



MARCH 2022

2nd Edition of

INTERNATIONAL CONFERENCE ON

MATERIALS SCIENCE AND ENGINEERING

VIRTUAL EVENT

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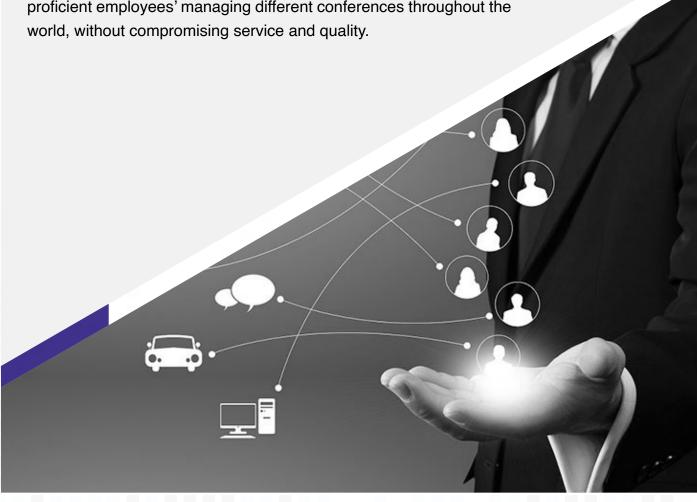
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ABOUT MAGNUS GROUP

Magnus Group (MG) is initiated to meet a need and to pursue collective goals of the scientific community specifically focusing in the field of Sciences, Engineering and technology to endorse exchanging of the ideas & knowledge which facilitate the collaboration between the scientists, academicians and researchers of same field or interdisciplinary research. Magnus group is proficient in organizing conferences, meetings, seminars and workshops with the ingenious and peerless speakers throughout the world providing you and your organization with broad range of networking opportunities to globalize your research and create your own identity. Our conference and workshops can be well titled as 'ocean of knowledge' where you can sail your boat and pick the pearls, leading the way for innovative research and strategies empowering the strength by overwhelming the complications associated with in the respective fields.

Participation from 90 different countries and 1090 different Universities have contributed to the success of our conferences. Our first International Conference was organized on Oncology and Radiology (ICOR) in Dubai, UAE. Our conferences usually run for 2-3 days completely covering Keynote & Oral sessions along with workshops and poster presentations. Our organization runs promptly with dedicated and proficient employees' managing different conferences throughout the



ABOUT MATERIALS 2022

Materials 2022 webinar serves as a podium for the interaction between experts in the areas of healthcare around the world and aims in sharing some research and translational studies on various advances in the related fields.

It is expected to bring together both reputable scientists in advanced stages of their and young researches from many related disciplines. The webinar expects many new ideas to emerge at the interfaces between disciplines aiming to solve the most important problems relating to the health and wellbeing of the humanity. With its strong emphasis on innovative approaches, the webinar offers a chance for scientists, academicians, doctors, nurses and physicians working in different areas of healthcare to learn new ideas that could help them advance their own research and forge new professional relationships and collaborations. Our honorary speakers will provide you with the most clinically up-to-date relevant information,

you'll leave better educated and more invigorated than you thought possible.



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Bala Vaidhyanathan*, George Chi-Tangyie, Annapoorani Ketharam, Thanos Goulas

Loughborough University, United Kingdom

Additive manufacturing of advanced ceramics: The art of the possible

The processing of advanced functional ceramic powders and suspensions into useful engineering components has been investigated via a series of research projects each focusing on a different stage of the manufacturing route viz., (i) the ability to control the agglomerates present in the ceramic powder resulting in the production of a free-flowing and crushable powders, (ii) the formation of low viscosity but high solids content nanoceramic suspensions suitable for 2D and 3D additive layer manufacturing (3D printing) and (iii) the use of novel field assisted sintering techniques (FAST). This holistic approach helped to transfer the developments achieved in each stage of the manufacturing process to the next and resulted in the ability to form fully dense advanced ceramic components whilst restricting the grain growth to a minimum.

The methodology has been employed to develop various advanced functional ceramic components such as 3D printed BaTiO3 based light-weight PTCR heaters for automotive and aerospace applications that surpasses existing commercial counterparts, ultra-low loss microwave dielectrics for beyond 5G communication devices, additively manufactured (AM) zirconia based biomedical components exhibiting vastly superior hydrothermal ageing resistance and mechanical performance suitable for use in biomedical implants (eg., hip/knee prosthesis, finger joints, dental and jaw repairs), petro-chemical valve parts as well as for ballistic armour applications. Significant sustainability advantages were noted with AM compared to conventional subtractive manufacturing methods in terms of reduction in material wastage and process efficiency. 3D printing of hydrothermally immune nanostructured dental implants was regarded as one of the six best modern technological developments in materials science by a recent BBC documentary (Materials of the Modern Age: The Secret Story of Stuff). These novel advancements are covered by a series of patents and papers and this talk will provide an overview of some of these developments.

What will audience learn from your presentation?

- The researchers, academics and industrial colleagues will learn the state-of-the-art developments in the rapidly growing field of additive manufacturing of ceramics.
- It will help the audience to understand the parameters that control the 3D printing of advanced ceramics, the challenges associated the ink formulations and post processing of printed parts.
- They will be able to understand the advantages of using field assisted sintering methods for the rapid densification of advanced ceramic components and how to effectively employ them to minimize grain growth whilst maximizing densification.

Biography

Bala Vaidhyanathan is a Professor of Advanced Materials and Processing and was the Associate Dean for Enterprise at the School of Aeronautical, Automotive, Chemical and Materials Engineering at Loughborough University. He leads the Advanced Ceramics Research Group in the Materials Department and has over 200 peer reviewed publications, named inventor on 17 patents, delivered >50 Plenary/keynote/invited presentations, organizing committee member for >10 global conferences and written six book chapters. He is the Editor of Advances in Applied Ceramics, and on the Editorial Board for many International Materials' Journals. He had been a research staff at the Pennsylvania State University, USA, and a Lead Scientist at General Electric.

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Jean EbothéUniversity of Reims Champagne Ardenne (URCA), France

Geometrical impact on magnetic properties of mesoscopic scale thick nickel thin films

Areal material thin film never exhibits a perfect or ideal geometrical shape, regardless of its formation conditions. This is mainly depicted by its unavoidable bulk usually represented by its thickness ($d\neq 0$) and its surface irregularities commonly considered in term of surface roughness ($\sigma\neq 0$), both film characteristics being closely interconnected. Their individual morphology and microstructure engender different behavior under a particular physical field (E) effect. Any related film's property (p) always results from their combined contributions. The study of p evolution is commonly investigated through its dependence on d as mainly encountered for macroscopic scale thick samples. However, configuration of real nano-films and nanostructured thin films is specific most of the time. Consequently, the study of their p evolution requires an adapted approach reflecting that specificity.

In the present work, our original proposal is illustrated by the study of nanostructured nickel electrodeposits for which evolution of coercivity (Hc) and magnetic domain size (w) are precisely investigated. It is then clearly demonstrated that only a new film geometrical characteristic (τ) defined as τ = (d/ σ) can consistently lead to the announced objective. The study of these properties evolution using the normalization model indicates a discontinuity in the magnetism of the investigated samples. Bloch magnetic domains (MD)B are associated with mixed domain walls (DWN + DWB) below a critical position (τ 0 -1) \approx 0.35, while Néel domain walls (DWN) coexist with mixed magnetic domains (MDB + MDN) beyond that position.

What will audience learn from your presentation?

- Investigators in inorganic material thin film physical properties are mainly concerned in the present work.
- They will be able to clearly classify real material thin films into different specific categories taking into account the important role of their both geometrical characteristics mentioned here.
- They will learn that real nanostructured thin films cannot be so quickly considered as macroscopic or microscopic scale thick samples in the study of their physical properties.
- They will see that the usual physical laws in which film thickness characteristic is involved should be more cautiously considered with nanofilms or nanostructured samples.
- They will realize that our approach is consistently elaborated in order to be adapted to different situations, improving by the way the accuracy of the measured film property.
- Illustration of our approach is proposed here in the study of magnetic properties but we believe it could also serve in the study of other film physical properties.

Biography

Dr. Jean Ebothé, PhD, DSci of Louis Pasteur University of Strasbourg, France. Distinguished Professor in Material Sciences and Physics of URCA, France. Chair of Material Sciences, Dept. of Mechanical Engineering, Technical Institute of Troyes. Head of Research team "Physics of Interfaces and Nanostructured Material thin films". Past Member of National Council of French Universities (CNU)-Section 28. Officer of Excellency French National Order of Merit "Ordre des Palmes Académiques".

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Hui Li*1,2,4,6, Xintong Wang^{1,2}, Xiaoyue Hu^{1,2}, Jian Xiong³, Qingkai Han¹, Xiangping Wang⁴, Zhongwei Guan^{5,6}

- ¹Northeastern University, Shenyang, China
- ² Central South University, China
- ³Harbin Institute of Technology, China
- ⁴Key Laboratory of Impact Dynamics on Aero Engine, Shenyang, China
- ⁵Technology Innovation Institute, Abu Dhabi, UAE
- ⁶University of Liverpool, United Kingdom

Vibration and damping study of multifunctional grille composite sandwich plates with an IMAS design approach

In the present study, an integrated material and structure (IMAS) design approach is proposed for fabrication of a multifunctional grille composite sandwich plate. It consists of two panels made of carbon fiber/resin polymer (CFRP) and one grille functional core that includes several grid frame beams (GFBs) and grille functional units (GFUs) via falcon riveting connections to achieve vibration sensing and damping control functions. In each GFU, it is composed of a rectangular grille (RG) and several embedded functional materials with 4-layer laminates, including a piezoelectric sensing layer, an upper copper wire layer, a magnetorheological elastomer (MRE) layer and a lower copper wire layer. To investigate the free vibration and damping characteristics of such a highly integrated sandwich structure, an analytical model is proposed that is based on the complex modulus method, the polynomial expansion approach, the improved Rayleigh-Ritz method, etc. After the natural frequencies, modal shapes and damping parameters are successfully solved, with results from literature being employed to roughly validate the model developed. Meanwhile, the dynamic experiments with different internal magnetic field distribution patterns and intensities of MRE are undertaken to give a further validation of the present model. Finally, the parameter analysis is carried out and some important conclusions are summarized to better exert active and passive vibration suppression performance of the CFRP-GFB-GFU plate.

What will audience learn from your presentation?

- An integrated material and structure design approach is proposed for fabrication of a multifunctional grille composite sandwich plate.
- A dynamic model of the multifunctional grille composite sandwich plates is proposed to predict the free vibration and damping characteristics.
- Numerical and experimental validation are conducted to prove the effectiveness of the present model.
- The parametric study is conducted to achieve some new analysis findings, which provides the important reference for better exerting vibration suppression performance of this highly integrated multifunctional sandwich plate.

Biography

Hui Li is an associate professor in Northeastern University, China. He has published more than more than 70 research articles in SCI/EI journals and 60 Chinese invention patents, including 30 top-level SCI papers in Compos Sci Technol, Compos. B. Eng, Mech Syst Signal Process, Nonlinear Dyn., etc. He once was a vibration engineer in Shenyang Machine Tool Co, Ltd, a postdoctoral fellow at Shenyang Engine Research Institute, and a visiting scholar in Liverpool University and Hanyang University. His research interest includes: nonlinear vibration, vibration and impact modeling, dynamic thermal evaluation of porous, hybrid and multifunctional composite materials and structures.



Jake Airey*¹, Matt Spencer¹, Mark Simmons², Richard Greenwood²

¹Rolls-Royce plc, UK ²University of Birmingham, UK

The evaluation of anti-wear additives on micropitting propensity and tribofilm thickness

This study aims to evaluate the performance of several different lubricant formulations over the range of conditions seen within Rolls-Royce's future concept gas turbine design called the UltraFan®. The design features a Power Gearbox (PGB) that allows optimisation of the speed of the fan system and the intermediate pressure (IP) turbine. The PGB presents a new tribological challenge for the lubricant as well the need to continue protecting other oil system components such as various bearing chambers and other gearboxes. Oils have been evaluated using a Micro-Pitting Rig (MPR) to explore how different types and concentrations of anti-wear additives in the lubricants formulation influence micropitting. Also, an MTM-SLIM (Mini Traction Machine with Spacer Layer IMaging) was used to measure the thickness and morphology of the tribofilm produced which will aid the understanding of how they influence micropitting.

What will audience learn from your presentation?

- The fundamentals of tribology; the study of wear, friction and lubrication.
- Share information about the formulation of aviation lubricants and their influence on transmission failure mechanisms.
- Discuss a common failure mechanism in gears (micropitting) how certain components of a lubricants formulation influence this.
- Information about a future Rolls-Royce engine in development; The UltraFan©.

Biography

Dr. Jake Airey studied Chemistry at the University of Sheffield and graduated with an MChem in 2014. He then did another postgraduate degree in Advanced Chemical Engineering at the University of Birmingham and graduated in 20156. He stayed on at the same institution undertaking an Engineering Doctorate (EngD); an industrially focused PhD conducting research into the Tribological Performance of Gas Turbine Lubricants sponsored by Rolls-Royce and published 1 article in the field. He graduated from this EngD in 2020. Prior to graduation, Jake became a Failure Investigator in Singapore at Rolls-Royce in 2019 and in 2021 became the Team leader for Failure Investigation.

