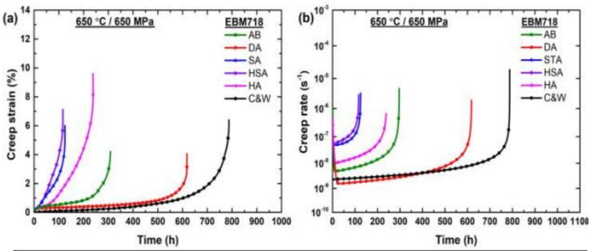

Fig.1 Plots showing creep properties of EBM IN718 for as-built and various post-heat-treated specimens along the building direction; (a) depicts the creep curves at 650 ∘C and 650 MPa, and (b) shows the correlations between creep rate and time.

Reference:

[1]. J.W. Brooks, P.J. Bridges, Metallurgical stability of Inconel alloy 718, Superalloys. 88 (1988) 33 –42.

[2]. J.H. Moll, G.N. Maniar, D.R. Muzyka, Heat treatment of 706 alloy for optimum 1200 ℉ stress-rupture properties,Metall. Mater. Trans. B. 2 (1971) 2153–2160.

Biography

I'm Palleda Thaviti Naidu, and I'm currently pursuing my Ph.D. at Tokyo Metropolitan University, Japan, in the department of mechanical systems design. Also a guest researcher at the National Institute for Material Science (NIMS), Japan. I received my master's degree in Materials Science and metallurgical engineering from Indian Institute of Technology, Hyderabad (IITH). In my research career, I published three peer-reviewed papers. My current research focus on additive manufacturing of nickel based and High entropy superalloys for high temperature applications.

Hybrid Session: Frontier of Smart Materials and Biomaterials

Chaired by **Dr. Jie Xu,** Tianjin University, China
Co-Chaired by **Dr. Madleen Busse,** Munich Institute of Biomedical Engineering, Germany

Time: 03:30 PM-05:40 PM, Oct. 28th, 2022 (Friday), Time Zone: GMT+2

Title: New Development and Key Technology of Smart Materials in Large-Span Spatial Structures

Weixin Wang[3], Jie Xu[1,2,3 *], and Qinghua Han[1,2,3]

[1] Key Laboratory of Earthquake Engineering Simulation and Seismic Resilience of China Earthquake Administration (Tianjin University), Tianjin 300350, China

[2] Key Laboratory of Coast Civil Structure Safety (Tianjin University), Ministry of Education, Tianjin 300350，China

[3] School of Civil Engineering, Tianjin University, Tianjin 300350, China

Abstract

Cable roof structures built with carbon-fiber-reinforced polymer (CFRP) cables instead of steel cables, which are called CFRP cable roofs, represent a new structure with great development potential. However, as one of the main stressed components of structures, CFRP cables are required to have better fire resistance. In this paper, the fire resistance of a type of high-temperature-resistant (HTR) CFRP tendon is studied. Damage pattern recognition and damage evolution of unidirectional (UD) CFRP tendons in the tensile process were analyzed based on the acoustic emission (AE) technique. Finally, a new anchorage system is developed for the HTR CFRP tendons.

***Keywords**: Carbon-fiber-reinforced polymer; High temperature properties; Pattern recognition; Damage evolution; Acoustic emission；Anchorage system*

Reference

1. Jie Xu, Weixin Wang, Qinghua Han, LiuXuan Liu.. Compos. Struct., 238, 111948, (2020)
2. Jie Xu, Weixin Wang, Qinghua Han，CONSTR BUILD MATER, 258,119526-0，(2020)

Biography

Dr. Jie Xu is Professor at Tianjin University. He received his M.S. from Tianjin University in 2008 and obtained Ph.D. from Politecnico di Torino, Italy, in 2012. He is the chief engineer of civil engineering testing center and deputy director of bridge and structural engineering laboratory of Tianjin University. His research mainly focuses on structural health monitoring, ultra-high performance material and new technique and new system. He has published 3 technical books and also published about 100 technical papers. He has also been a reviewer for more than ten high level international scientific journals, such as CACIE, SHM, CBM and so on. His research result has been applied in many important projects and he has been awarded several awards for both research and teaching.

Title: Noise and Vibration Reduction Using Hybrid Piezoelectric and Viscoelastic Damping Treatment: Finite Elements Reduced Order Model

Walid Larbi
Professor
Structural mechanics and coupled systems laboratory (LMSSC)
Conservatoire National des Arts et Metiers
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France

Abstract

In this work, a reduced order coupled finite element/boundary element method (FEM/BEM) for control of noise radiation and sound transmission of vibrating structure by viscoelastic and passive piezoelectric treatments is presented. The system consists of a sandwich structure composed of elastic faces and a viscoelastic core (with surface mounted piezoelectric patches) and coupled to external/internal acoustic domains. The passive shunt damping strategy is employed for vibration attenuation in the low-frequency range while dissipative viscoelastic materials are used for the higher-frequency domain.
First, a finite element formulation (FEM) of sandwich structures with viscoelastic core and equipped with shunted piezoelectric patches is presented. This formulation involves structural displacement in the structure (sandwich structure with piezoelectric elements) and the electric charge and voltage between the electrodes in the piezoelectric patches. The charge/voltage variables are intrinsically adapted to include any external electrical circuit into the electromechanical problem and to simulate the effect of shunt damping techniques. Moreover, since the elasticity modulus of the viscoelastic core is complex and frequency dependent, this formulation is complex and nonlinear in terms of frequency. The direct solution of this problem can only be considered with models which do not imply a prohibitive number of degrees of freedom. This has severe limitations in attaining adequate accuracy and wider frequency ranges of interest. A reduced order-model is then proposed to solve the problem at a lower cost in the second part of this work. As a next step, the direct boundary element method (BEM) is used for modeling the scattering/radiation of sound by the structure coupled to an external/internal acoustic domain. The BEM is derived from a boundary integral equation involving the surface pressure and normal acoustic velocity at the boundary of the acoustic domain. The coupled FEM-BEM model is obtained by using a compatible mesh at the fluid-structure interface. Numerical examples are presented in order to validate and analyze results computed from the proposed formulations.
Key Words: vibroacoustic, piezoelectric shunt damping, viscoelastic damping, finite element method, boundary element method, reduced order model

Biography

Dr. Walid Larbi is a full professor of Mechanic and Civil Engineering at Conservatoire National de Arts et Métiers (CNAM) in Paris (France). He is head of the CNAM Civil engineering diploma. He is responsible for training and research development in the field of Construction in Middle East and North Africa. His researches cover Passive Vibration Control, Acoustic and Vibroacoustics, Fluid-Structure Interaction, Dynamic of structures, Reduced Order Models, Composite and Piezoelectric Materials. He has been invited to serve in the scientific committees of many international congress and he is reviewer of 24 journals. He has authored or co-authored more than 120 journal and conference papers and chapters.