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Siwat Linjee*1, Pitichon Klomjit², Chaiyasit Banjongprasert^{1,3}

¹Chiang Mai University, Thailand, ²National Science and Technology Development Agency, Thailand ³Chiang Mai University, Thailand,

Development of ultrafine-grained Al-Zn-In alloy for high-performance Al-air battery anode

Aluminum-air battery with a high theoretical energy density is one of the strong candidates as alternative battery for electric vehicles because it is recyclable, environmentally friendly, inexpensive, and abundant. However, the limitations of aluminum-air battery are a high self-corrosion rate in alkaline solution, and its open-circuit potential is lost significantly during anodic polarization due to the presence of an oxide film on the surface. Alloying and grain refinement can improve those properties. This research will present the development of high-performance aluminum alloy anode by a reduction of grain size using equal channel angular pressing (ECAP) and additions of zinc and indium. The potentiodynamic polarization, electrochemical impedance spectroscopy, and self-corrosion test were carried out to study those effects in a 4 molar sodium hydroxide solution. The results showed that ultrafine-grained Al-Zn-In had higher utilization, capacity density, energy density, and voltage than coarse-grained Al-Zn-In and coarse-grained pure Al, respectively because the addition of zinc improved the stability of ion dissolution with the growth of corrosion product film of zinc. An addition of indium promoted electrochemical activities. Moreover, ECAP increased grain boundaries through grain size reduction, causing more negative potential and a uniformly corroded surface of the Al-Zn-In anode.

What will audience learn from your presentation?

- The audience will learn an innovative technology for the development of high-performance aluminum-air battery.
- The audience will realize the effect of grain size on anode performance.
- The audience will realize the effect of the addition of zinc and indium on enhanced anode performance.
- This presentation shows an alternative battery for use in electric vehicles in the future.

Biography

Mr. Siwat Linjee is a MSc student in Materials Science at the Chiang Mai University, Thailand from 2019 - present. He joined the Advanced Metallic and Ceramic Materials Processing Laboratory under supervision of Asst. Prof. Dr. Chaiyasit Banjongprasert at Department of Physics and Materials Science, Faculty of Science, Chiang Mai University, Thailand. He has published 1 research article in Journal of Physics: Conference Series with 2 under review research articles.



Dilip Chalissery¹, Dennis Schönfeld¹, Mario Walter¹, Inga Shklyar², Heiko Andrae², Christoph Schwörer³, Tobias Amann³, Linda Weisheit⁴, Thorsten Pretsch*¹

¹Fraunhofer Institute for Applied Polymer Research IAP, Germany ²Fraunhofer Institute for Industrial Mathematics ITWM, Germany ³Fraunhofer Institute for Mechanics of Materials IWM, Germany ⁴Fraunhofer Institute for Machine Tools and Forming Technology IWU, Germany

Recognizing the potential of 4D printing

Pour-dimensional (4D) printing is still a young technology used to introduce material functionalities into components in an additive manufacturing (AM) process. The use of shape memory polymers such as thermoplastic polyurethanes or polylactic acid enables the production of thermoresponsive objects by implementing internal stresses in course of AM. The associated gain in functionality offers several advantages. By setting property profiles in the preceding synthesis process and by selecting appropriate print settings, a high degree of control over thermoresponsiveness can be achieved. In addition, a time- and energy-consuming thermomechanical treatment, which is often required for shape memory polymers, is no longer necessary; the thermoresponsive objects can be taken directly from the printer. Ideally, the 4D-printed objects then also follow a lightweight design.

Here we report on the design development of thermoresponsive objects, which we produced by fused filament fabrication. The functional devices offer excellent opportunities for carrying out assembly processes, while later a material-inherent programmable stiffness can be used for their disassembly, e.g. at the end of use or end of life. In perspective, the reuse of materials in 4D printing or other polymer processing techniques can further enhance their sustainability and thus initiate important steps toward a circular economy for functional materials with comparable property profiles. Against this background, recent work by the Fraunhofer Cluster of Excellence Programmable Materials CPM (project 630507) highlights opportunities and challenges of 4D printing and identifies possibilities for its use in areas such as healthcare.

What will audience learn from your presentation?

- Explain how the audience will be able to use what they learn?
- Polymer and process development for 4D printing.
- Criteria for the design of 4D printed objects.
- New usage concepts for 4D printed objects.
- How will this help the audience in their job? Is this research that other faculty could use to expand their research or teaching? Does this provide a practical solution to a problem that could simplify or make a designer's job more efficient? Will it improve the accuracy of a design, or provide new information to assist in a design problem? List all other benefits.
- Selecting the right polymer materials for 4D printing.
- 4D printing with commercially available printers.
- Transfer of knowledge to new applications.

Biography

Thorsten Pretsch has received his doctorate in Chemistry from the Free University of Berlin in 2004 and has been conducting research for more than 14 years in the field of shape memory polymers. Currently, he is deputy scientific coordinator at Fraunhofer Cluster of Excellence Programmable Materials CPM and responsible at Fraunhofer Institute for Applied Polymer Research IAP for the division Synthesis and Polymer Technology and the working group Shape Memory Polymers. He has published about 30 research articles in SCI(E) journals and is involved as inventor in 25 patent applications.



L Reddy*, P L Masiteng, A Balakrishna University of Johannesburg, South Africa

Recent development in NaCa(AG):Sm³⁺ (where AG = BO₃⁻³, PO₄⁻³ and SO₄⁻²) nanophosphors-applications for solid state lightning

In the present work, we have intended to investigate the photoluminescent (PL) properties of NaCa(AG): $Sm^{3+}(AG = BO_3^{-3}, PO_4^{-3}, SO_4^{-2})$ nanophosphors synthesized via the solution combustion method. Structural, morphological, and optical properties were carried out using different techniques. From the XRD results, it is confirmed that these materials are formed in the orthorhombic (BO₂-3, PO₄-3) and monoclinic (SO₄-2) structures. Morphological studies were carried out using a high-resolution scanning electron microscopy technique. From these results, it is confirmed that the prepared materials are formed in different particle shapes and sizes. Optical band gap energy values were calculated from the diffuse reflectance measurements, using the Kubelka-Munk function. Variations in the optical band gaps were noticed for the all undoped $NaCaBO_4$, $NaCaSO_4$ and doped $NaCa(AG):Sm^{3+}(AG = BO_3^{-3}, PO_4^{-3}, SO_4^{-2})$ nanophosphors. Photoluminescence excitation spectra were measured by monitoring the emission peak at 614nm wavelength, and this resulted in a high intensity excitation peak at 404nm. Similarly, by using this 404 nm UV excitation wavelength, photoluminescence emission spectra were noticed leading to a high intensity orange-red emission at 608 nm wavelength. From the photoluminescent properties it was noticed that NaCaPO4:Sm3+ showed the highest intensity in orange-red emissions compared to the other materials studied. Using PL data, the Commission International de l'Eclairage (CIE), colour coordinates were noticed and estimated for all studied materials. From the CIE colour diagram, it is confirmed that sodium calcium phosphate has the best colour purity. From the present investigations we found that Sm3+ doped sodium calcium phosphate to be a potential candidate for the enhancement of reddish-orange colour emission for solid state lighting and for colour display applications.

What will audience learn from your presentation?

- Comparisons are made of between the various NaCa(AG) compounds to show which compound produces the best reddish-orange emission when doped with Eu3+
- This research will help other researchers in eliminating compounds that produce a poorer reddish-orange emission, within this anionic group. This research can be extended by doping the same compound with other lanthanides to produce reddish-orange emission. Collaboration with other research groups can be strengthened for better phosphor materials

Biography

Dr Leelakrishna Reddy has studied physics at the University of Johannesburg, South Africa. He has completed his PhD in 2010, specializing in condensed matter physics. Currently, he is a senior lecturer in physics in the Department of Physics at the same university. He was the Head of Department of physics from 2014 to 2017. His interests are in nanophysics and has supervised many students in this area to completion. He has published more than 50 papers, including both conference and journal publications.



Shivani DhallDAV Collage, Jalandhar, India

Role of candle carbon soot as gas sensing material

In recent years, the rapidly increment in industrial emissions, vehicle exhaust and open burning of garbage waste are the main cause of pollutants gases which regularly deteriorate the natural environmental conditions. The continuous monitoring of these pollutant gases (H_2 , CO & NOx) is necessary to prevent environmental deterioration. Various types of instruments and materials are available to monitor the pollutes and harmful gases. Among materials, carbon materials are widely investigated because of they are enormously to these pollutants gases at room temperature conditions. In the present work, the cost-effective candle carbon soot (CCS) is used to detect 0.5% concentration of H_2 gas at room temperature. A simple candle flame is used to synthesize the layers of carbon soot at room temperature conditions. The acid treatment of the CCS at room temperature was drastically improved their structural and sensing properties as compared to as-synthesized CCS. To the best of our knowledge, detection of low concentrations of H_2 gas is reported here for the first time using economical CCS at room temperature. These results are important for developing a new class of chemiresistive type gas sensor based on change in the electronic properties of the CCS.

What will audience learn from your presentation?

- How we synthesis candle carbon soot.
- Fabrication of Candle carbon soot-based sensor.
- How we tested gas sensor.

Biography

Dr. Shivani Dhall has been working as an Assistant Professor in the Department of Physics, D.A.V. College, Jalandhar, since July 2018. Previously, she worked as a NPDF in Department of Physics, IITD. During her PhD, she worked in CEN, Electrical Department, IIT Bombay. She got best INUP project award from IIT Bombay in 2015. In 2018, she awarded with CSIR Nehru and DS Kothari Fellowships. In 2019, She received TARE project under DST for continue her research work. She is working on carbon materials, nanoparticles and their device fabrication using lithography technique for gas sensing, photo-sensor and interconnected applications. She is reviewer of many SCI journals. She has 21 SCI Journals publications.



Rupali Nagar*, Vishal Kamathe Symbiosis Institute of Technology, India

Sol-derived three-dimensional growth of tin oxide fractals

Fractal structures occur very often in nature as snowflakes, neuron network in human brain, mountains, trees, geometry etc. The complex structure has a governing power law that scales at different length-scales. This network which has repeating units possesses very interesting properties. In this work an attempt to grow fractals under lab environment is discussed. For this, sol-gel technique has been used to obtain SnO₂ fractals. By introducing chloride and hydroxyl ions in the reaction mixture, faster crystallization is achieved. Limited volumes of the gel, when dried, dry in different patterns. Based on the empirical evidence, the growth mechanism is proposed. When large volumes of gel are used, an interesting three-dimensional growth has been observed. Interestingly these structures continue to grow in the ambient condition vertically upwards, defying gravity. This clearly indicates that the gel network continues to expand with the help of little moisture present in the ambient. The growth process has been observed over a period of months, through different seasons and on large-scale substrate. The process is being understood to replicate or induce fractal formation in other metal oxide samples as well. Here, the role of hydrogen bonding is understood to aid in the network formation. Further, parameters like temperature and pressure will be discussed to understand the influence of ambient environment on the repeating unit of the fractal, fractal dimension, lacunarity, connectivity etc. The understanding of fractal formation and subsequent growth may be very helpful in simulating growth of skin tissue during wound repair, understand crack propagation in buildings, telecommunication improvements in antenna designs etc.

What will audience learn from your presentation?

- Explaining what fractals are?
- Fractals have been used to solve many complex problems.
- Fractals have wide applicability ranging from biology, geology, material science, neural networks, communication, etc.
- Understanding the growth of fractals could open gateways for addressing problems of Li dendrite in batteries or help researchers in tissue growth for better healing of wounds, etc.

Biography

Dr. Rupali Nagar studied Physics St. Stephen's college, Delhi university, India as UG and at IIT Kanpur for Masters. She then joined the research group of Prof. J P Singh and Prof. B R Mehta at Indian Institute of Technology Delhi, New Delhi India and received her Ph.D degree in 2011. She then pursued her post-doctoral research in the research group of Prof. S. Ramaprabhu at Indian Institute of Technology Madras, Chennai, Tamil Nadu. She then joined Symbiosis Institute of Technology, Pune as Assistant Professor. She has established a research Lab Nanomaterials for Energy Applications at SIT. She has received 2 minor and one major research grant. She has published more than 20 papers, has 2 patents and published 2 book chapters.



Santosh Kumar Khetan, Pranav Pradeep P., Shwetha Govinda Bhat*, P. S. Anil Kumar

Indian Institute of Science, Bangalore. INDIA

Oxide substrate termination and 2D growth of perovskite magnetic oxide ultrathin films

Cingle-site atomic termination of oxide single crystalline substrates are becoming highly essential due to the growing popularity and demands of Reflection High Energy Electron Diffraction (RHEED) assisted 2D epitaxial layer-by-layer growth of thin film heterostructures and the associated physics at their interfaces. Understanding the complex interactions in perovskite oxide heterostructures, both electronic and magnetic, can be realized only when the growth of such materials is fully under control. In this regard, we have achieved single-site atomic termination in SrTiO3 (001) and (111). However, substrates like LSAT (001) known to pose hurdle in achieving an atomically smooth single-site termination at the surface, hindering a controlled growth process. We have performed study of the evolution of step-terraces by studying the various influential annealing parameters which are seldom end-to-end. Further, growth of 2D epitaxial layer-by-layer growth of various perovskite magnetic oxides up to unit-cell thickness level are demonstrated using pulsed laser deposition (PLD) technique. We have extensively investigated growth of variety of magnetic materials such as doped manganites and ruthenates on atomically terminated substrates. Different influential deposition condition parameters of growth, such as, growth temperature, pressure, laser beam conditions etc. are studied to understand the growth modes of the thin film. RHEED spots and the intensity oscillations of the specular beam are monitored to observe the growth mode. Important findings such as X-ray diffraction, reflectivity measurements and results of atomic force microscope images will be further discussed on supporting the optimal growth conditions of thin film systems. Magnetic measurements of such samples along with Curie temperature as a function of thickness will also be dealt in detail.

What will audience learn from your presentation?

- Knowledge of influential parameters in deciding the step-terraces of the substrates and the deposition conditions are crucial but time-consuming process. My talk will provide an overall clear picture of the phase- space involved.
- Understanding of the complex PLD growth of thin film would provide the audience a complete practical knowledge before-hand while working on a new material.
- I will cover how the control over the growth can help one to control all the associated electrical and magnetic characterization achieved with quality close to its single-crystal bulk counterparts.

Biography

Dr. Bhat completed her Ph.D in 2015 at Department of Physics, IISc, India, on spin injection into semiconductors using oxide magnetic thin films. She continued to be research associate extending her work into growth and characterization of PLD grown strong spin-orbit coupled iridates. Currently, as an INSPIRE faculty fellow since 2017, she is extensively working on RHEED assisted 2D layer-by-layer growth of ultra-thin magnetic layers using PLD and their structural, magnetic and magnetotransport characterizations while co-supervising Ph D students, masters, and B. Tech project students. She has published several international publications and regular reviewer for Elsevier, AIP and IEEE publications.



Ramavatar Meena^{1,2*}

¹Natural Products & Green Chemistry Division and AcSIR, CSIR-Central Salt & Marine Chemical Research Institute, India ²Academy of Scientific and Innovative Research (AcSIR), India

Seaweed polymer containing functional materials to protect environment

India has ~7500 km long coastline that is accessible for seaweed activities including seaweed cultivation. Seaweeds represent one of the most significant and auspicious sources for numerous natural products including gelling polymers. Moreover, seaweed polymers have been widely used as a key ingredient in the pharmaceutical, food, cosmetics, and dairy industries as a stabiliser. In recent, I have developed green processes for the production of these seaweed polymers under the value addition program of Indian seaweed biomass.

The synthesis of functional materials using seaweed-derived polymers for potential applications is demanding research in the modern era. These functional materials are of great importance owing to their biodegradability, catalytic property, excellent bioactivity, and less toxicity. In this direction, we have developed green and eco-friendly methods for designing seaweed polymer containing functional/smart materials for potential uses such as self-healable emollients, biodegradable packaging, sensors, bioactive compositions, and catalysts. These developed materials are characterized using advanced analytical tools such as scanning electron microscopy (SEM), transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS), FTIR, NMR, XRD. This short talk provides the progress towards the preparation of seaweed polymer containing functional /smart materials for various applications.

What will audience learn from your presentation?

- Explain seaweed-derived polymers?
- Significance of functional modification of natural polymers?
- How we prepare seaweed polymer containing functional materials?
- This presentation summarizes study done over the years on the preparation of functional materials using seaweed polymers in lab and potential applications.

Biography

Dr. Ramavatar Meena has expertise in the field of downstream processing of seaweed biomass, polymers, functional modifications, sustainable/advanced materials, hydrogels, biodegradable films, and characterization techniques. He has completed his Ph.D. from M. K. Bhavnagar, University, Bhavnagar, India and visiting as DST BOYSCAST Fellow at Hamburg University, Germany. He is the Senior Principal Scientist of CSIR-Central Salt & Marine Chemicals Research Institute, a premier R&D organization. His group has developed several process technologies for the commercial production of valuable seaweed products. He has transferred more than seven (07) technologies to more than eighteen (18) Indian industries for the commercial production of seaweed products. He has published more than seventeen (17) national/international patents, more than 80 research papers in reputed journals and has been serving as an editorial board member of repute. He is the recipient of several awards "DBT-Biotech Products Awards-2020; CSIR Award for S&T Innovations for Rural Development-2012; Fellow of Royal Society of Chem. (FRSC); Life Member of IIMM; Best Technology Award -2016 & 2018; IIMM outstanding Research Paper Award 2018; etc".



Soumendu Sinha^{1,2}

¹CSIR - Central Electronics Engineering Research Institute (CEERI), India, ²Academy of Scientific and Innovative Research (AcSIR), India

Development of sensing film materials using reactive sputtering process for FET-based pH sensors

In on-Sensitive Field-Effect-Transistor (ISFET)-based chemical/biochemical sensors are used for measuring ion concentrations analyte solutions. Most commonly, they are used as pH sensors, where the current through the transistor changes with respect to the ion concentration at the sensing region (gate). ISFET is a solid-state device, which makes it rugged for the measurement of ion activities in analytes, with the aid of a reference electrode and it has been widely used for pH measurements. pH is one of the most important parameters in agricultural, environmental, bio-medical and potable water studies. ISFET has attracted much interest due to the feasibility of facile integration with readout circuits. It is an alternative to the conventional glass membrane electrode-based pH sensors, where it enables measurements in ultra-small volumes with fast response. This work deals with the design, fabrication and characterization of ISFET-based pH sensors.

The most critical element in ISFET-based pH sensors is the sensing film deposited over the gate region of the sensor. In this work, the sensing films are deposited using pulsed-DC magnetron-assisted reactive sputtering technique. Various process parameters for deposition of the film were optimized through several experiments. The deposition process for three sensing films were optimized, namely, AlN, Al_2O_3 and TiN, and their material characterization was carried out using various techniques. ISFET-based pH sensors were fabricated using well established, CMOS compatible unit processes. In this work, three variants of ISFET-based pH sensors have been fabricated with AlN, Al_2O_3 and TiN as the sensing films, using self-aligned process. The devices were encapsulated using the Dam-and-Fill technique and packaged using thick-film alumina technology. The sensors were characterized for pH sensing applications. Moreover, drift and hysteresis studies were performed for each sensor and low drift and hysteresis values were obtained for the fabricated ISFETs.

What will audience learn from your presentation?

- The audience will get an overview of FET-based pH sensors which has applications in various areas including environmental field studies, agricultural monitoring, biomedical monitoring, etc.
- The audience will also get an overview of the development of sensing films using sputtering technique, which is a cost-effective and simple physical vapor deposition process and they can utilize the technique for depositing several other types of dielectrics for various applications.
- The device fabrication process will be discussed and the characterization results will be presented, which will introduce the audience to a facile self-aligned CMOS-compatible device fabrication technique.
- The talk will help the audience in understanding the development process of FET-based sensors which will be useful for the researchers working in the area of electrochemical chemical/biochemical sensors.

Biography

Dr. Soumendu Sinha received his B.E. (Hons.) in Electrical and Electronics Engineering from Birla Institute of Technology and Science (BITS), Pilani, and his M.Tech. and Ph.D. from Academy of Scientific and Innovative Research (AcSIR), India. He is currently working as a Senior Scientist in Semiconductor Devices Design Group at CSIR-CEERI, Pilani. He is also an Assistant Professor at AcSIR, India. He has authored and co-authored over 30 papers in reputed journals and national/international conferences. His current research interests are in the interdisciplinary areas of solid-state electrochemical sensors and MEMS-based sensors and transducers.



Bhaswati Choudhury
SurfPlasma, Inc, USA

Surface Dielectric Barrier Discharge (DBD) plasma decontamination

Inhanced distribution of atmospheric surface DBD (Dielectric barrier discharge) plasma generated ozone in air for $oldsymbol{\perp}$ effective decontamination is examined. This is achieved through experimental investigation of (a) the effect of better ozone distribution on decontamination and (b) ozone distribution produced by surface DBD plasma reactors. This study provides an alternative technique for decontamination of cleanroom facilities and heat-sensitive equipment, which can overcome disadvantages of high processing temperatures, long exposure times, harsh chemicals, toxic residuals, and material incompatibility associated with conventional decontamination methods. The need for such an alternative technique is crucial with the advent of advanced materials and disinfectant resistant micro-organisms, along with the global challenge of environmental pollution. Examples of such need of alternative approaches include minimizing (a) damage of heat sensitive materials and material alteration with thermal and chemical treatments in the manufacturing industry and (b) deterioration in food nutrition with traditional processing methods. In this study, spore forming bacterial species, Bacillus subtilis, which is commonly used to test decontamination methods, is used as the test organism. Significant reduction (~78%) of bacterial concentrations in the inoculated volume of air is observed using the comb shaped DBD plasma reactor. Increased reduction (~98%) is observed when the same reactor was used in conjunction with an external fan for better ozone distribution. Considering this, new surface DBD configurations can be used instead of the external fan to obtain better ozone distribution leading to lower ozone requirements and energy consumption. For this purpose, ozone distribution in conjunction with the flow generated by surface DBD reactors is studied using contrasting DBD reactor configurations in order to enhance decontamination with less ozone requirements and energy consumption. The study also discusses advancing DBD decontamination applications with its potential to overcome existing drawbacks that has limited this technology despite advantages of low temperatures and non-toxic residuals.

What will audience learn from your presentation?

- The audience can use the knowledge of DBD plasma decontamination for decontamination of cleanroom facilities and heat-sensitive equipment in the manufacturing industry.
- The audience can use this knowledge to test alternative decontamination techniques as needed in their industry.
- This research can help faculty to expand their teaching.
- It will help improve the design of plasma reactors currently used for decontamination.

Biography

Dr. Bhaswati Choudhury studied Mechanical Engineering at the University of Florida, Gainesville (UF). She graduated as MS in mechanical engineering in 2016. During her MS, she had joined the Applied Physics Research Group at UF and started research on plasma reactors under the guidance of Dr. Subrata Roy. She received her PhD degree in 2020 at UF on SDBD plasma decontamination. After graduation, she obtained the position of Research Scientist and Project Manager at SurfPlasma, Inc, and is currently serving as Principal Investigator for research projects funded by the NSF (National Science Foundation) and NASA (National Aeronautics and Space Administration).





MATERIALS SCIENCE AND ENGINEERING

28-30\{\xi}

Materials 2022



K. NikbinImperial College London, United Kingdom

An integrated multiscale structural integrity approach to predicting damage and failure in advanced steels under fatigue/creep/oxidation

Tew fabrication methods in advanced steels highlight issues related to identifying component susceptibly to long term damage and structural failure under fatigue, creep and environmentally assisted corrosion/oxidation processes. It is a costly and time-consuming process to evaluate and characterise material properties every time a new alloy is developed. It is essential therefore to develop numerical procedures to optimise the testing and predict the operational processes. This lecture highlights the new materials fabrication methods and presents the recent advances in research and development of design and life assessment of advanced steel components. The methodologies presented cover techniques in virtual testing methods and multiscale modelling to determine the remaining life assessment of components. Guidelines for assessing the structural design, relevant failure criteria and the significance of defects in as received and welded components are discussed. The experimental procedures will need to contain methodology for dealing with failure by net section rupture, incremental crack growth or some combination of both processes. The onset of brittle or ductile fracture in determining tolerable defect size need to be considered. The procedure should also be applicable to defects, which are caused by time-dependent environmental phenomena where the degraded material property is available and can be used in performing the life assessment analysis set out. Finally, the characterisation of material properties from experimental tests are needed to develop numerical models of failure mechanisms to predict damage and crack growth. The lecture will highlight the experimental links to modelling and the need for validations of the models. An integrated model is presented which can be used to predict time dependant intergranular creep, cycle dependant transgranular fatigue and time dependant surface corrosion or oxidation damage or cracking in components.

Biography

Professor Nikbin Holds a Royal Academy Chair in 'Structural Integrity' and has worked in the Mechanics of Materials Division for over 40 years. The group have built up experience in 'Structural Integrity' of metallic and composite materials based research, involving experimental testing, numerical modelling and the verification of component lifting methods which are associated with failures due to brittle, ductile, fatigue and creep and environmental fracture mechanisms. The main aim has been directed towards developing techniques for predicting failure using fracture mechanics, continuum damage mechanics and micro to meso-scale modelling techniques, which are validated through appropriate experiments.

The structural integrity group and the EDF Energy High Temperature Centre headed by Prof. Nikbin has collaborated with industry and international research establishments on numerous multi-disciplinary projects dealing with different aspects of fracture occurring at a range from cryogenic to very high temperatures. In particular, the main impetus has been in the field of high temperature creep/fatigue and environmental crack growth by considering the experimental, metallurgical and computational multi-scale modelling, virtual testing and progressive failure analysis approaches associated with the relevant damage mechanisms. A considerable knowledge base has been accumulated on advanced steels, single crystals and high temperature protective coatings as well as composites materials. The consequent product of this research has been the development of life assessment codes that have been adopted by a range of industrial bodies. Substantial input has been made to a number of codes including BS7910, ASTM, ASME, API, British Energy R6/R5 codes, ISO standards dealing with residual stresses and component creep/fatigue testing and also the design code for the ITER super magnet structure which includes fatigue fracture criteria for cracked components. In addition the fracture mechanics life assessment approaches have been continually developed to improve safe prediction capabilities



Zakaria Boumerzoug
University of Biskra, Algeria

Continuous casting of copper wire

Copper is the most widely used metal in the field of electricity transport. Thousands tons of copper are manufactured every year as rods, tubes, bars, and other diverse section products. For a large production of copper, casting is the most suitable process. The production of copper wires is carried out by continuous casting which is a simple and economical method. Continuous casting is a process of melting and continuous solidification and it has been used for more than 100 years to produce components. Different continuous casting production techniques will be presented. In particular, the vertical continuous casting will be detailed. The metallurgical parameters and problems of the production of copper wires will also be presented. Some solutions for these issues were suggested.

What will audience learn from your presentation?

- The audience will be able to learn about the continuous casting process?
- The industrial will know about the main parameters of manufacturing of copper wire by vertical casting process.
- Some solutions for a specific issues will be suggested.

Biography

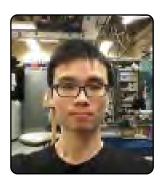
Zakaria Boumerzoug is a professor of metallic materials at Biskra University. He joined Biskra University in 1992. He has completed his PhD from Constantine University in 1998. He published more than fifty articles and he participated to more than thirty international conferences as speaker and invited speaker (ICWET'16 Turkey, 3rd WCSE2017 Spain, ICMTMTE2018 Russia, HORA2019 Turkey,...). He was as a member and also as a guest editor in some international conferences. He has supervised 20 PhD students. He has reviewed many articles of some scientific journals. He is a chief of an international project between Biskra University and UMONS University in Belgium. He has a short international teaching experience at Cadiz University, Spain. He organised more than 10 scientific meeting in Algeria. He is the academic editor of the journal Advances in Research from 01/09/2018 to 31/08/2022. He edited a book of Advanced Materials Design and Mechanics.