Title: Development of Anticorrosive and Antibacterial Coatings for Preservation of Glass Heritage Objects

Oana Catalina Mocioiu
Senior Researcher
Department of Oxide Compounds and Material Science
Institute of Physical Chemistry Ilie Murgulescu of the Romanian Academy (ICF)
Romania

Abstract

In the general perception it is considered that glass objects are stable and do not have to be protected because they have resistance at corrosion. In the reality depending on the composition and obtaining processes, glasses can be more or less stable. In the Europe the more known artefacts of glass are medieval stained-glass windows (Spain); vitreous tesserae from mosaics (Italy); glass flutes (France). In Romania the glass bracelet from Byzantine period were excavated by archaeologists. The main oxide compositions from glass artefacts are potash–lime–silica; soda-lime-silica and lead-silicate. In addition to the main oxides such as SiO_2, PbO, Na_2O, K_2O, CaO, MgO, Al_2O_3, traces (below 5%) such as CuO, MnO, SnO_2, Fe_2O_3 are present in historical glasses, which decrease their chemical stability. Silica based coatings were deposited on model glass similar with historical objects in order to establish their structure, morphology, anticorrosive and antibacterial properties in order to be used for heritage objects preservation.
Keywords: historical glasses, anticorrosive coatings, FTIR.

Biography

Dr. Oana Catalina Mocioiu is a senior researcher in Department of Oxide Compounds and Material Science into Institute of Physical Chemistry “Ilie Murgulescu” of the Romanian Academy since 2000. She grew up in Romania and received her Bachelor's degree from the University POLITECHNICA of Bucharest in 1999. She obtained her Ph.D. degree in Chemistry from School of Advanced Studies of the Romanian Academy in 2008. Her activity was focused on synthesis and characterization of glasses, enamels, oxides, biomaterials and nanomaterials. The materials were obtained by classical ceramic route and by chemical routes as sol-gel, hydrothermal method, metal oxide decomposition and so on. She has also experience in measurements/ data interpretation for different methods of characterization.

Title: Nanocapsules for Lung Imaging and Cancer Radiotherapy

Gerard Tobias
Institut de Ciència de Materials (ICMAB-CSIC)
Spain

Abstract

The application of nanotechnology to medicine (nanomedicine) has become one of the most promising routes for the targeted diagnosis and treatment of diseases. The small size of nanomaterials, large surface area and high reactivity impart unique physicochemical properties to these materials, in such a way that several therapeutics based on nanomaterials have been approved for clinical use in the past few years. However, there are still several limitations that need to be overcome to obtain novel and efficient nanocarriers. We have shown that it is possible to achieve ultra-sensitive imaging and the delivery of an unprecedented amount of radiodose density using nanocarriers. Furthermore, functionalization of the external surface of nanocarriers with chosen targeting ligands allows selective internalization in cancer cells. The developed nanocarriers present a high in-vivo stability and have shown to also allow lung tumor radiotherapy [1-4].

Keyworkds: carbon nanotubes, filling, biomedical imaging, therapy

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Biography

Gerard Tobias obtained the degree in Chemistry (with Honours) from the Autonomous University of Barcelona (2000), Master in Materials Science and Ph.D. with European mention (UAB, ICMAB, 2004). He was a research visitor at Ames Laboratory (USA) and EMAT (Belgium). Between 2004-2009 he was a postdoctoral researcher at the University of Oxford (UK). Since 2009 he leads research on "Nanoengineering of Carbon and Inorganic Materials" at the Materials Science Institute of Barcelona (ICMAB-CSIC). Dr. Tobias has coordinated the FP7 European network RADDEL and has been granted an ERC Consolidator Grant (NEST, 725743).

Title: Targeted X-ray Staining - 3D Visualization of Biological Structures

Madleen Busse
Postdoctoral Research Associate
Munich Institute of Biomedical Engineering
Germany

Abstract

The application of 3D X-ray imaging for biological samples from various research fields such as developmental biology, zoology, plant biology, veterinary science, or medicine to gain a deeper understanding of the micro-architecture on a (sub)cellular level is limited by the missing attenuation contrast of soft tissue. The development of novel staining tools for X-ray soft-tissue imaging will overcome these challenges. The application of recently developed methods are highlighted combining target-specific X-ray staining with a laboratory-based nanoscopic X-ray CT setup enabling resolutions down to 120 nm. The staining tools were designed to improve the attenuation contrast in X-ray imaging, which is achieved by changing chemical parameters such as the fixative, the stain concentration within the sample or the introduction of elements with a high atomic number Z and density.

The results clearly show that the X-ray attenuation contrast in the samples is remarkably improved by our staining methods. Detailed tissue (sub)structures are apparent, which cannot be visualized without the staining. The nanoscopic CT data reproduce the tissue (micro)morphology with a similar level of detail as the corresponding histological light microscopy images in 2D and enable pathological characterization of the crucial features being relevant for diagnosis. Beyond that, the applied methods allow for visualization of the 3D tissue architecture, offering deeper insights into the 3D microscopic structure of soft-tissue. The additional benefits of being a non-destructive imaging technique that provides isotropic resolution should be highlighted. Moreover, by demonstrating the compatibility of the X-ray stains with standard histological staining methods, we highlight the feasibility of integrating staining-based nanoscopic CT imaging into the pathological routine. This work highlights the potential of 3D X-ray histology as a tool for modern histological and histopathological applications.

Biography

Dr. Madleen Busse started her scientific training as a chemist at Leipzig University in Germany. She was one of the first Bachelor and Master of Science in Germany. In 2008 she moved to Melbourne in Australia where she commenced her Ph.D. at Monash University in the field of bioinorganic chemistry working with the main group metal bismuth. Together with her family, she transferred to The University of Sydney in 2012 to work on 157-Gadolinium Photon Capture Therapy. Dr. Busse returned to Germany to take up a Technical University of Munich Foundation Fellowship in 2015. Together with the Marie Sklodowska-Curie Individual Fellowship, which she received just one year later, she shaped her scientific profile in "Targeted X-ray Stain and Staining Protocol Development" using "Microscopic and Nanoscopic X-ray Computed Tomography". Since 2018 Madleen is leading the "Staining Group" at the Chair of Biomedical Physics at the Technical University of Munich. Today she will give us some insights into "Targeted X-ray Staining for the visualization of biological structures."

Online Session: Plenary Forum

Moderator: **Dr. Ameersing Luximon,** EMEDS Ltd. (Hong Kong), China

Time: 07:30 AM-08:35 AM, Oct. 29th, 2022 (Saturday), Time Zone: GMT+2

Moderator

Ameersing Luximon
Director
EMEDS Ltd. (Hong Kong)
China

Biography

Currently, Dr. Ameersing Luximon is Director of EMEDS Ltd. (Hong Kong) and President of the Hong Kong Ergonomics society (HKES). Previously, Dr. Luximon worked as Associate Professor of Fashion and Textile Design in the Institute of Textiles and Clothing, The Hong Kong Polytechnic University. He is one of the inventors of iDummy, a robotic mannequin. He is active both academic and industry for more than 20 years. His research areas include Ergonomics and design, Wearables, and social Robots.

Title: RNA Nanomedicines: Smart Materials for Delivery

Ernst Wagner
Professor
Ludwig Maximilian University (LMU)
Germany

Abstract

It took fifty years from first RNA transfections to approved gene therapies as drugs [1, 2]. At least 19 gene therapies and 17 RNA therapies reached the medical market, including mRNA vaccines [3]. Targeted intracellular delivery remains the key requirement for such agents. For this purpose, chemical evolution approaches are pursued for refinements of synthetic nanocarriers [4]. Natural evolution optimized viruses based on variation and selection of their gene and protein sequences. Our strategy focuses on such a bioinspired, sequence-defined process including (i) artificial amino acids (ii) precise assembly into sequences by solid phase-assisted synthesis (iii) screening for delivery and selection of top candidates, followed by further variation. The optimal sequence of nanocarriers depends on the RNA cargo, as outlined for siRNA, mRNA, or Cas9/sgRNA delivery.

1. Vaheri A, Pagano JS (1965) Infectious poliovirus RNA: a sensitive method of assay. Virology 27, 434.
2. Lächelt U, Wagner E (2015) Nucleic Acid Therapeutics Using Polyplexes – A Journey of 50 Years (and Beyond). Chem. Rev. 115, 11043.
3. ASGCT and Informa Pharma Intelligence (2022) Gene, Cell, & RNA Therapy Landscape; Q1 2022 Quarterly Data Report.
4. Freitag F, Wagner E (2021) Optimizing synthetic nucleic acid and protein nanocarriers: the chemical evolution approach. Adv. Drug Del. Rev. 168, 30.

Biography

Ernst Wagner is Professor of Pharmaceutical Biotechnology at LMU and Center of Nanoscience since 2001. From 1992-2001 he was Director Cancer Vaccines, Boehringer Ingelheim (first polymer-based gene therapy trial in 1994), 1987-1995 group leader at IMP Vienna and Vienna University Biocenter, 1985-1987 postdoc at ETH Zurich, in 1985 Ph.D. in chemistry (TU Vienna). He is Academician of European Academy of Sciences, member of CRS College of Fellows, Board member of German Society for Gene Therapy, he was Editor-in-Chief, J Gene Medicine 2016-2022. He has authored 489 publications, with 48 235 citations, h-index 110 (GS).

Title: Functional Cement Composites with Nanoparticles for Sustainable Construction in the Prospect of Their Synthesis, Properties and Application

Agnieszka Slosarczyk[1a]* and Izabela Klapiszewska[2a]

[1]Professor of PUT

[2]Professor assistant

[a]Poznan University of Technology, Institute of Building Engineering, Piotrowo 5, 60-965 Poznan, Poland

Abstract

The pursuit of sustainable development in the construction industry has led to an increasing focus in recent years on functional materials that, in addition to good mechanical performance, will also be characterized by other properties, such as photocatalytic, self-healing, self-monitoring and/or antibacterial properties [1-2]. In these solutions we are increasingly finding materials based on nanotechnology due to their specific mechanism of action, different from bulk materials [3]. An important aspect of the effective action of nanomaterials in building materials, here cement composites, is their proper dispersion. Therefore, the main objective of the study was to compare different methods of zinc oxide dispersion in cementitious composites and to determine the effect of the introduction method on selected mechanical and antimicrobial properties.

Keywords: zinc oxide, antimicrobial properties, cement composites, nanoparticles dispersion, mechanical performance

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Biography

Agnieszka Slosarczyk, Ph.D., D.Sc. Eng., Habilitation in Civil and Transport Engineering (D.Sc. 2019 at Poznan University of Technology), Doctor of Chemical Sciences (Ph.D. 2009 at Poznan University of Technology). Since 2021 employed as professor of PUT in Institute of Building Engineering at Poznan University of Technology. Member of International Association of Advanced Materials, Polish Society of Composite Materials and Polish Carbon Society. Field of experience and interest: composites and new building materials and nanomaterials, nanotechnology, chemistry and chemical technology, carbon chemistry.

Hybrid Session: Composite Materials and Polymer

Chaired by **Dr. Gideon Ayim-Mensah,** The University of the West of Scotland, UK

Time: 07:30 AM-08:25 AM, Oct. 29th, 2022 (Saturday), Time Zone: GMT+2

Title: Effects of Nitinol on the Ductile Performance of Ultra-High Ductility Fibre Reinforced Cementitious Composite

Gideon Ayim-Mensah[a]* and Milan Radosavljevic[b]

[a]Lecturer in Civil Engineering, Forth Valley College, Grangemouth Road, FK2 9AD, UK

[b]Vice Principal and Pro Vice Chancellor, University of the West of Scotland, High Street, PA1 2BE, UK

Abstract

The effects of nitinol on the ductile performance of fibre reinforced cementitious composites were investigated in this study. Nitinol fibres with two different diameters of 1 mm and 0.5 mm and nitinol powder of diameter 70 nm were used as micro-reinforcement and reactive powders respectively. The test results showed that nitinol powder accelerates the hydration of cement and promotes the nucleation of TiO_2 onto C-S-H leading to increased flexural and compressive strength. The nitinol fibre cementitious composite achieved ductilities of 7.3 % and 7.8 % with 1mm and 0.5 mm nitinol fibres respectively at 28 days of curing. However, the nitinol fibres reinforced cementitious composites were unable to sustain ductilities after 90-days of curing losing nearly half of their ductile potency. On the other hand, nitinol powder achieved ductilities of 2.8 % and 5.6 % at 28 and 90 days of curing, respectively. Nitinol powder showed a potential as a ductile cementitious composite without the use of fibres

Key Words: Nitinol fibres, Nitinol powder, Ductility, Cementitious composite

Biography

Dr. Gideon Ayim-Mensah is a doctor of Civil Engineering from the University of the West of Scotland. He has worked in the built industry for more than 10 years working as a Structural Engineer and Construction Manager. His research interest is in improving the mechanical properties of cementitious composite, ductility of concrete, use of bio-materials as fibres, smart materials and carbonation in concrete. Prof. Milan Radosavljevic is a Professor of Civil Engineering and Vice-Principal and Pro Vice-Chancellor (Research, Innovation & Engagement). My research interest is in virtual construction, (including Building Information Modelling and Management), off-site construction (including mafacturization, automation and total construction service), cementitious materials (including eg. delayed Ettringite Formation), team dynamic and effectiveness (e.g. circumstances and parameters that make teams succeed or fail), innovative behaviour (e.g. enablers and barriers to creativity and innovation in the industrial context), project planning (e.g. particularly detailed short-term planning including scheduling, control, resource planning and continuous improvement), technology implementation process (e.g. selection and successful implementation of new technologies including materials, tools and IT), communication (e.g. bringing down communication barriers within project teams comprised by individuals from different organizations)

Title: Flash Chemistry Makes Impossible Organolithium Chemistry Possible

Aiichiro Nagaki
Department of Chemistry, Faculty of Science, Hokkaido University
Japan

Abstract

Many successful applications reported in the literature speak well for the power of the flow-microreactor method in chemical synthesis. The reaction time in a flow microreactor is defined as the residence time between a reagent inlet and the quencher inlet, which can be controlled precisely and reduced to millisecond order by adjusting the length between these positions and the flow speed. Such a feature of flow microreactors enables the use of short-lived highly reactive intermediates for synthesis. Various chemical reactions using highly reactive short-lived organolithium species that are difficult or even impossible to perform in batch processes can be accomplished in flow microreactors using space integration of reactions. In this presentation, we slow our recent results to various synthetic reactions mediated by organolithium reagents based on flash chemistry conducted in flow reactors, especially utilizing space-integration of the flow reactions.

Keywords: Microreactor, flow chemistry, organolithiums, flash chemistry

References

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5. A Novel Approach to Functionalization of Aryl Azides via Generation and Reactions of Organolithiums Bearing Masked Azides Using Flow Microreactors. Ichinari, D.; Ashikari, Y.; Mandai, K.; Aizawa, Y.; Yoshida, J.*; Nagaki, A.* *Angew. Chem., Int. Ed.* **2020**, 59, 1567-1571.