MATERIALS SCIENCE AND ENGINEERING

Materials 2022



C.H.Wong*1,2, R.Lortz². A.F.Zatsepin¹

¹Ural Federal University, Russia ²The Hong Kong University of Science and Technology, Hong Kong

Enormous enhancement of p-orbital magnetism in the lightly doped carbon chains

We present a path to tailor adapted magnetic properties in carbon chains. Our undoped carbon chains show p-orbital ferromagnetism up to 400K experimentally. As the ferromagnetism of carbon chains depends on chain-to-chain distance, a tunable ferromagnetism may occur if the carbon chains are compressed. We also demonstrate that the charge fluctuation of the free radical electrons triggered by a time-varying electric dipole moment leads to enormous p-orbital magnetism of carbon chain. By introducing 25% arsenic and 12.5% fluorine into the monoatomic carbon chain, the magnetic moment of the arsenic atom reaches 2.9 μB, which is \sim 1.3 times stronger than magnetic moment of bulk Fe and meanwhile its exchange–correlation energy reaches 22 meV (\sim 270 K). Besides, the closely-packed carbon chains further developed for magneto-electric applications is highly possible if the substrate plays a role as an actuator.

What will audience learn from your presentation?

- The audience should be able to apply the relationship between p-orbital ferromagnetism and the dynamics of freeradical electrons to design nano-magnets of carbon. The p-orbital magnetism in carbon chains triggered by kink structures and free-radical electrons may be the origin of unusual magnetism in nano-graphene.
- The results can be elaborated to study unusual magnetism in nano-graphene.

Biography

Dr. Roy WCH serves as Scholar in The Hong Kong University of Science and Technology. He has published international journals and patents in Materials Physics & Artificial Intelligence in addition to university textbooks about electric motors, turbocharged engines and FPGA programming. Apart from this, he has served as invited speaker in the international conferences on science. He works as journal reviewer for American Chemical Society, Elsevier and The Royal Society of Chemistry.



S S Lokesh Vendra*, Ravikumar
Indian Institute of Technology, Madras (IIT Madras), India.

Transition metal modified SiOC as a next generation dielectric material for energy storage applications

Amorphous silicon oxycarbides are well-known to be an advanced ceramics because of their exceptional high temperature properties, mechanical properties, and functional properties. In this study, we used a liquid precursor-derived ceramic method to modify the SiOC with hafnium n tetra butoxide precursor to synthesize the SiOC/HfO₂ composites. The powders were sintered using the spark plasma sintering technique to produce sintered pellets of these compistes. X-ray diffractograms confirmed the crystallization phase of tetragonal HfO_2 in these composites. The elemental composition and bonding properties were investigated using X-ray photoelectron spectroscopy. Electron microscopy was used to explore morphological features. The dielectric permittivity of the SiOC/HfO2 composites showed a value of ε ~20 and loss of $\tan\delta$ ~ 0.25 low loss compared to SiOC. The work provides a pathway for cost-effective, tunable, and fully functional SiOC/HfO₂ composites for next generation dielectric materials.

What will audience learn from your presentation?

The presentation will give an idea about next generation advanced materials like SiOCs fabricated from polymer derived ceramic (PDC) route. Polymer-derived ceramics (PDCs) have been used and are being considered for a range of applications throughout the past five decades. Most of the available literature on high temperature and mechanical properties, functional properties. Also, proven to be an efficient anode material for battery in energy storage applications. Hence, from this work, it will get to know the maximum possible applications of PDCs including as dielectric materials, which could be sort out design of materials in respective applications.

Biography

SS Lokesh Vendra, research scholar pursuing his doctoral thesis under the supervision of Prof. Ravikumar at Department of Metallurgical and Materials Engg., IIT Madras, Chennai, India. He also a visiting scholar and working under Prof. Gurpreet Singh at Kansas State University, Manhattan, Kansas, US. He did his Master of Technology from Department of Metallurgical and Materials Engg., IIT Roorkee, Uttarakhand, India. His areas of interest on advanced energy storage materials, functional ceramics, materials characterization. Presently he is working on developing the SiOC based materials for energy storage applications through precursor route.



Seongwoo WooEthiopian Technical University, Ethiopia,

Improving the reliability design of mechanical systems such as refrigerator

To enhance the lifetime of mechanical system such as automobile, new reliability methodology – parametric Accelerated Life Testing (ALT) – suggests to produce the reliability quantitative (RQ) specifications—mission cycle—for identifying the design defects and modifying them. It incorporates: (1) a parametric ALT plan formed on system BX lifetime that will be X percent of the cumulated failure, (2) a load examination for ALT, (3) a customized parametric ALTs with the design alternatives, and (4) an assessment if the system design(s) fulfill the objective BX lifetime. So we suggest a BX life concept, life-stress (LS) model with a new effort idea, accelerated factor, and sample size equation. This new parametric ALT should help an engineer to discover the missing design parameters of the mechanical system influencing reliability in the design process. As the improper designs are experimentally identified, the mechanical system can recognize the reliability as computed by the growth in lifetime, LB, and the decrease in failure rate, ②. Consequently, companies can escape recalls due to the product failures from the marketplace. As an experiment instance, two cases were investigated: 1) problematic reciprocating compressors in the French-door refrigerators returned from the marketplace and 2) the redesign of hinge kit system (HKS) in a domestic refrigerator. After a customized parametric ALT, the mechanical systems such as compressor and HKS with design alternatives were anticipated to fulfill the lifetime – B1 life 10 years.

What will audience learn from your presentation?

- Reliability test plans of multi-module product based on its BX life definition.
- Acceleration method of mechanical system.
- Derivation of sample size equation combined with targeted BX lifetime and accelerated factor.
- Accelerated life testing with reproduction of design problems and its action plans.
- Evaluation of the final product design to ensure the BX lifetime are satisfied.

Biography

Dr Woo has a BS and MS in Mechanical Engineering, and he has obtained PhD in Mechanical Engineering from Texas A&M. He major in energy system such as HVAC and its heat transfer, optimal design and control of refrigerator, reliability design of thermal components, and failure Analysis of thermal components in marketplace using the Non-destructive such as SEM & XRAY. In 1992.03–1997 he worked in Agency for Defense Development, Chinhae, South Korea, where he has researcher in charge of Development of Naval weapon System. He was working as a Senior Reliability Engineer in Refrigerator Division, Digital Appliance, SAMSUNG Electronics. Now he is working as associate professor in mechanical department, Ethiopian Technical University.



Lydia BondarevaEhrisman's Federal Scientific Centre of Hygiene, Russia

Nanomaterials in nuclear technologies and radioecology

adioactive waste is a byproduct of nuclear power generation and applications of various radioactive materials in many $oldsymbol{\Gamma}$ commercial sectors. This waste has been strictly regulated as a highly hazardous material to all forms of life as well as the environment. The technologies currently adopted for managing radioactive waste are mainly based on segregation and storage. Ideally, radioactive waste should be isolated from entering the environment, but there has been slow progress toward sustainable waste management. Nanomaterials, with unique physical and chemical properties, such as the nanosize effect, large specific surface area, and high reactivity and selectivity, have become new materials for radioactive wastewater decontamination. Therefore, this review aims to provide a comprehensive overview and analysis of a newer generation of nanomaterials that have been demonstrated to be effective for radioactive wastewater decontamination, such as carbon-based nanomaterials, metal nanoparticles, nanosized metal oxides, metal sulfides, nanosized natural materials, layered double hydroxides, hydroxyapatite nanoparticles, metal-organic frameworks, cellulose nanomaterials, and biogenic nanocomposites. Although many different types of nanomaterials have been developed, their engineering feasibility toward radioactive wastewater decontamination has not yet been demonstrated for real-world largescale applications. Lastly, the challenges associated with the applications of nanomaterials for radioactive wastewater decontamination have been discussed in detail while shedding light on future research directions. Key results concerning large-scale application of nanomaterials in nuclear engineering are reviewed. The data on redox reactions of uranium and actinides in solutions and solid-phase transformations for the development of modern technologies for fuel reprocessing and handling of alkaline radioactive waste are discussed. The information concerning various methods for treatment of liquid radioactive waste with nanostructured sorption materials (carbon materials included) is also presented.

Biography

Lydia Bondareva, PhD of Analytical Chemistry, Full Professor of Ecology. Leader research in Analytical laboratory. Education: Lomonosov's Moscow State. University, Analytical chemistry. Field: analytical chemistry, radioecology, chemistry of pesticides, aquatic plants. I have more than 200 scientific articles in top-rated scientific journals and am the author and co-author of monographs.



Selcuk Poyraz Adiyaman University, Adiyaman, Turkey

A novel combined approach to simultaneous nanostructured conducting polymer carbonization and carbon nanotube/metal oxide nanowire growth

Carbonized conducting polymer (CCP), i.e. polypyrrole (PPy), nanostructures with carbon nanotube (CNT) and metal oxide nanowire (MONW) growth on their surface were obtained with a great potential as a building material for advanced engineering applications. A well-established, in-situ polymerization/coating method and a simple and straightforward microwave (MW) energy-based carbonization approach, i.e. PopTube, were systematically combined to prepare this novel material. Through this simple, facile, yet highly efficient, affordable and easily scalable combined synthesis method, it becomes possible to produce such CCPs with unique morphological, spectroscopic, thermal and elemental features, all of which are strongly supported by both various material characterization test results and the relevant literature data. Thus, it is believed that such CNT and MONW decorated CCPs (CNT-MONW/CCP) obtained via the above-mentioned method would soon become a material of preference for a large span of advanced applications in various science and engineering fields.

What will audience learn from your presentation?

- The audience will learn about the preparation of nanostructured hybrid electrode materials that can be used for electrochemical energy storage applications.
- This research will help the other faculty or researchers in the audience to expand their relevant research or teaching activities.
- This research will also provide a practical solution to nanostructured hybrid materials preparation within very short time frames by using microwave energy and could simplify researcher's job in an efficient manner.

Biography

Dr. Poyraz studied Textile Engineering at Cukuorova University, Turkey and graduated as BS in 2007. He then joined the research group of Dr. Xinyu Zhang at Auburn University, USA. He received his MS and PhD degrees in 2010 and 2014, respectively at the same university. After six months of postdoctoral fellowship supervised by Dr. Zhang at the same university he returned to Turkey and obtained the Assistant and Associate Professor positions in 2018 and 2021, respectively at Adiyaman University. He has published 25 research articles in SCI(E) journals.



Osman AdiguzelFirat University, Elazig, Turkey

Shape reversibility and displacive transformations in shape memory alloys

Some materials take place in class of advanced smart materials with adaptive properties and stimulus response to the external changes. Shape memory alloys take place in this group by exhibiting a peculiar property called shape memory effect, which is characterized by the recoverability of two certain shapes of material at different temperatures in reversible way. Shape memory effect is initiated on cooling and deformation the material and performed thermally on heating and cooling after first cooling and stressing treatments. Therefore, this behavior is called thermoelasticity. This deformation is plastic deformation, with which strain energy is stored in the material and released on heating by recovering the original shape.

These alloys exhibit another property called superelasticity which is performed in only mechanical manner, by stressing and releasing the material at a constant temperature in parent phase region and recover the original shape simultaneous and instantly on releasing the external forces. These alloys are used shape memory elements in many fields from biomedical to the building industry. These phenomena are result of crystallographic transformations in the materials, called martensitic transformations, by which crystalline structure of the material change. Shape memory effect is governed by successive thermally and stress induced martensitic transformations, on cooling and stressing. Thermal induced martensitic transformation occurs on cooling with cooperative movement of atoms by means of lattice invariant shears in <110> - type directions on {110} - type planes of austenite, along with lattice twinning and ordered parent phase structures turn into twinned martensite structures. These twinned structures turn into detwinned martensite structures by means of strain induced martensitic transformation with deformation in martensitic state. These alloys exhibit another property called superelasticity, which is performed by stressing and releasing material at a constant temperature in parent phase region, and shape recovery is performed simultaneously upon releasing the applied stress. Superelasticity is performed in non-linear way; stressing and releasing paths are different in the stress-strain diagram, and hysteresis loop refers to energy dissipation. Superelasticity is also the result of stress-induced martensitic transformation, and parent austenite phase structures turn into the detwinned martensite structure with the stressing.

Copper based alloys exhibit this property in metastable $\ensuremath{\mathbb{Z}}$ - phase region, which has bcc-based structures at high temperature parent phase field. Lattice invariant shear and twinning is not uniform in copper alloys, and they give rise to the formation of unusual layered complex structures, like 3R, 9R or 18R structures depending on the stacking sequences, with lattice twinning. Unit cell and periodicity is completed through 18 layers in direction z, for 18R martensite structures in ternary copper-based alloys.

In the present contribution, electron diffraction and x-ray diffraction studies performed on two copper- based CuZnAl and CuAlMn alloys. Electron diffraction patterns and x-ray diffraction profiles show that these alloys exhibit super lattice reflections in martensitic condition. Specimens of these alloys aged at room temperature in martensitic condition, and a series of x-ray diffractions were taken duration aging at room temperature. Reached results show that diffraction angles and peak intensities change with aging time at room temperature. Some of the successive peak pairs providing a special relation between Miller indices come close each other, and this result leads to the rearrangement of atoms in diffusive manner.

Keywords: Shape memory effect, martensitic transformation, thermoelasticity, superelasticity, lattice twinning, detwinning.

What will audience learn from your presentation?

- Shape memory alloys are multifunctional materials and used in many fields. Shape memory effect is multidisciplinary subject.
- This conference is also multidisciplinary conference, and I will introduce the basic terms and definition about shape memory effect ant martensitic transformation at the beginning of my talk, considering every delegate is not familiar with this phenomenon.

Biography

Dr. Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey. He has studied at Surrey University, Guildford, UK, as a post-doctoral research scientist in 1986-1987, and studied on shape memory alloys. He worked as research assistant, 1975-80, at Dicle University and shifted to Firat University, Elazig, Turkey in 1980. He became professor in 1996, and he has been retired on November 28, 2019, due to the age limit of 67, following academic life of 45 years. He published over 80 papers in international and national journals; He joined over 120 conferences and symposia in international and national level as participant, invited speaker or keynote speaker with contributions of oral or poster. He served the program chair or conference chair/co-chair in some of these activities. In particular, he joined in last six years (2014 - 2019) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. Also, he joined over 70 online conferences in the same way in pandemic period of 2020-2021. He supervised 5 PhD- theses and 3 M. Sc- theses. Dr. Adiguzel served his directorate of Graduate School of Natural and Applied Sciences, Firat University, in 1999-2004. He received a certificate awarded to him and his experimental group in recognition of significant contribution of 2 patterns to the Powder Diffraction File – Release 2000. The ICDD (International Centre for Diffraction Data) also appreciates cooperation of his group and interest in Powder Diffraction File.