Biography

Dr. Aiichiro Nagaki, now is a professor of department of chemistry, faculty of science, hokkaido university. Aiichiro Nagaki graduated from Doshisha University in 2000. He received his Ph.D. in 2005 from Kyoto University under the supervision of Professor Junichi Yoshida. He worked with Professor Hiroaki Suga, Tokyo University, from 2005 as a postdoctoral fellow. In 2006, he became an assistant professor of Kyoto University. He was promoted to a junior associate professor in 2013, an associate professor in 2018 and became a full professor of Hokkaido University in 2022. He His current research interests are organic synthesis and microreactor synthesis. Awards: Takeda Pharmaceutical Co., Ltd. Award in Synthetic Organic Chemistry, Japan (2012), Incentive Award in Synthetic Organic Chemistry, Japan (2012), and Young Innovator Award on Chemistry, Micro-Nano Systems (2013), ESPEC Prize for the Encouragement of Environmental Studies (2013), Flow Chemistry India 2014 Distinguished Presentation Award (2014), and SSOCJ Tosoh Award for Environment and Energy (2022).

Hybrid Session: Electronic Materials, Conductor and Semiconductor

Chaired by **Dr. Sepideh Akhbarifar,** The Catholic University of America, USA

Time: 09:30 AM-11:40 AM, Oct. 29th, 2022 (Saturday), Time Zone: GMT+2

Title: Social Robots and Wearable

Ameersing Luximon* and Y. Luximon
Director
EMEDS Ltd. (Hong Kong)
China

Abstract

Future provides a mixture of two technologies: social robots and wearables, to enable humans have a desired, safe, and healthy lifestyle. Wearables can include functional clothing, accessories, wearable technologies, and sensors (surface or implantable). Wearables can have several functions such as provide a way to collect data from the user and the surroundings; communicate data and information to the user and interested parties; protect the user; enhance some functions of the user; and improve the social status of the user. Social robots are similar to wearables and can provide nearly all the functions of wearables but in a different way. Wearables are in and on the body, while social robots are outside the body. In addition to function, design of wearables include biocompatibility, comfort and fit, health and safety, and ergonomics. Wearables has to be fashionable and stylist and should not impact the normal function of the user. On the other hand, since social robots are outside the body, the design and development of the social robots is influenced more on human psychology rather than physical ergonomics such as comfort and fit. Development of both social robots and wearables are important as they do not compete with each other but rather complement each other. More research is needed in to study the interaction of social robots with humans, including humans with wearables.

Biography

Currently, Dr. Ameersing Luximon is Director of EMEDS Ltd. (Hong Kong) and President of the Hong Kong Ergonomics society (HKES). Previously, Dr. Luximon worked as Associate Professor of Fashion and Textile Design in the Institute of Textiles and Clothing, The Hong Kong Polytechnic University. He is one of the inventors of iDummy, a robotic mannequin. He is active both academic and industry for more than 20 years. His research areas include Ergonomics and design, Wearables, and social Robots.

Title: MoS_2 2D Material-Based Devices

Jamila Boudaden* and Armin Klumpp
Fraunhofer Research Institution for Microsystems and Solid State Technologies EMFT
Germany
* Corresponding author: Jamila.boudaden@emft.fraunhofer.de

Abstract

Nowadays 2D Material is intensively studied and searched to fabricate sensor devices for flexible electronic application. The final goal of this study is to develop a flexible smart sensor to sense biomarker. To realize the sensors devices, we explored the preparation methods of 2D Material (i) by liquid phase exfoliation, the growth methods of MoS_2 layer on 200 mm substrate (ii) by sulfurization of metallic layer Mo to realize MoS_2 layers and (iii) by chemical vapor deposition.
It worth to underline that the fabrication of sensor devices based on 2D Material goes beyond the state-of-the-art sensors. Currently, the largest barrier to the fabrication of monoscale devices based on thin layer of 2D Material is related to the no existence of mature technologies that allow a large-scale growth on 200 mm substrate with a controllable quality as well as patterning of these novel 2D Material layer to fabricate sensor devices.
Here, we describe the work accomplished by following three different ways to obtain 2D-layeded MoS_2 and then to fabricate sensor devices. The liquid exfoliation is the first method used to obtain thin layered MoS_2 in different solvents. Secondly, MoS_2 layer was grown by sulfurization on 200 mm substrate. Finally, chemical vapor deposition method was used to grow MoS_2 layer on 200 mm substrate. Mainly, optical characterization method was employed to extract the optical parameter of the MoS_2 layer grown by different methods. Then we will present the current−voltage (I−V) characteristic of the fabricated sensor devices using the sulfurization and CVD growth.
Keywords: 2D Material MoS_2, large scale growth, sulfurization, CVD growth, liquid exfoliation

Biography

Dr. Jamila Boudaden received her Ph.D. in Experimental Physics from the University of Basel in Switzerland. Since 2011 she has been working as scientific member of the Silicon Technologies and Devices division. She has experience in MEMS devices realization, like microphones, micro-pumps. Her current research is focused on designing sensitive materials for highly selective gas detection, developing and analysing chemical sensors. She is currently preparing for "habilitation" at the Institute of Electronic and Sensor Materials, Technische Universität Bergakademie Freiberg, in the field of "Chemical and Biological Sensors". Within EU projects, we are working on the growing 2D-Layer (MoS_2 and WS_2) as well as the fabrication of 2D-layer to make devices on a 200 mm large scale wafer.

Title: Metal-Insulator Transition in Ruthenate Pyrochlores

Sepideh Akhbarifar
Postdoctoral Researcher & Adjunct Faculty
The Catholic University of America, Vitreous State Laboratory, Washington, D.C.
USA

Abstract

The electrical conductivity and Seebeck coefficient of lead yttrium ruthenate pyrochlore solid solutions ($Pb_{2-x}Y_xRu_2O_{6.5+z}$) were investigated in the temperature range of 298 to 575 K. Only some properties of the endmembers $Pb_2Ru_2O_{6.5}$ and $Y_2Ru_2O_7$ were known before. By increasingly substituting lead by yttrium in the metallic, Pauli paramagnetic $Pb_2Ru_2O_{6.5}$, a temperature independent metal insulator transition (MIT) was observed at $x \approx 0.2$. At higher yttrium contents than 0.2, semiconductor/insulator materials formed until the antiferromagnetic Mott insulator $Y_2Ru_2O_7$ was reached. The appearance of an MIT will be explained with the Mott–Hubbard mechanism of electron localization. A critical content of yttrium opens the Mott–Hubbard gap and fills the lower Hubbard band (LHB) with localized t_{2g}^4 electrons. The Seebeck effect (S) reached a maximum between 400 and 500 K, for at least all $x \leq 1.5$. This temperature dependence can be explained in terms of S varying proportionally with the effective mass of the carriers and inversely with their concentration.

Key Words: Metal-insulator transition, ruthenate pyrochlores, Seebeck Coefficient, electrical conductivity, Mott-Hubbard mechanism

Biography

Sepideh Akhbarifar is a postdoctoral researcher in physics (materials science) and adjunct faculty in the School of Engineering at The Catholic University of America, Washington, DC, USA. She holds a Ph.D. in physic and has master's degrees in Nuclear Environmental Protection and in Chemical Engineering. Her scientific interests focus on environmental protection, specifically energy efficiency. Her research comprises thermoelectric materials, materials with low CO_2 footprint (geopolymers), and materials to fixate long-lived radionuclides. She was honored as a 'Young Women Inventor 2010' by Iran's National Elites Foundation. She publishes widely, including a chapter of a book on thermoelectricity. She presents her work at national and international conferences and holds two patents. She is an active member of several scientific societies, e.g., member of the 'Early Career Subcommittee' of the Materials Research Society, USA. She works also as a reviewer for several peer-reviewed journals.

Title: Frontiers of Bandgap Engineering in 2D Electronics

Hussain Alsalman[a,b*], Seungjun Lee[b], Javad G. Azadani[b], and Tony Low[b]
Associate Professor
[a]King Abdulaziz City for Science and Technology (KACST), Riyadh 6086-11442, KSA
[b]Department of Electrical & Computer Engineering, University of Minnesota, Minneapolis, Minnesota 55455, USA

Abstract

Modern industries are pivoted around the latest developments in solid state electronic devices. The scope of which could not be any broader with applications in future energy, sustainability, and modern electronics. This is more evident most recently with advanced countries pledging significant funds building infrastructure to advance capabilities in this field. Among the key components in the design of such electronics is the bandgap, which is considered the electronic map of how these devices will behave in real life. One of the crowning achievements of 2D materials is their celebrated ability to leverage a high degree of control over the bandgap. In this talk, we will be covering concepts afforded with 2D materials in tailoring the bandgap as well as present the latest theoretical concepts that aim to better understand and predict the electronic behavior in the 2D realm compared to bulk[1]. The impact of number of layers, orientation, phase, stacking order, electric fields, and alloying[2] will be covered. Heterostructure band alignment theories will be discussed, along with models[3] to better predict expected band structure formations. Elemental doping effects on bandstructure and transport will be presented[4]. This talk will provide a fascinating insight into one of fastest developing fields for advancing the competitiveness of solid-state devices.

Keywords: 2D materials, electronics, bandgap

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Biography

Dr. Hussain Alsalman is an Associate Professor at the National Nanotechnology Center of KACST. He received his Ph.D. in electrical & computer engineering from Cornell University in 2016 working on 2D materials for experimentally fabricating 2D transistors. He was a visiting scholar at the University of Minnesota at Prof. Tony Low’s group where he worked on computational science for 2D electronics. His current interests are in 2D heterostructure band structure formation and applications to electronic devices.

Title: Synthesis of Zinc Oxide Semiconductor Nanoparticles for Light Absorption and Photocatalytic Activity

Gurjinder Singh
Former Assistant Professor
Dept. of Electronics Engg.
Sri Guru Granth Sahib World University
India

Abstract

Among metal oxide semiconductors, zinc oxide (ZnO) is a wide band gap semiconductor with energy of 3.37eV. ZnO has potential applications in the field of photocatalyst, sensors and solar cells. The chemical and optical properties of zinc oxide semiconductor nanoparticles are size and shape dependent. The synthesis route and material engineering affects the morphology of synthesized ZnO nanoparticles. The selection of capping and reduction agents, the molar concentration of precursor materials and synthesis temperature yield nanoparticles with different size and shape. The band gap tuning through doping with transition metals i.e. cobalt and manganese pave the way for utilization of ZnO nanoparticles in light absorption and Photocatalytic activity.
Keywords; Zinc Oxide. Nanoparticles, Semiconductor, Band Gap, Photocatalytic

Biography

Dr. Singh has research area in the field of synthesis, characterization and electronic properties of metal oxide semiconductor nanoparticles. His research work highlights the synthesis of copper oxide, zinc oxide and titanium dioxide semiconductor nanoparticles through chemical and green synthesis methods. He has published research articles having Photocatalytic applications of nanoparticles. His current research work relates to the properties of metal oxide semiconductor nanoparticles i.e. light absorption, photocatlytic, photoluminescence, anti-reflective and electrical resistivity for optoelectronic devices.

Online Session: Smart Materials & Technologies for Energy Conversion and Storage

Chaired by **Dr. Shenghao Wang,** Shanghai University, China

Time: 09:00 AM-10:20 AM, Oct. 30th, 2022 (Sunday), Time Zone: GMT+2

Title: Halide Perovskite Materials and Energy Conversion Solar Cells

Shenghao Wang
Materials Genome Institute
Shanghai University
China

Abstract

Organic–inorganic halide perovskites attracted tremendous attention because of their unique optoelectronic properties (such as large absorption, long diffusion length, low exciton binding energy, and high mobility) and the versatile fabrication methods (such as spin-coating, spray, co-evaporation, chemical vapor deposition, close space sublimation, etc.). The power conversion efficiency (PCE) of perovskite solar cells (PSCs) has increased from 3.8% to 25.7%, which reveals very promising potential for commercial applications. Two types of perovskite structures, namely, homovalent to lead (ABX_3 (A: Cs, MA, FA; B: Pb, Sn, Ge)) and heterovalent to lead (Cs_2ABX_6 (A: Ag, Na; B: Bi; X = I, Br); Cs_3BiI_9) will be discussed in this presentation. The strategies for preparing high quality perovskite films (including antisolvent, Lewis acid-base, additive engineering, scalable fabrication, strain engineering and band gap adjustment), and therefore to fabricate high performance PSCs will also be discussed.

Biography

Shenghao Wang received his Ph.D. from University of Tsukuba, Japan. He worked as a postdoctoral scholar in Okinawa Institute of Science and Technology Graduate University (OIST), Japan, from 2013 to 2016. Then, he joined the University of Tsukuba as a faculty member. From 2018, he has appointed as a full professor in Shanghai University, China. He is also currently a visiting scholar in OIST. His research interests include surface and interface sciences, thin film growth and solar cells. He has published more than 40 papers, such as Nature Energy, Energy & Environmental Science, Applied Physics Letters, etc. He was awarded the "Top Peer Reviewer" by Publons (2019), "Shanghai Young Rising-Star Scholar" by Shanghai Science and Technology Committee (2019), "Eastern Scholar (Specially appointed professor)" by Shanghai Institutions of Higher Learning (2017), "Japan Marubun Research Promotion Foundation" (2014) and "Excellent Poster Award" in the 4th Tsukuba-Hsinchu Joint Symposium on Interdisciplinary Nano-Science and Technology, Tsukuba, Japan (2012). He is an associate editor for *Frontiers in Physics* and is listed on editorial board members of *Energies*. He has developed 4 granted patents, including US patent, Japan Patent, China patent, and Korea patent. He ever served as the committee members of 2018 IEEE International Reliability Physics Symposium (IRPS) (CA, USA, March 11-15, 2018), 29th and 31st European Symposium on Reliability of Electron Devices, Failure Physics and Analysis (ESREF) (AALBORG, DENMARK, Oct. 1-5, 2018; Athens, Greece, Oct. 5-8, 2020), European Advanced Materials Congress 2018 (EAMC 2018) (August 20–23, 2018, Sweden) and the 6th Global Conference on Materials Science and Engineering (CMSE2017) (Beijing, China, Oct. 24-27, 2017) .