S. EL Moudni EL Almi*¹, R. Moussaoui¹. M. Monkade². K. Lahlou³. H. Aouragh¹

¹Faculty of Science Oujda Morocco ²Faculty of Sciences EL Jadida Morocco ³Hassania School of Public Works Casablanca Morocco

Industrial by-products of granular character: Management issues and valorization approach in civil engineering

Every year, billions of tonnes of waste are generated worldwide, with humanity discharging 12 billion tonnes of industrial and household waste annually. The production of this waste has increased incredibly over time due to rapid urbanisation, population growth and industrial development. Among the most abundant industrial wastes, we can mention household waste incineration bottom ash, coal ash, steel and lead slag. Indeed, about 58.4% (5357 million tonnes) of the global industrial waste rate is produced by six countries: China, Japan, India, South Korea and Australia. Landfilling of this waste. Of course, the management of these huge quantities of waste presents a great challenge to the producing countries. In addition to the gases emitted during the production process, landfilling is a direct threat to the environment, especially to water and soil. In addition, economic growth, driven by infrastructure development, requires increased demand for construction materials, especially aggregates and sand. Today, many developing countries suffer from the problem of depletion of natural aggregates, which requires the search for alternative products. Researchers have become aware of the geotechnical characteristics of some of these wastes, notably coal ash and slag, which has led to their use in civil engineering, particularly in the road sector.

Morocco has a subsoil rich in varied mineral resources spread throughout the kingdom. The main mining operations concern, among others, phosphate, coal, lead, iron, zinc, copper and nickel. There are officially 240 mining sites in the Kingdom, among which 200 are closed and abandoned. Today, several storage sites have been generated in the country, of which two are considered to be the main ones. The first storage site is located in the WEST of the country in the Jorf Lasfar industrial zone in the city of El Jadida, which contains: a large thermal power plant, a steel mill and phosphate processing units. The waste generated is mainly in the form of: Coal ash, iron slag and phosphogypsum. The second storage area is located in the east of the country near the cities of Jerada and Touissite, in addition to coal ash, the waste stored in this area is in the form of lead and zinc slag.

Our research work has proven the possibility of using these by-products in road construction. Indeed, the treatment of coal slag with lime improves its properties for use in sub-base courses, and our results show the possibility of using lead slag as a substitute for sand in asphalt and gravel. This will make it possible to meet the increased local need for aggregates while mitigating the environmental risks of landfills.

Biography

Dr. EL Moudni studied at Chouaib Doukkali University in EL Jadida Morocco joined the research group of Prof Monkade Mohamed in 2005. She received her PhD degree in 2010 at the same institution, these research works in the field of materials are focused on the valorization of waste in civil engineering since 2014 she has been a professor at the faculty of sciences in oujda, Morocco. She is also a member of the research group managed by Professor Wim Venden Bergh, director of the research team of road engineering at the faculty of engineering in Antwerp, Belgium.



C.DIOURI*1, K.LAHLOU1, K.EL OMARI2, M.MASSKOURI1, H.AIT ELCAID1

¹Ecole Hassania des Travaux Publics, Equipe ERIC Laboratoire GCHec, Marocco ²OCP S.A., Marocco

Moroccan phosphogypsum recycling in road applications.

Morocco produces annually an important quantity of phosphogypsum, a byproduct of the phosphoric acid industry by the wet process, consisting mainly of calcium sulfate dihydrate $(CaSO_4.2H_2O)$ in association with low amounts of silicon (Si), phosphorus pentoxide (P_2O_5) , organic matter and traces of rare earth elements (REE). Storing phosphogypsum in stockpiles brings about technical and financial problems, due to the fact that they occupy large land areas and cause serious environmental damage. This presentation aims to suggest novel alternative to recycle PG in road applications in a circular economy approach. In order to evaluate this option, we first identified and characterized the phosphogypsum produced in the industrial area of Jorf Lasfar. Then, our experimental approach focused on an optimal mixture between phosphogypsum and sand, treated with cement , which meets the mechanical requirements of a road pavement. A mathematical model was developed so as to obtain the dry density of any mixture using the percentage of PG, sand, cement and moisture. The target was to rise the strength up to a threshold allowing the use of the stabilised mixture as a material in road pavement, while neutralizing acidity generated by PG. The criteria detailed in SETRA's guides were used to identify the needed responses which were then modelized by experiments design approach, and in particular mixing designs. Two optimal mixtures were reached, one for the subgrade layer of the pavement, the other for the base layer.

A cost comparison for the PG-SC-C mixes in different pavement structure types were carried out, resulting in the conclusion that pavement structure with a hydraulically bound base is the most economic type. Then, a comparative rational design using ALIZE software showed a significant cost gain compared to an equivalent road structure made up of conventional gravel.

What will audience learn from my presentation?

- The audience will be able to characterize what phosphogypsum is, and then discover new recycling horizons of this byproduct in road application.
- The presentation will help the audience understand what a mixture design with constraints is, and how far it is helpful to save time having the same or rather clearer results.
- It provides a practical solution to stockpiles problem, occupying large land areas and causing serious environmental damage.
- It is a practical solution to building materials shortage.

Biography

Phd. Student DIOURI Chaimaa studied Civil Engineering at the EHTP, Casablanca, Morocco and graduated with honors in 2019. She then joined the research group of Prof. LAHLOU Khaled at the ERIC team, EHTP research laboratory, Morocco. After three years doctoral fellowship, she obtained the position of a part-time lecturer in materials'resistance at the EHTP, and final year project co-supervisor in the same institition. She has published a research article in AJCE journal after an oral presentation at RUGC 2021.



Vito Rizzi*¹, Jennifer Gubitosa¹, Paola Fini², Angela Agostiano^{1,2}, Pinalysa Cosma^{1,2}

¹University of Bari, Italy

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Agricultural wastes as environmentally friendly materials to remove pollutants from water

The high rate of resource consumption and large amounts of produced wastes have been reported to drive towards lack L an ecological collapse. Interestingly, a circular economy approach could reduce this environmental concern avoiding the waste management, and all outputs (products, by-products, wastes) would become inputs (material and energy) to other processes. When the model is based on the production of renewable biological resources, and these resources are converted into value-added products, the concept of bio-circular economy take place. It means to develop an economy plan based on the production from biological resources with a sustainable transformation of wastes, offering alternatives to their dumping, burning, composting etc. About this purpose, the use of fruit Peels as food/agricultural wastes have attained interest, as adsorbent materials for water purification, avoiding their disposal according to the principles of Green Chemistry and Sustainable Development. For this purpose, this work proposes, among wastes, the use of Kiwi Peels to remove emerging pollutants (not regulated substances that could affect both human health, and the whole environment, causing severe problems) and textile dyes from water. Indeed, among the explored wastes, Kiwi Peels removed the largest number of contaminants. Kiwi Peels were characterized by adopting in synergy FTIR-ATR, TG and SEM analyses, before and after their use, and as result they are proposed as recyclable adsorbent. To infer information about the behaviour of Kiwi Peels during water treatments, model contaminants were selected and investigated; so, the role of several parameters affecting the process was assessed. The thermodynamic, the adsorption isotherms and kinetics were also studied. Finally, to extend the lifetime of Kiwi Peels, desorption experiments were carried out by using hot water or salt solutions. 10 cycles of adsorption/desorption were studied, evidencing the recycling of both pollutants and Kiwi Peels. Moreover, to find the best conditions of work for inducing the solid-state pollutant photodegradation, a preliminary investigation was performed, proposing a possible alternative for pollutant recycling and adsorbent regeneration. Finally, mixtures of pollutants were also studied and in the case of dyes, dyeing experiments were also performed, evidencing the dye ability to colour cotton fibers after the colour recycling.

What will audience learn from your presentation?

- The explained concept could be useful for the development of adsorption processes that agree with the green chemistry and bio-circular economy principles.
- Interesting information related to the study of adsorption processes will be presented and discussed, offering an overview about the use of wastes as adsorbents with their related main features.
- Innovative and green technologies to recycling the adsorbent materials will be presented.

Biography

Dr. Rizzi studied Chemistry at the University of Bari, Department of Chemistry, Italy and graduated as MS in 2012. During his MS, he joined the research group of Prof. Pinalysa Cosma and Angela Agostiano at the same Department. He received his PhD degree in 2016 at the same institution by debating a thesis about the use of multifunctional materials for water remediation and biomedical studies. After three year postdoctoral fellowship, supervised by Prof. Cosma, he obtained the position of Researcher and Assistant Professor. He has published more than 50 research articles in SCI(E) journals.



Jennifer Gubitosa*¹, Vito Rizzi¹, Angela Agostiano^{1,2}, Paola Fini², Pinalysa Cosma^{1,2}

¹Università degli Studi "Aldo Moro", Italy ²Consiglio Nazionale delle Ricerche CNR-IPCF UOS Bari, Italy

A food waste-based polyphenolic extract for synthesizing gold nanoparticles as powerful multifunctional platforms in cosmetics and biomedicine

In this work, the synthesis and characterization of innovative gold nanoparticles (AuNPs) as multifunctional platforms in biomedicine and cosmetics is presented. In detail, grape pomace, a typical agricultural waste derived from Vitis vinifera, is proposed as raw material from which a water-based polyphenolic extract can be obtained and used for synthetizing AuNPs by following an approach in accordance with the principles of Green Chemistry and Circular Economy. This extract acts as reducing agent towards an aqueous solution of tetrachloroauric acid (the metal salt precursor of the metallic gold), thanks to the high content of polyphenols, allowing the formation of nanoparticles. The obtained AuNPs are characterized through several complementary techniques, namely UV-Visible, ATR-FTIR and XPS spectroscopies, XRD, TEM, DLS and Zeta Potential analyses. These hybrid nanostructures can find application as multifunctional platforms in biomedicine for photodynamic and photothermal therapy, as well as for cosmetic formulations due to their exhibited antioxidant, skinlightening, and sunscreen properties.

What will audience learn from your presentation?

- The explained concepts could be useful for showing the development of an alternative nanomaterials' synthetic approach in accordance with the Green Chemistry principles.
- The valorization of food/agricultural wastes will be proposed according to Circular Economy principles.
- Information related to the morphological, chemical, and physical characterization of gold nanoparticles will be presented and discussed.
- Information about exploring the antioxidant, sunscreen and skin-lightening properties of gold nanoparticles will be presented.

Biography

Dr. Gubitosa studied Pharmacy at the University of Bari, Department of Farmacia-Scienze del Farmaco, Italy and graduated as MS in 2017. During her MS, she then joined the research group of Prof. Pinalysa Cosma and Prof. Angela Agostiano at the Department of Chemistry, University of Bari. She became Cosmetologist and Safety Assessor of Cosmetic Products in 2019. Currently, she is PhD student in Chemical and Molecular Sciences at the same Department. She has published 24 research articles in SCI(E) journals.



Thomas J. WebsterInterstellar Therapeutics, USA

Commercializing university-based research: Self-assembled nanomaterials for fighting COVID-19, inhibiting infection, killing cancer, and regenerating tissues

Nanotechnology is now found in almost every aspect in life, from the liposomes that carry vaccines for COVID-19 to coatings placed on floors to reduce wear. Over the past 20 years, the use of nanotechnology in medicine has grown from the unknown to now significantly helping to prevent, diagnosis, and treat numerous diseases. Self-assembled materials have been synthesized using standard organic chemistry methods. All materials have been studied for their ability to attach to viruses (such as SARS-CoV-2) to keep the virus from replicating. Further, such materials have been used to fight infection, inhibit cancer cell growth, and improve tissue growth using standard in vivo and in vitro methods. For the self-assembled nanomaterials, one type of self-assembled nanomaterial composed of DNA base pairs has been the focus of our efforts to functionalize with specific peptides suitable for attaching to SARS-CoV-2 and all of its known variants. After binding to SARS-CoV-2, the self-assembled molecule inhibits SARS-CoV-2 binding to and entering mammalian cells keeping it from replicating. Moreover, these unique self-assembled nanomaterials have been functionalized with peptides to attach to and penetrate to kill gram-positive bacteria, gram-negative bacteria, and antibiotic-resistant bacteria. Further, these self-assembled nanomaterials were functionalized with peptides to attach to and kill cancer cells. Lastly, significant effort has been spent to functionalize these self-assembled nanomaterials with peptides to promote bone, cartilage, vascular, skin and other tissue growth. In vitro and in vivo studies will be presented as well as lessons learned trying to commercialize university-based research into real commercial products.

Biography

Thomas J. Webster's (H index: 108; Google Scholar) degrees are in chemical engineering from the University of Pittsburgh (B.S., 1995) and in biomedical engineering from RPI (Ph.D., 2000). He has served as a professor at Purdue (2000-2005), Brown (2005-2012), and Northeastern (2012-2021) Universities and has formed over a dozen companies who have numerous FDA approved medical products currently improving human health. He has directed numerous international centers in biomaterials and has graduated over 200 students with over 750 peer-reviewed publications. Prof. Webster is a fellow of over 8 academic societies and is a SCOPUS highly cited researcher (top 1% citations for materials science and mixed fields) as well as a Public Library of Science (PLoS) World Top 2% Scientist by Citations in all fields.