Title: Basic Semiconductor Properties and Solar-to-Energy Applications of Bournonite $CuPbSbS_3$

Yuhao Liu*, Xinlong Zheng, and Xinlong Tian
Associate Professor
State Key Laboratory of Marine Resource Utilization in South China Sea
Hainan Provincial Key Lab of Fine Chemistry
School of Science, Hainan University
China

Abstract

Solar-to-energy (STE) technique can effectively solve the current energy crisis and environmental pollution issues, in which the key factor is the development of advanced semiconductor photocatalysts. Based-on the electronic dimensionality concept, a promising STE semiconductor material should be electronically high-dimensional [1]. Herein, we propose an electronically three-dimensional semiconductor, bournonite $CuPbSbS_3$ as a prospective efficient STE material. Theoretically, $CuPbSbS_3$ exhibits optoelectronic properties of nearly direct bandgap, high optical absorption coefficients, appropriate *p*-type doping, and defect tolerance [1]. Experimentally, butyldithiocarbamate acid (BDCA) solution process is used for the synthesis of material and take it into the application of solar cells and photocatalytic hydrogen evolution, which highlight the potential of $CuPbSbS_3$ for STE applications [1,2].

Keywords: Solar-to-energy, electronic dimensionality, $CuPbSbS_3$, butyldithiocarbamate acid

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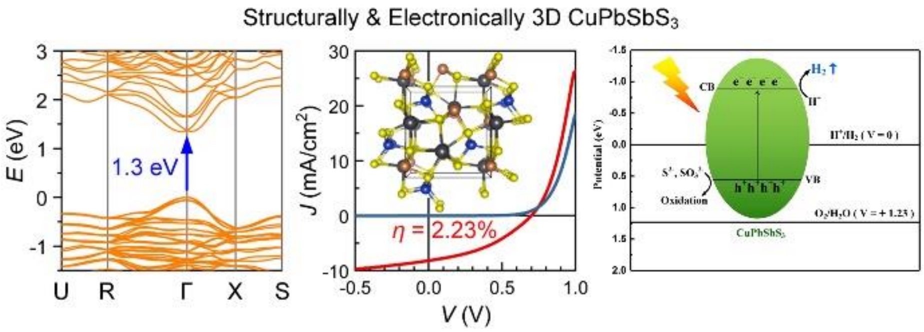

Biography

Prof. Yuhao Liu obtained his Bachelor's degree from Ludong University of Physics and Optical Engineering in 2012/06. From 2012/09 to 2017/06, he studied at the College of Physics at Huazhong University of Science and Technology, and he received his Ph.D. degree in 2017/6. From 2017/06 to 2020/06, he worked as the postdoctoral fellow in Wuhan National Laboratory for Optoelectronics (WNLO) at Huazhong University of Science and Technology. Currently, he holds the associate professor position in School of Science in Hainan University. His research interest is the fabrication and utilization of metal chalcogenide photocatalysts for the application of solar-to-energy.

Title: Direct Evaluation of Charge-Carrier Mobility of Organic Semiconductor Thin-Films with Dynamic Charging Map

Wen-Shan Zhang* and Rasmus R. Schrödre
Research Fellow
Ruprecht-Karls University Heidelberg
Germany

Abstract

The key property of organic semiconductors (OSCs) to achieve high performance devices is a high charge carrier mobility. However, the mobility is a material- and device-dependent value, including both the intrinsic and extrinsic factors. The experimental data and computational value deviate from each other commonly over several orders of magnitude, obscuring material scientists to draw a rational structure-function-relationship.

Herein, we present an electron-spectroscopic method to evaluate the charge-carrier mobility directly from thin-films or microcrystals of OSCs. With the proposed method the effects of the extrinsic impact factors are reduced to only one - the contact resistance. We use an analytical SEM and record the secondary electron (SE) emission spectrum. The dynamic charging map, generated from the SE spectra on each pixel, is used for the mobility evaluation (working principle see Figure 1).[1] By comparing the stage currents among different OSCs, which exhibit the same/similar charging maps under different charging condition, one can evaluate OSCs in terms of lateral charge carrier mobility. The results agree very well with the theoretical calculation (eg. transfer integral [2]).

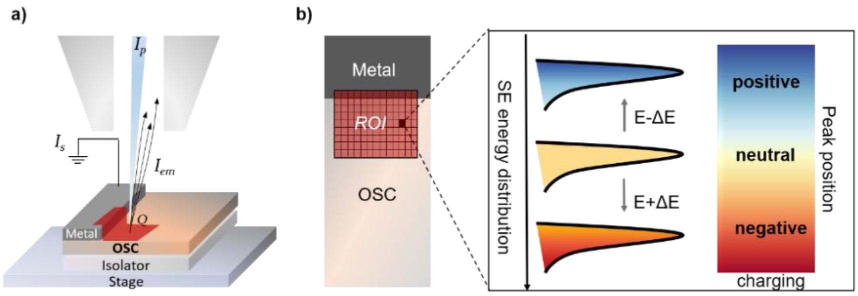

Figure 1. Conceptual illustration of the working principle: a) beam-material interaction, in which Q, I_p, I_s and I_{em} stand for accumulated charges in OSC, beam current, stage current and emission current, respectively. b) surface charging map.

Keywords: Organic semiconductor, charge-carrier mobility, electron-spectroscopy, dynamic charging map.

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Biography

Dr. Wen-Shan Zhang has studied chemistry and received Bachelor of Science in Tsinghua University, Beijing, P. R. China. She went later to Germany to continue her study. She received her Master of economy chemistry and Ph.D. in organic chemistry in University Ulm. After two years postdoctoral stay in Technical University Eindhoven, the Netherland, she moved to back to Germany. Currently, she is a research fellow in Ruprecht-Karls University Heidelberg. Her research focus lies on the electron-micro-/spectroscopic characterization of organic materials, especially on charge transport property. She has published in several high-impact journals, likewise Adv. Mater., Adv. Energy Mater., Angew. Chem. Int. Ed., Adv. Electron. Mater. etc.

Online Session: Nano, Optoelectronic Materials and Optics Technology

Chaired by **Dr. Peter Belobrov,** Siberian Federal University, Russia

Time: 12:30 PM-02:15 PM, Oct. 30^{th}, 2022 (Sunday), Time Zone: GMT+2

Title: Study on the Wavelength Modulation Spectroscopy Technique for the External Cavity Diode Laser Based on Narrow Band Interference Filter

Xiao Xiao[1,2,*], Jianquan Zhang[1,2], Guopeng Zhou[1,2], Fengqi Yu[3,4], George N. Lawrence[5], and Zhibin Wang[1,2]

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[2]Hubei Xiangcheng Intelligent Electromechanical Industry Technology Research Institute Co., Ltd.

[3]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen 518055, China

[4]Chinese University of Hong Kong, Hong Kong, China

[5]1087 Lewis River Rd. #217, Applied Optics Research, Woodland, WA 98674, USA

Abstract

An improved narrow band interference filter based tunable external cavity diode laser (ECDL) has been proposed and theoretically investigated in this study as a light source for tunable diode laser absorption spectroscopy-wavelength modulation spectroscopy (TDLAS-WMS) system. The proposed model can use piezoelectric ceramic actuator to change and modulate its output central wavelength so that the laser central wavelength could periodically scan the absorption spectral band of the desired gas. Compared with the tunable monolithic diode laser, the narrow band interference filter based tunable ECDL might be able to accurately sense the type and concentration of a large variety of gases. Therefore, it can be used in the TDLAS-WMS system for high precision gas sensing and is expected to replace the tunable monolithic diode laser.

Keywords: narrow band interference filter; ECDL; TDLAS-WMS; piezoelectric ceramic actuator

Biography

Xiao Xiao, male, born in August, 1982, doctor of engineering, lecturer of institute of engineering and technology in Hubei university of science and technology. In July, 2005, he graduated from Huazhong university of science and technology with a bachelor's degree in optical information science and technology; in july, 2007, he graduated from Huazhong university of science and technology with a master's degree in optoelectronic information engineering; in july, 2013, he graduated from Shenzhen Institute of advanced technology, Chinese Academy of Sciences, with a Ph.D. degree in optical engineering. He used to be engaged in the research, development, and integration of new near-infrared band tunable external cavity semiconductor lasers based on narrow-band interference filters, as well as the application of such lasers in the monitoring of environmental pollution gas and industrial waste gas. Now he is engaged in the research of key technologies on machine vision based robot system. A total of 9 academic papers were published, including 3 in SCI and 3 in EI; he has obtained 2 national authorized invention patents.

Title: Smart Diamond 2-5 nm

Dr. Peter Belobrov
Professor
Siberian Federal University
Russia

Abstract

Here we have shown that a 2-5 nm diamond ball, depending on self-consistency with the boundary, can have a continuum of states that allow it to exhibit unique properties in the collective characteristics of various smart composite materials. A theory of this diamond compass (DC) is first condensed state matter of bulk diamond was developed. DC exists between organic diamondoids ($C_{10}H_{16}$, $C_{59}H_{60}$, $C_{66}H_{64}$, etc.) and nanodiamond (C_nH_m, $n>10^4$, $m<n/10$). This smart restless state has illustrated by the method of molecular dynamics. We suggested the DC model from inorganic core and organic shell with interface of Tamm layer. Main heart of suggested theory is self-consistency of internal current, electronic, vibration, and spin fields with location of carbon atoms, which create all these fields. The principal point of discovered states is balance between the lattice fields of cubic diamond and close-packed surface non-lattice structures of carbon in organic shell. 3D dipolic with $\sim 10^3 \div 10^4$ number of carbon atoms tends to form dense packing. The full evidence had made by theoretical calculations, experimental proofs and computer simulations. We measured joint electronic, magnetic, optic, spin-lattice relaxation and other characteristics of DC during change a wide range of external conditions (temperature, fields, compositions) by PEELS, NMR, EPR, Raman, Auger etc. The comparison the theory with all set of experimental data allows conclude that DC is smart topological material. We looked at a couple typical materials from DC: soluble aggregates nDC ($n \sim 10^5$) & solid porous semiconductor NDC ($N \sim 10^{19}$). We plan to discuss the results application for understanding the diamond/SiC interface.

Key Words: diamond compass, Tamm layer, restless state, smart composites

Biography

Dr. Peter I Belobrov (Ph.D. and Dr. habilitate – biophysics) is a Professor of Biophysics at Siberian Federal University. In 1990, he led the molecular architecture group (MOLPIT now). Together with A M Staver, he founded the Russian program “Diamond Nanotechnology” (1992-1994). He was editor of the NANO-II proceeding (1993). Belobrov has fundamental results: a) in the theory of the ground state of dipole systems (1983), b) the stochastic breaking of bound states in BZT model (1976), c) the method of equivalent dynamic system (1985), and d) the dipolic conception (1991). He proposed a physical mechanism of bioluminescence (1991), nanodiamond surface states (2001) and diamond compass (2015). He has priority results: the structure of the bacterial luciferase Langmuir-Blogged films (1988), field emission (1998) and paramagnetic properties of nanodiamond (2001), the semiconductor from nanodiamond-pyrocarbon composite (2001). There are of cited papers and a few inventions (see Google profile). His interest is diamond 2-5 nm, dipolic, biological measures and microfluidic.

Title: Philosophical Issues Concerning the Sense of Movement

Maria Teresa Alvarez Mateos
Postdoctoral Fellowship Margarita Salas
Universidad Complutense, Spain
Penn State University, USA

Abstract

The aim of this presentation is to discuss some philosophical aspects involved in the work of R. Smith *The Sense of Movement* (2019). I will expose the some outstanding moments in the evolution of the understanding of movement in the history of thought, analyzing why the sense of movement has gone unnoticed and has been hidden by the five known senses (taste, touch, sight, hearing, smell), being sometimes erroneously subsumed under the sense of touch. I will critically expose the primacy of vision in the analysis of perception that has apparently dominated the history of philosophy, and the review of this primacy from Husserlian and post-Husserlian phenomenology, and I will show how Smith considers this interpretation to be a misconception, as long as for him it is indeed the sense of touch the one that has dominated the philosophical epistemology. Finally, I will expose what is the role of kinesthesies (the sensations of body movement) in the constitution of space according to Edmund Husserl, thus showing some philosophical ways to recognize the place that the sense of movement occupies in the explanation of our way of constituting experience.

Keywords: PHENOMENOLOGY, EMBODIMENT, ROGER SMITH, KINESTHESIES

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Biography

Teresa Álvarez got her Licenciatura Degree both in Philosophy and Spanish Philology. She did her MA in Philosophy at Humboldt University in Berlin, finishing it with a thesis about *Passive Synthesis and Intersubjectivity in Husserl's genetic Phenomenology*. After, she did her Ph.D. in Philosophy at Universidad Complutense (Madrid) in cooperation with Husserl Archives Freiburg. Her Ph.D. project was on *Language and Objectivity from a Phenomenological Perspective*. After a 6-Month postdoctoral Fellowship at Universidad Nacional Autónoma de México, she holds now a Margarita Salas Postdoctoral Fellowship from the Spanish government, and she is working on her project *Language of Grievance: a Phenomenological and Linguistic Approach to Verbal Injury*, under the supervision of Eduardo Mendieta at Penn State University (until December 2023).

Title: Light-matter Interactions in Low-dimensional Structures and Molecules

Mousumi Upadhyay Kahaly
Scientific Application Division
ELI-ALPS, ELI-HU Nonprofit Ltd.
Hungary

Abstract

Increasing interest in the fields of ultrafast science such as femto-second chemistry, high-harmonics generation, and attosecond streaking using gaseous targets demands a thorough understanding of light-matter interactions at different structural dimensionalities from atoms and molecules (zero-dimensional) to solids (three-dimensional) structures.

All these wide class of materials, High-harmonic generation (HHG)- an extremely nonlinear optical process originating from interaction with a strong driving laser field, is considered in recent years as a rapidly expanding and interdisciplinary field, to engineer 'new advanced light sources'.

In order to maximize the output signal, and possibility of advanced applications, these materials should have high "alignment" and "orientation" (A&O) with respect to laser field. In this presentation, first we will demonstrate the critical role of varying pulse parameters for (two pulse) on the A&O dynamics of an poly-atomic molecule, in its equilibrium ground and field resonant vibrational state. The field parameters used are identified to be experimentally feasible. By analyzing the interplay between laser pulse parameters and the resulting rotational population distribution, the origin of specific A&O dynamics is addressed. Next, on achieving the high alignment and orientation of the molecules, we show our results for simulate the high harmonics spectra using time dependent density functional theory and strong field approximation. We identify possible optimized conditions in laboratory environment, how harmonic generation can be am-plified significantly in atoms, molecules or solids, suggesting an effective approach for increasing the HHG yield, which is considered in recent years as a rapidly expanding and interdisciplinary field, which is being considered as a new, state-of-the-art knob for ultrafast manipulation of information.