Ricardo Acosta OrtizApplied Chemistry Research Center Saltillo, México

Synthesis and evaluation of the performance of a new curing agent for the photopolymerization of biobased epoxy resins

This talk deals with the synthesis of new curing agent derived from cystamine, for biobased epoxy resins. The curing agent was synthesized in two stages: first, the mercapto-ethylation reaction between ethylene sulfide and diallyl amine, and second, the oxidation of the amino-thiol obtained in the first stage, to obtain a tetraallyl functionalized diaminedisulfide. The prepared curing agent was used to photocure nopol- derived epoxy resins by using the epoxy/thiol-ene photopolymerization technique. This method utilizes an epoxy resin, an allyl functionalized diamine, a multifunctional thiol and a photoinitiator. The resulting polymer is a crosslinked co-network of polyether-polythioether type. The epoxy/ thiol-ene photopolymerization technique displays advantages such as: a) high reactivity, the curing the epoxy resin takes minutes instead of hours in comparison with the conventional thermal processes and b) the obtained crosslinked polyether-polyethioether derived from the epoxy/thiol-ene phtopolymerization displays higher toughness than the polyethers obtained in a conventional thermal curing of epoxy resins using polyamines as curing agents. In this work two experimental biobased epoxy resins derived from terpenoid nopol were prepared and phtopolymerized using the curing agent derived from tetraallylated cystamine. The kinetics study demostrated high reactivity of the photocurable formulations obtaining high conversions in just two minutes of irradiation time. The obtained polymers showed modulus between 2000 and 3300 MPa depending on the type of epoxy resin. The obtained polymers could have potential application as coatings considering that one of the main disadvantages of conventional epoxy polymers is their brittleness due to high level of crosslinking when using conventional curing agents.

What will audience learn from your presentation?

- A novel method of cross-linking of epoxy resins is described.
- People working in the area of thermosets could find this method very useful.
- This type of curing of epoxy resins is an ecofriendly process.

Biography

Dr. Ricardo Acosta studied Chemistry at the State University of Coahuila in Mexico and graduated as BSc in 1985. He then joined the chemistry research group at the Applied Chemistry Research Center (CIQA). He received a PhD degree at the Manchester Metropolitan University, UK in 1995. After one year postdoctoral fellowship supervised by Prof James Crivello in The Rensselaer Polytechnic Institute in Troy, NY in 2000 he obtained the position of senior researcher at CIQA. He has published more than 60 research articles in SCI(E) journals.



Mustapha Hidouri*, Samira Jebahi, Khaled Boughzala

¹Gabes University, Tunisia

- ²National Center for Nuclear Sciences and technology, Tunisia
- ³High Institute of Applied Sciences and technologies, Tunisia

Multiple ion-substituted hydroxyfluorapatites bioceramics

Biocompatibility and their ability to absorb at a rate similar to bone growth. Calcium phosphate such as hydroxyapatite and/or fluorapatite (H-FAp, Ca₁₀(PO₄)60H₂/F₂) are the eminent bioceramics widely used in various biomedical applications, mainly in orthopedics and dentistry reparation due to their close similarities with inorganic mineral component of bone and teeth. In fact due to the complexity of the chemical composition of bone and dentine which contain several elements till now no material like natural one was synthesized. All the existing researches tried to obtain the material the more equivalent. As far as we are concerned several attempts to introduce the maximum number of ions into the structure of hydry/fluor-apatite have been established. Thus mangnesium Mg²⁺, strontium Sr²⁺, zinc Zn²⁺, sodium Na⁺, potassium K⁺, carbonates CO₃²⁺, fluorides F⁻ and chlorides Cl⁻ ions were inserted in the apatite structure. The synthesized materials were characterized by several techniques (DRX, FTIR, Chemical anlysis, G-DTA, 31P NMR, Raman, SEM, ...) to verify the purity and confirming their insertion in the structure. After that the materials were pressurelessly sintered and the densification conditions were optimized. The densest materials were also mechanically characterized. The biological properties of the dense bodies were in-vitro tested; the bioactivity and the biocomtability of the materials were defined. The suitable materials were in the last step tested in-vivo for their possible application as bone and dentine substitutes.

Biography

Ass. Prof. Dr. Mustapha Hidouri is a Teacher-Researcher in the field of materials and environment. Born in Tunisia (1974), Mustapha Hidouri received his PhD in Materials Chemistry at 2004. Actually he occupied the post of an associate professor at Gabes University in Tunisia. His researches deal with biomaterials and environment studies. He published more than 20 papers and 2 books 4 chapter books and presented more than 30 oral and poster presentations in scientific congresses. His is a reviewer in many impacted journals.





Materials 2022



Jared FooRolls-Royce Singapore Pte Ltd, Singapore,

A case study of austenitic stainless steel air tube fracture from an aircraft gas turbine engine

An air tube made of austenitic stainless steel (grade 347) that belonged to an aircraft gas turbine engine was found to have fractured. The fracture was found along the edge of a circumferential weld (HAZ) between the flange and the tube. Fractographic examination revealed that one half of the fracture surface was due to intergranular cracking, whereas the other half was predominantly transgranular cracking. The transgranular fracture was a result of High Cycle Fatigue (HCF) mode of propagation which had originated from the intergranular fracture zone. Metallographic examination across the fracture confirmed that the material had been sensitised which was considered to be caused by prolong exposure of the tube material to high temperature air in the range of 500°C to 900°C. The evidence suggested that the intergranular cracks was initiated due to sensitisation which was likely to have weakened the material sufficiently to allow a HCF failure mode to occur and resulted in the final failure of the tube.

What will audience learn from your presentation?

• The presentation is a case study that describes a problem encountered in an aircraft gas turbine engine. It explains the materials characterization techniques and methodologies commonly used in the aerospace industry to determine the root cause of the failure. With the root causes identified, steps can be taken, for example by improving the design of the product and/or reviewing of in-service conditions to prevent similar failure occurrence.

Biography

Mr Jared Foo has a degree in Materials Engineering and MSc in Mechanical and Materials Processing from Nanyang Technology University (NTU). Jared has fifteen years of experience in the area of materials failure investigation, testing and characterization. He started the first few years of his career as Materials engineer in commercial laboratories serving the marine, oil and gas, construction and transportation sectors. He joined Rolls-Royce in 2010 as a Failure Investigator, with the last five years as team leader, focusing on in-service aircraft gas turbine engines in the Asia Pacific Region. Jared is a member of the Institute of Materials, Minerals and Mining.



Chang-Liang Yao*1, Do-Sik Shim²
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²Korea Maritime and Ocean University, Korea

Study on mechanical properties of copper alloy (CuNi2SiCr) layered on Nickel Aluminum Bronze (NAB) by using direct energy deposition

Nickel aluminum bronze (NAB) is widely used to fabricate marine propellers owing to its excellent corrosion resistance in sea water. The repair process of damaged propellers is an important research topic. This research proposes a repair method in which metal additive manufacturing (AM) technique is employed, not the conventional welding. Of various metal AM technologies, we studies direct energy deposition (DED) which can be useful for repairing of a damaged component. The DED process uses high-power lasers to melt metal powder and then solidify it on the site to be repaired to achieve the repair of damaged parts. For repairing NAB substrate, CuNi, SiCr powder was used. Thus, this study focused on the mechanical properties of CuNi, SiCr deposited on the NAB substrate through DED. First of all, the optimal process parameters of the DED process were established by trying different laser power, powder feed rates, scanning speed, coaxial gas flows and powder gas flows rate. In addition, the mechanical properties of the deposited and substrate were studied through microhardness measurement, tensile test and Charpy impact test. The results show that the microstructure of the deposited layers is α -Cu, which shows the characteristics of low strength, hardness and high toughness. The microstructure of NAB substrate exhibits higher hardness and strength and lower toughness than the deposited CuNi₂SiCr, since the substrate was composed of typical $\alpha + \beta$ solid solution and different intermetallic κ phases. Moreover, the tensile strength and elongation of the deposited specimens are lower than those of the substrate because the deposition layers have micropores. This study indicates that copper alloy CuNi, SiCr is deposited by DED, which provides a new idea for repairing NAB parts through metal additive manufacturing. The future research includes the methods for avoiding the internal porosity and enhancing its strength and hardness of the deposited part.

What will audience learn from your presentation?

- Copper alloy CuNi₂SiCr powder can be deposited by direct energy deposition.
- The pores generated in the deposited region degraded its strength and toughness.
- The hardness and strength owing to α phase formed in the deposited copper alloy are lower than those of the substrate, but the toughness is higher than that of the substrate.
- The microstructure of the deposited part is mainly composed of α -Cu phase, which led to more excellent impact performance and toughness compared with NAB substrate.

Biography

Chang-liang YAO is a currently MS student at the Department Ocean Advanced Materials Convergence Engineering in Korea Maritime and Ocean University (KMOU), Korea. He received his BS degrees in Material Processing and Control Engineering from Shanghai University of Engineering Science (SUES), China in 2019. His research interest is focused on direct energy deposition.





MATERIALS SCIENCE AND ENGINEERING

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M. Parfenova¹, V. Vorobjeva¹, V. Lutsyk*^{1,2} & A. Zelenaya¹

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3D computer models of isobaric phase diagrams for ternary systems to verify and validate thermodynamic calculation and experimental investigation: Ag-Bi(Sb)-Sn, Al(Bi)-Sn-Zn, Au-Ge-Sn

The assembled 3D computer models of isobaric phase diagrams (PD) for ternary systems permit to verify and validate the data on phase equilibriums and to design the microstructures of heterogeneous material, including the materials genome decoding. The project "PD as an Advanced Tool of Materials Science", http://ipms.bscnet.ru/labs/skkm.html, is focused on the following topics: concentration fields of different dimension with the different solidification schemes and microstructures, correction of PD graphics, multi-component systems polyhedration, 3-and 4-phase regions with the reaction type changing, competition of crystals with different dispersion in the invariant regrouping of masses, mathematical approximation of PD, assembling of PD computer models, 3D prototyping of the phase regions and concentration simplexes for the exploded PD and for the concentration complexes of the reciprocal quaternary systems, simulation of DTA spectra and X-ray analysis spectra in the training programs for specialists in the field of physics-chemical analysis. Computer models of PD are the wonderful addition for the thermodynamically assessed experimental PD. There are great tasks to digitalize the phase equilibriums data for the multicomponent systems and there are many advices, which way to teach and to learn the language of multidimensional phase diagrams. In addition to these advices, we propose to elaborate the 3D and 4D computer models for the isobaric PD of ternary systems. And to prototype the exploded T-x-y diagrams by a 3D printer.

This work was been performed under the program of fundamental research SB RAS (project 0270-2021-0002).

What will audience learn from your presentation?

- Listeners will know information about the 3D computer models of isobaric phase diagrams.
- They will be acquainted with the novel technique to decipher the Material Genome by the crystallization paths in the concentration fields of different dimension.
- They will be ready to use the 3D printer for the prototyping of the exploded phase diagrams for the ternary systems.

Biography

Vasily Lutsyk (Materials CAD sector head at IPMS SB RAS http://ipms.bscnet.ru/labs/skkm.html) studied Chemistry at Donetsk University, Ukraine, former USSR, and graduated as MS in 1970; got PhD degree in 1978 at V.I. Nikitin Chemistry Institute of Tajikistan Academy of Sciences, Dushanbe, former USSR (Thesis on Inorganic Chemistry: "Liquidus' models in the ternary systems with the molybdenum anhydride and the alkali metals sulphates", superviser Prof. Marx Mokhosoev) & Doctor's Degree in 1997 at the Irkutsk University, Russia (Thesis on Physical Chemistry: "Heterogeneous design: CAE of the multicomponent systems by means of the equations for the boundaries of homogeneous regions").





MATERIALS SCIENCE AND ENGINEERING

Materials 2022



Dhanesh G. MohanShandong University, China

High entropy alloys for additive manufacturing

High entropy alloys are a new class of promising materials based on the innovative notion of alloying, which is based on the use of numerous primary components in high concentrations (HEAs). So far, numerous HEAs have been identified with qualities that are superior to those of normal alloys, and additional superior high-entropy alloys are likely to be created in the future. However, due to the fundamental needs of HEAs, the production process of HEAs using standard manufacturing processes has considerable constraints. In contrast, additive manufacturing (AM) has opened up new possibilities for creating geometrically complicated HEAs with the ability to adjust their in-situ microstructure characteristics.

What will audience learn from your presentation?

- This presentation provide the state of the art in AM of HEAs, in light of the increased interest in AM of HEAs in recent years. It explains the feedstock requirements for laser-based additive manufacturing processes. The current situation of practically all HEAs treated by laser metal deposition (LMD), selective laser melting (SLM), and selective electron beam melting (SEBM) is then described.
- The characteristics of AM-derived microstructures, as well as their exceptional attributes and underlying processes for diverse material processing combinations, are given special emphasis.
- The post-AM treatments as well as the fabrication procedures for defect-free HEAs are summarised. Finally, a conclusion will be offered on the existing state and future possibilities of additive manufacture of HEAs.

Biography

Dr. Dhanesh G. Mohan is a licensed Professional Engineer (P.E.), Chartered Engineer (C.Eng), writer, and educator. He is a Postdoctoral Research Fellow of the Institute of Materials Joining at Shandong University, Jinan, China. His research-based on Net-Zero Manufacturing concepts and mainly focused on Additive Manufacturing (AM) (Friction Stir Additive Manufacturing, 3D printing of high entropy alloys, 3D Composite printing, and Big area additive manufacturing), Surface coating methods, fabrication of high entropy alloys, Corrosion studies, Quantum dots, and Hybrid friction stir welding methods (Laser-assisted FSW, Ultrasonic vibration-assisted FSW, Induction assisted FSW and FSP). To study and understand these methods' mechanical, metallurgical, corrosive, and microstructural properties on dissimilar metals and alloys (steels, magnesium alloys, aluminium alloys, and high entropy alloys). He wrote more than 30 research articles in SCI-indexed journals and authored 2 books on AM for HEAs and Hybrid FSW.