Biography

Dr. Mousumi Upadhyay Kahaly finished her Ph.D. from JNCASR, India, and completed her postdoctoral tenures in Max Planck Institute for Solid State Research, Germany and then Atomic Energy Commission CEA, France. Currently she is leading the Computational and Applied Materials Science team in ELI-ALPS, Hungary. The Extreme Light Infrastructure (ELI) https://www.eli-alps.hu/ project is the first infrastructure in the world able to investigate interactions between light and matter with the highest intensity. The main theme of Dr. Mousumi's research activities involve probing the structure, dynamics of materials through simulations, and understanding response and applications of light-material interactions in different regimes. They are actively involved to provide simulation support and theoretical understanding of user experiments in ELI that will have a considerable impact on numerous fields of materials science, medicine and environmental protection.

Poster & Paper

Title: Preparation and Characterisation of Poly(lactic acid)/Cellulose (Extracted from Eucomis Autumnalis) Composites for Various Applications

S.T. Sikhosana[a], T.P. Gumede[a]*, N.J. Malebo[a], A.O. Ogundeji[b], and B. Motloung[c]

[a]Department of Life Sciences, Central University of Technology, Free State, Bloemfontein, South Africa

[b]Department of Microbiology and Biochemistry, University of Free State, 205 Nelson Mandela Drive, Park West Bloemfontein, Free State, South Africa

[c]Department of Chemistry and Polymer Science, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa

Abstract

PLA infused with cellulose generally exhibits mechanical and physiological properties that broaden its application spectrum. These composites currently play a critical role in sustainable development as potential plastic substitutes to replenish our infinite resources. To produce high-performance materials suitable for a wide range of applications, self-aggregation and filler dispersity in the PLA matrix should be considered. Among the commonly studied organic fillers for PLA, cellulose is the most promising. It is available in various particle sizes and sources, providing numerous options for finding a suitable match for PLA matrices. The crystalline portion of naturally stiff chains extracted from herbaceous plant cell walls is being studied for potential filler roles. In this study, cellulose was extracted from the leaves of E. autumnalis to create a novel PLA/cellulose composite. Based on a distinguished cellulose spectrum, increased crystallinity and thermal stability compared to the leaf powder, varying contents of EA cellulose were incorporated into a PLA matrix. FTIR and SEM were used to investigate the surface morphology and structural properties of the composites. Furthermore, the thermal and mechanical properties of the composites were investigated using standard techniques (i.e., TGA and Tensile). At high filler content (97/3.0), there was better distribution and improved interfacial adhesion, resulting in a high Young's modulus.

Keywords: nanocomposites, poly(lactic acid), medicinal plants, Eucomis autumnalis, cellulose

Biography

Thandi Patricia Gumede completed her Ph.D. in Polymer Science at the University of the Free State. She is currently a Senior Lecturer at the Central University of Technology, Free State in Bloemfontein. Her research interest is on biodegradable polymers, natural fiber-based composites, conductive biopolymer composites and phase change materials (PCMs). To date, she has published more than 10 research articles in peer-reviewed journals, 3 book-chapters and attended various local and international conferences. Her research work has been cited 129 times, with an H-index of 7 according to Google Scholar and 115 times, with an H-index of 6 according to Scopus.

Title: Building 3D Reconstruction of TomoSAR Using Multiple Bounce Scattering Model

Fubo Zhang, Yaqian Yang*, Longyong Chen, and Ling Yang

National Key Laboratory of Microwave Imaging Technology

Institute of Aerospace Information Research Chinese Academy of Sciences and University of Chinese Academy of Sciences, China

Abstract

Tomographic synthetic aperture radar (TomoSAR) plays a critical role in the 3D reconstruction of complex urban targets with the capability of 3D imaging. Nevertheless, multipath scattering interference is common in 3D point clouds, seriously affecting the structure of the 3D model. In this letter, the multipath scattering phenomenon of buildings is analyzed and the building 3D reconstruction of TomoSAR using multiple bounce scattering model is proposed. The superiority of the proposed method is demonstrated for experiments on array TomoSAR data. It is found that the proposed method not only achieves interference suppression but also improves integrity and accuracy taking advantage of multiple scattering information.

Keywords: Multiple Bounce Scattering, 3D reconstruction, TomoSAR

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Biography

Yaqian Yang received the B.S. degree in Electronic and Information Engineering from Hebei University of Technology , City, China, in 2020 and will receive the M.S. degree in Signal and information processing from University of the Chinese Academy of Sciences, City, China, in 2023. Her research interests include SAR 3D imaging, Microwave imaging and Multiple Bounce Scattering.

Title: One-pot Synthesis of Nitrogen-doped Graphene- Fe_3O_4 for Additive Drug Electrochemical Detection

Yingyot Poo-arporn[1*], Saithip Pakapongpan[2], and Rungtiva P. Poo-arporn[3]

[1] Synchrotron Light Research Institute, 111 University Avenue, Nakhon Ratchasima, 30000, Thailand

[2] Graphene and Printed Electronics for Dual-Use Applications Research Division, National Science and Technology Development Agency (NSTDA), Pathum Thani 12120, Thailand

[3] Biological Engineering Program, Faculty of Engineering, King Mongkut's University of Technology Thonburi, Bangkok 10140, Thailand

Abstract

Food contamination with antibiotic-resistant bacteria can be a major threat to public health since the antibiotic resistance determinants can be transferred to other bacteria of human clinical significance. Trace determination is crucial to minimize risks of human intoxication and in the prevention of serious environmental impacts. Herein, a simple one-pot solvothermal synthesis approach for a nitrogen-doped graphene oxide-Fe_3O_4 (NG/Fe_3O_4) nanohybrid was fabricated without the addition of any extra reductant and its application towards ultrasensitive diethylstilbestrol (DES) electrochemical sensor is demonstrated to screen for antibiotic residue contamination in milk samples. The determination of additive drugs, DES, was achieved based on the reduction current response at NG/Fe_3O_4 modified MSPE to eliminate interference as far as possible. The chemical structure of the prepared NG/Fe_3O_4 was characterized by XRD, XPS, and EXAFS. The electrochemical properties of NG/Fe_3O_4 were evaluated with cyclic voltammetry and square wave voltammetry. The NG/Fe_3O_4 modified electrode presented superior electrochemical performance, including high sensitivity, high catalytic activity, fast response time, selectivity.

Keywords: Diethylstilbestrol, Nitrogen-doped graphene, Electrochemical sensor

Biography

Yingyot Poo-arporn is currently a Beamline Scientist at the Synchrotron Light Research Institute (SLRI), Thailand. He earned his Ph.D. in Chemistry from Kasetsart University in 2008. He developed and used the beamline and end-station for performing time-resolved X-ray absorption spectroscopy. He focused on in-situ and Operando studies on metal and semiconductor surfaces for catalysis and sensor applications.

World Symposium on Materials Sciences and Engineering 2023

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