Mizuki Mukai*¹, Kiyotaka Obunai², Kazuya Okubo², Nobumasa Nakajima³, Nobuyoshi Maizuru³

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³Kaneka Co., Ltd., Hyogo, Japan

Study on impact and fatigue properties of butt and single lap joint adherend by epoxy resin enhanced by dispersed core shell rubber particles

poxy adhesives have been widely used in a variety of fields, which require the lightweight joints and joints of different $oldsymbol{L}$ martials, such as aircraft, automotive and wind turbine blades. Core shell rubber (CSR) particle is one of modifier to improve toughness of epoxy adhesives. The CSR particles have a rubber core and is covered with a compatibilizer copolymer shell. It has been known that the static strength of the adhesive joint using it is improved when CSR particles are added into the adhesive. However, the effect of the modification with the CSR particles on the impact and fatigue properties has not been known in detail, while they are expected for many practical applications. The purpose of this study is to investigate quantitative improvement rates of impact and fatigue properties of steel joints adherend by epoxy resin modified with CSR particles. Three types of adhesives of which rubber contents were about 3.60wt% and 3.85wt% for the modification and also 0wt% of unmodified one for comparison were prepared as the materials of adhesives to make the single lap joints in order to investigate the effect of the modification. Impact load was applied to the specimen of butt joints of which length, width and thicknesses was 90mm, 45mm and 20mm respectively, by hitting hammer moved from upper position like a pendulum. Cyclic loading was repeated to specimen of single lap joints under three-point bending, where cyclic stress ratio and frequency were R = 0.1 and f = 5.0Hz, respectively in order to measure the fatigue life and residual strain. The maximum cyclic stress was set to 70%, 75% and 80% of average static bending strength. The test results showed that the impact strength of adhesive joints were improved about 12.9% and 29.1% and the fatigue lives of those were also improved about 1.79 times and 3.51 times, respectively, when the rubber content of added CSR particles was 3.60wt% and 3.85wt%, compared to those by unmodified adhesives. The residual strain at the same number of cycles was decreased about 25.7% and 45.7% when rubber content of added CSR particles was 3.60wt% and 3.85wt%, respectively compared to as well, while the nominal residual strain was increased with increase of the number of cycles. These results showed that the crack propagations of adhesives were prevented when CSR particles were added because the residual strains of adhesives were usually related with crack propagation. The rough fracture surfaces of specimens of butt joints adherend by epoxy resin modified with CSR particles were observed suggesting the traces of the plastic deformation of adhesives around CSR particles and between CSR particles. It is said that the energy release of epoxy adhesives around the CSR particles was contributed to the improvement of the impact property of adhesive joints.

What will audience learn from your presentation?

- Quantitative improvement rates in impact strength and fatigue life of steel joints adherend by epoxy resin by dispersed by CSR particles.
- What contributes to the improvement of the impact and fatigue properties of the steel joints adherend by epoxy resin by dispersed by CSR particles.
- Influence of the modification with the CSR particles on the fracture surface and the residual strain of the steel joints.

Biography

Mizuki Mukai is a master course student of Doshisha University. He studies mechanical engineering at Doshisha University in Kyoto, Japan and graduated from the university in 2020. He has entered the Advanced Material Structural Engineering Laboratory of Prof. Okubo and Prof. Obunai in March 2019. His research is to investigate the mechanical properties of adhesive joints enhanced by core shell rubber particles dispersed in epoxy resin. He presented on impact property of adhesive joint at the 20th Forum for Young Adhesives Engineers in the Chubu Branch of the Adhesion Society of Japan in 2021.



S, DharUniversity of Calcutta, India

Growth of dilute III-V-N and III-V-Bi semiconductors by liquid phase epitaxy

Dilute III-V- Nitride and III-V- Bismide materials have found great interest as promising materials for the fabrication f sources and detectectrs in the near infrared region. These materials are obtained by adding very little amounts of N or Bi to the base III-V crystal and this causes a large increase in the energy band gap of the material. This provides an easy way for the tuning of the band gap of the material by controlling the N or Bi to the semiconductor. These materials are grown by MBE and MOCVD techniques. We have grown them using a far simpler and hazard free liquid phase epitaxy (LPE) technique. GaAsN grown by this technique indicated a maximum N content in the solid as 0.5 wt% which upon addition of Li3N to the growth melt increased to 0.9%. The technique also successfully yielded GaSbN, InPN and InAsN epitaxial layers. By adding controlled amounts of Bi to a GaSb growth melt we have been able to produce GaSbN layers. Various interesting properties of this material have been obtained. We have also grown InPBi, InSbBi and InPNBi epitaxial layers by LPE technique. The properties f these materials will be discussed in details.

Biography

Dr. Sunanda Dhar has retired as a professor with the Department of Electronic Science, University of Calcutta in 2017 and is still associated with the same Department as an active researcher. For the past three decades, he has been working on the experimental and the theoretical properties of group III-V compound semiconductors grown by liquid phase epitaxy (LPE). He was the first to develop LPE techniques for the growth of dilute nitride and bismide semiconductors. He has spent 2 years at the University of Michigan, USA during 1984-86 working on the deep level studies of various III-V semiconductor structures grown by LPE, MBE and MOCVD techniques. He also worked as a visiting scientist for 9 months at Lancaster University, UK during 2008-09 working on the implementation of his LPE technique for the growth of dilute nitride semiconductors for mid-infrared detectors. He has made 90 publications in refereed journals, 85 papers in conference proceedings, 56 invited talks, edited one conference proceedings and two patents. Dr. Dhar has written a book chapter entitled `Deep levels in III-V compound semiconductors grown by molecular beam epitaxy` in the series `Semiconductors and Semimetals` (1986) of Academic Press, USA and another book chapter entitled `Group III-V bismide materials grown by liquid phase epitaxy` in the book `Bismuth-Containing Compounds` of Springer Series in Materials Science in 2013. He is the life member of the Semiconductor Society of India and a member of the Materials Research Society of Singapore.



Nandini Bhattacharya*^{1,2}, Mandira Kochar¹, H.B.Bohidar¹, David Cahill²

¹TERI-Deakin Nanobiotechnology centre, India ²Deakin university, Australia

Green synthesized graphene for delivery of plant growth regulators into plants

esearch presented in the study explores application of a graphene-based nanodelivery system for the efficient **N**delivery of plant growth regulators. Traditional methods of reduction of graphene oxide (GO) involve chemical and thermal reduction pathways that involve strong chemical agents such as hydrazine. Moreover, these processes release by-products that are toxic in nature and hazardous to the environment, leading to serious environmental problems and furthermore, involve high economic costs. In this work, we demonstrate a simple and green approach of reduction of graphene oxide, where graphene oxide is converted to reduced graphene oxide (rGO) using the culture supernatant as well as whole culture of a diazotrophic bacterial strain, collected from a rice field. Additionally, we have chemically reduced GO by L-ascorbic acid and used it as a reference standard. Subsequently, the rGO has been characterized by UV-visible spectroscopy, SEM, TEM, X-ray diffraction, Raman spectroscopy, Fourier transform infra-red spectroscopy and confocal microscopy. This synthesis process is both environment-friendly and non-toxic. Our results show the successful synthesis of reduced graphene oxide that is comparable to the chemically synthesized rGO prepared by us. Further, this green synthesized rGO shows good potential as a nanocarrier for the delivery of plant growth regulators to crop plants, displaying increased growth parameters of plants. In addition, the rGO synthesized from a biological source demonstrates significant positive effects on plants. Our findings suggest that GO can be reduced by an eco-friendly green approach using bacterial culture supernatant to produce a biocompatible graphene that is suitable for application as a nanofertilizer as well as a delivery vector for plants.

What will audience learn from your presentation?

- This presentation explores a novel approach of green synthesis of graphene from a microbial source.
- The possible role of reduced graphene oxide as a plant biostimulant has been demonstrated here.
- Research in this presentation offers a new approach for the exogenous application of plant growth regulators to plants.
 Furthermore, this presentation highlights the crucial role of the concentration and time of exposure of nanomaterials to plants, that in turn determine the final impact of the nanomaterial on plants.

Biography

Nandini joined the TERI-Deakin Nanobiotechnology centre as a PhD student in nanobiotechnology in 2017. She has presented her work on graphene nanomaterials in several seminars and conferences. Before joining TERI, Nandini was working as a Senior Research fellow at the Indian Institute of Science, Bangalore, India. Her research interests include synthesis of nanomaterials using biological approach, microbiology and plant physiology.



Umesh. P. Borole^{1,2}, Tejaswini, Gawade^{1,2}, P. Chowdhury*^{1,2}

¹CSIR - National Aerospace Laboratories, India ²Academy of Scientific and Innovative Research (AcSIR), India

Development of current sensors using giant magnetoresistance effect in magnetic multilayers

In recent years, Giant Magnetoresistive (GMR) technology became prominent in the field of magnetic sensing. One of the important applications of magnetic field sensors developed using GMR technology is detection and measurement of current. The current sensors are vital elements in the field of power electronics used for control and monitoring applications. Recently, development of the Hybrid Electrical Vehicles and Electrical Vehicles have upraised the demands of open loop current sensors. In this regard, the development of the current sensor was carried out using GMR technology.

In the present work, we study the CoFe/Cu magnetic multilayer thin film structure of nano-meter thicknesses for its use in magnetic sensor. The fabrication of multilayer thin films was carried out using Ultra High Vacuum (UHV) sputtering technique. The multilayer structure was optimized for GMR properties on 4-inch wafer with low hysteresis and nonlinearity. The magnetic sensors were micro-fabricated using fabricated multilayer thin film structure. We study the application of the GMR sensor in open loop intrusive and non-intrusive current sensing. The current sensor prototypes were designed and developed as per industrial and aerospace standards. Fabricated current sensor were studied for AC/DC and thermal properties. Further the sensors were evaluated for aerospace and industrial applications addressing real time problems.

What will audience learn from your presentation?

- Knowledge of magnetic multilayer thin films. Fabrication of the thin films using sputtering technique and their characterization.
- Development of the sensor and various step in microfabrication of the sensor.
- Overview of the sensor development process from material to the real-world applications.

Biography

Dr. Prasanta Chowdhury graduated in physics at the University of Burdwan in 1992 and completed his post-graduation from the University of Burdwan in 1995. He obtained his doctorate in physics from the Indian Institute of Technology, Bombay in 2000. He worked in South Korea as a post-doctorate fellow. Presently he is working as a scientist at National Aerospace Laboratories, India. His current activities include the development of magnetic sensors for automotive applications, polymer-based actuators for application in aerospace and biomedical. He is an author of over 70 international journal publications.



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Frequency analysis of functionally graded material circular beams

Junctionally graded materials (FGMs) are widely used in many engineering structures due to their attractive elastic $oldsymbol{\Gamma}$ properties. FGMs are a combination of two materials in which their properties are continuously graded either through the thickness and/or along the length using different gradation rules such as the power-law or sigmoid law or exponential law or Mori Tanaka's law. An elasticity solution for the free vibration analysis of composite beams involves complex mathematics which is sometimes very difficult to solve. Therefore researchers have developed approximate theories for the analysis of circular beams made up of composite materials. The study of fundamental frequencies of the curved beam is an important aspect when it is made up of advanced composite materials. This article is focused on the frequency analysis of functionally graded material sandwich circular beams considering the influence of transverse normal strain. A fifth-order circular beam theory considering the effects of transverse shear and normal strains is developed in this study. The theory assumes fifth-order variation of axial displacement and fourth-order variations of transverse displacements. Hamilton's principle is employed to derive equations of motion. Analytical solution of the circular beam is obtained using the Navier technique. Symmetric and anti-symmetric functionally graded circular beams are considered for numerical studies. The material properties of face sheets are graded in the thickness direction according to the power law. The fundamental frequencies are obtained for different values of radius of curvature, the power-law index, and lamination schemes. The numerical values of frequencies obtained using the present theory are compared with the past literature and found in good agreement with those. Based on the comparison of the numerical results and discussion it is concluded that the present theory is in good agreement with other theories while predicting the fundamental frequencies of circular beams. It is also concluded that for the same length and thickness, the value of non-dimensional fundamental frequency increases as the radius of curvature is decreased.

What will audience learn from your presentation?

- All those who are doing research in the area of shear deformable beams, plates, and shells made up of advanced composite materials such as functionally graded materials.
- This presentation will help young researchers to expand their research in the area of mechanics of laminated composite beams, plates, and shells.
- Laminated composite beams, plates, and shells are widely used in mechanical, civil, aerospace, offshore, and marine
 industries. This presentation will help researchers to solve real-life problems and to provide accurate design solutions
 to composite structures.

Biography

Atteshamuddin S. Sayyad received his PhD in Structural Engineering from Government College of Engineering, Aurangabad, Maharashtra, India. The thrust research areas of Atteshamuddin are bending, buckling and free vibration analysis of beams, plates, and shells made of advanced composite materials using higher-order theories. He is currently working as a Professor at Department of Structural Engineering, Sanjivani College of Engineering, Kopargaon, Maharashtra, India. He has published more than 100 research articles in SCI/SCOPUS indexed journal,



Praveen K SaxenaTech Next Lab Pvt Ltd, India

Material growth, characterization of group IV, III-V & II-VI Semiconductors an its use for various device applications

The state-of-the-art in studying material growth & characterization of conventional and nano-electronic devices through purely atomistic methods in form of family of innovative TNL TCAD software has been reported. The significance of using full flow of TNL TCAD suite especially for advanced node technologies in real time device fabrication have been elaborated in details.

1.Introduction

A real time lattice based epitaxial growth technique for group IV, IV-IV, II-VI and III-V compounds based on MBE, CVD & MOCVD reactor's input conditions using EpiGrow simulator with self-assembly of adatoms allow any kind of structure to be grown on appropriate substrate. The full electronic band structure can be obtained by FullBand simulator for better understanding of the structural and electronic properties of the thin film. The carrier transport properties can be estimated with multiple appropriate scattering mechanisms and Monte Carlo technique associated used for the Boltzmann Transport Equation (BTE), ElecMob simulator. The scattering processes acoustic, intervalley, optical (Polar), piezoelectric, ionized impurity, Coulomb, surface roughness etc are inbuilt feature. The semiconductor device technologies characterization through TNL's Monte Carlo Particle Device (MCPD) simulator enable for better insight of the device technology. The difference in TNL TCAD software with the conventional TCAD is attributed to obtain optimum conditions for material growth, band structures with physical parameters and estimation of accurate electron mobility based on different scattering mechanisms with accurate I-V characterization.

2. Benefits using Family of TNL Simulators

All TNL simulators are interfaced with each other whereas having capabilities to work in standalone mode. Users have flexibilities to calibrate the simulated output results with the experimental result at each step of simulation as per the TNL simulators flow depicted below.

What will audience learn from your presentation?

- Explain how the audience will be able to use what they learn?
- Material growth and characterization at atomistic scale with device characterization and modeling capabilities with more insights.
- How will this help the audience in their job? Is this research that other faculty could use to expand their research
 or teaching? Does this provide a practical solution to a problem that could simplify or make a designer's job more
 efficient? Will it improve the accuracy of a design, or provide new information to assist in a design problem? List all
 other benefits.
- Yes, the atomistic scale modeling for material growth and characterization and device applications can enhance the physics based knowledge about semiconductor technologies which will be helpful for research and teaching. For more benefits visit: www.technextlab.com

Biography

Praveen Saxena is CTO at Tech Next Lab Pvt Ltd. He holds a PhD (EE), IIT BHU, India. He has vast experience in the development and Modeling of different semiconductor technologies including material growth, characterization and device applications. Praveen has several years of experience in academia & industry. Praveen has collaborated with leading Southeast Asian companies on the process and device modeling. Previously he worked as Southeast Asia Head at Silvaco Singapore. Praveen is recipient of several national & international awards. He has successfully delivered several projects to Indian Defense (DRDO) and Indian Space Agencies (ISRO). Praveen also has many reputed publications.



Arun Kumar SinghGuru Ghasidas Vishwavidyalaya, India

Impact of molecular ordering and alignment of conjugated polymer on charge transport

Solution-processable conjugated polymers have received great attention not only due to their unique electrical, optoelectronic, and electrochemical properties, but also to their great potential for realizing lightweight, large-area, cost effective, and flexible functional electronic devices. The macroscopic morphology of conjugated polymers is very important for their electronic applications and controlling the morphology of polymer semiconductors leftovers a fundamental challenge that hinders their widespread applications in organic electronic devices. The poly(3-hexylthiophene) (P3HT) is one of the extensively investigated conducting polymer for organic electronic devices due to its easy processability, and self-assembling nature. However, low crystallinity, random orientations of polymer chains are the major concerns associated with P3HT for achieving the high performance of electronic devices. Here, we present a simple and effective strategy for macroscopically ordered and aligned morphology of P3HT thin films that exhibit remarkable enhancement in charge transport properties. The large-scale aligned nanostructures of solution processable P3HT films have been characterized by high resolution transmission electron microscopy and grazing incidence X- ray diffraction and atomic force microscopy.

What will audience learn from your presentation?

- Explain how the audience will be able to use what they learn?
- All those who interested in Materials Science & Engineering and work in area of Organic/Molecular electronics will enjoy. It will be of great interest to both specialists and general scientists from diverse backgrounds.
- How will this help the audience in their job? Is this research that other faculty could use to expand their research or teaching? Does this provide a practical solution to a problem that could simplify or make a designer's job more efficient? Will it improve the accuracy of a design, or provide new information to assist in a design problem? List all other benefits.
- Electronic properties of organic semiconductors.
- Applications of organic semiconductors.
- Yes, this study may provide the new approach in the area of organic electronics.
- Our study may also useful for other area of science and engineering.

Biography

Dr. Arun Kumar Singh is working as Associate Professor at Department of Pure and Applied Physics, Guru Ghasidas Vishwavidyalaya, Bilaspur, India. He received his M.Sc. degree in Physics from Banaras Hindu University, Varanasi, India and received his Ph.D. degree from School of Materials Science and Technology, IIT (BHU), India. After Ph.D., he joined postdoctoral research work at Graphene Research Institute, Sejong University, South Korea. He got India most prestigious research award, "INSPIRE Faculty awards" from DST, India. He has published many papers as a main author and co-author in international journals/conferences in the area of materials science/physics. His research work basically includes the charge transport in organic semiconductors/two dimensional nanomaterials and their electronics device applications. He is life member of many scientific societies and reviewer of International scientific journals.



Sanjay B. Patil*, Jitendra J. Desale
Shriman Sureshdada Jain College of Pharmacy, India

Development and *In Vitro* Evaluation of chitosan microspheres of sertraline hydrochloride for nasal delivery

The nasal route has gained tremendous attention for systemic drug delivery by many researchers within the last I few decades due to its great potential utility for drug delivery. It offers an attractive alternative for drugs that have limited oral bioavailability, are destroyed by gastrointestinal fluids, or are highly susceptible to hepatic first pass or gut wall metabolism. Nasal drug delivery also offers the convenience and safety of being noninvasive. In addition, nasal drug administration results in quick onset of action as compared to oral, sublingual and transdermal administrations. The aim of the present study was to develop and characterize chitosan mucoadhesive microspheres of sertraline hydrochloride for nasal administration to avoid first pass metabolism and to improve therapeutic efficacy in treatment of depression. Sertraline hydrochloride, a selective serotonin reuptake inhibitor (SSRI), is a drug of choice in the treatment of depression. Sertraline hydrochloride is slowly absorbed following oral administration and undergoes extensively first pass metabolism which results in low bioavailability of 44 %. The chitosan microspheres were prepared by emulsification-cross linking method using glutaraldehyde as a crosslinking agent A 23 factorial design was used with drug: polymer ratio (X₁), glutaradehyde concentration (X_2) and cross-linking time (X_2) as independent variables while mucoadhesive strength (Y_1) and particle size (Y₂) of the microspheres were the dependent variables. Regression analysis was performed to identify the best formulation conditions. The microspheres were evaluated for morphology and size by SEM, entrapment efficiency, in vitro drug release, differential scanning calorimetry (DSC), X-ray diffraction (XRD), ex vivo permeation studies and stability study. The microspheres were spherical with size of 15-40 µm, which is favorable for intranasal absorption. The shape and surface characteristics were studied by scanning electron microscopy (SEM) which showed that the microspheres were spherical in nature with nearly smooth surface. The entrapment efficiency was observed from 90 to 98% while percentage mucoadhesion was from 78 to 86%. The microspheres released around 87% of drug in 12 h. DSC and XRD studies revealed that sertraline hydrochloride was molecularly dispersed in the microspheres. It was concluded that chitosan microspheres could be used to deliver sertraline hydrochloride following nasal administration for avoiding first pass metabolism and improving the bioavailability.

What will audience learn from your presentation?

- All those who are interested in applications of biomaterials in healthcare will enjoy the presentation.
- The audience will get an overview on biomaterials in development of drug delivery systems.
- The audience will also learn about development of microparticles for nasal administration.
- The talk will help understand the systematic approach for designing the experiment with the help of factorial design.

Biography

Dr. Sanjay B. Patil is presently Associate Professor at SNJB's Shriman Sureshdada Jain College of Pharmacy, Chandwad, Nashik, Maharashtra, India. He obtained his Ph. D. degree in Pharmaceutical Sciences from Faculty of Pharmacy, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat, India in 2010. He has published and presented several papers in national and international journals and conferences. He is an editorial board member and reviewer for various journals. His area of research comprises development of novel drug delivery systems including in situ gelling system, nasal microparticles, and gastroretentive drug delivery systems.



Swamini ChopraMaharashtra Institute of Technology, India

Cryogenic treatment: Evolution for polymeric materials

Cryogenic treatment, though a conventional treatment to improve the wear performance, it is still an emerging tool in case of polymers. This can be the reason, not much work is carried out or documented on cryogenic treatment of polymers. Despite great progress that this field has witnessed in past few years, it is still at its infancy and needs much to be explored. The fundamental challenge is the detailed understanding of generalized mechanism in order to establish the cryogenic treatment as an integral part of manufacturing process itself in industry. An attempt has been made by our team over the years to developed cryogenic treatment process for polymers, polymer composites and polymer blends by targeting mechanical and tribological properties. Our work has given a new dimension to the existing technology and promoted interdisciplinary research by merging chemistry, physics and material science with engineering disciplines. In present work, an attempt has been made to review the area of Cryogenic treatment of different types of polymeric materials and established its mechanism for the improvement in properties. After meticulous analysis it was concluded that this treatment not only enhances the mechanical performance of polymers but also leads to indirect environmental benefits by improving the component life and thereby reducing industrial waste.

What will audience learn from your presentation?

- Cryogenic treatment of polymers is a new area and this presentation will be informative to the audience
- Performance of polymeric material against their metallic counterpart is always questionable. This treatment will give researchers an alternative to explore the area of cryogenic treatment for different materials
- This presentation summarizes study done over the years for various polymeric materials in lab and in actual applications. Cryogenic treatment is indeed a practical solution that could make many components more efficient.

Biography

Dr. Swamini has expertise in the field of polymers, composites, cryogenic treatment, tribological performance and characterization techniques. She received her Ph.D. in Metallurgical and Materials Engineering from Visvesvaraya National Institute of Technology (VNIT), Nagpur in 2019. After completing her Ph.D. in 3 years, she joined DRDO's Defence Institute of Advanced Technology (DIAT), Pune on a High Entropy Alloy (HEA) Project sponsored by DST, Govt. of India. She is presently working as Assistant Professor – Research in Mechanical Engineering Department, Maharashtra Institute of Technology (MIT), Aurangabad. With 3 patents, 4 books and 28 research articles in reputed journals, she is one of the youngest Doctorate faculty at MIT, Aurangabad.



Bhawna Batra ^a, Samiksha Sangwan ^b, Jyoti Ahlawat ^b, Minakshi Sharma ^{b*}

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Fabrication of an electrochemical cytochrome c biosensor based on graphene oxide nanoparticles

An improved cytochrome c (Cyt c) biosensor based on immobilization of cytochrome c oxidase (COx) on the surface of graphene oxide nanoparticles (GONPs) electrodeposited onto pencil graphite (PG) electrode. Characterization of graphene oxide nanoparticle was done by Transmission electron microscopy (TEM), Fourier transform infra-red spectroscopy (FTIR) and X-ray diffraction study (XRD). The working electrode (COx/GONPs/PG) was characterized at its different stages of fabrication by scanning electron microscopy (SEM) and FTIR. Fabrication of Cyt c biosensor was done by connecting COx/GONPs/PG as working electrode, Ag/AgCl as reference electrode and Pt as auxiliary electrode to potentiostat. The mechanism of detection of present biosensor was based on oxidation of Cyt c (reduced) to Cyt c (oxidized) by COx resulting in flow of electrons through GONPs to the PG electrode, hence current generated is proportional to the concentration of Cyt c. Present biosensor exhibited optimum potential at 0.49 V with optimum pH 7.5 and optimum temperature 35°C. Biosensor showed linearity within 40–180 ng/ml having 40 ng/ml limit of detection.

What will audience learn from your presentation?

• The present research work provides an improved laboratory model for cytochrome c biosensor in terms of higher sensitivity, higher analytical recovery, long stability, good precision than earlier reported biosensors. Proposed cytochrome c biosensor is the laboratory model, it can be miniaturized for commercial purpose.

Biography

Prof. Minakshi Sharma has completed his PhD at the age of 32 years from Maharishi Dayanand University, Rohtak (Haryana), India. She has published more than 50 papers in reputed journals.



Chebrolu Pulla RaoIndian Institute of Technology Tirupati, India.

Protein - inorganic sustainable hybrid nano-materials in water purification

Proteins belong to an important and abundant class of natural biomolecules. Use of such systems for the development of nano-materials for different applications would automatically endow its inherent property of immunogenicity, low-toxicity, biocompatibility, easy degradability and resource availability. Their nano-structures and thereby the utility can be modified by using biologically relevant metal ions. Therefore, various protein – inorganic based nano materials have been explored in our group for water purification. Some of those which will be covered in this lecture include, (a) Role of *Moringa Oleifera* coagulant protein coated copper phosphate nanoflowers for the removal of heavy toxic metal ions and in oxidative degradation of dyes from water.¹ (b) BSA-copper hydrogel in the absorption and degradation organic dyes from water.²-3 (c) pH responsive BSA-Au hydrogel beads for the removal of organic dyes and heavy toxic metal ions from contaminated water.⁴ Our group also developed some macrocyclic based organic – inorganic hybrid nano materials for the removal of dye contaminations from water.⁵

Contributions by all the co-workers, critical analysis by the peers, financial support by the funding agencies and the platform provided by IIT Bombay are gratefully acknowledged. I thank IIT Tirupati for my current position.

Biography

Dr. Chebrolu Pulla Rao is currently a J.C. Bose National Fellow and Professor at IIT Tirupati. Prior to this, he held an Institute Chair Professorship in the Department of Chemistry, IIT Bombay wherein he was a faculty during 1988-2019. He did his Masters from IIT Madras, Ph.D. from IISc., Bangalore, and two post doctoral stints one from Harvard University and the other from MIT, USA. His research interest spans across Biological Inorganic and Supramolecular chemistry using small synthetic molecular systems as well as proteins with an extension of the studies to biological cells, and the efforts are way into nanobiomaterials. His research group extensively uses spectroscopy, microscopy and diffraction techniques besides practicing biochemical methodologies including antiproliferative activity. Till now 37 PhD and 59 MSc students completed their degrees and published over 240 papers in journals of international repute and completed a number of research projects sponsored by Department of Science and Technology (SERB, Nano Mission), Council for Scientific and Industrial Research and Department of Atomic Energy-Board for Research in Nuclear Sciences. To its credit, the group has 3 US patents and 7 Indian patents awarded, and 4 more Indian patents are under active consideration by the Patent office. He is a fellow of Indian National Science Academy (FNA), Indian Academy of Sciences Bangalore (FASc), National Academy of Sciences Allahabad (FNASc) and Andhra Pradesh Academy of Sciences (FAPAS) and is a CRSI silver medalist. He has served on the editorial board of IJC A for a decade and the Journal of Chemical Sciences for three years.



Alicja Tymoszuk*¹, Dariusz Kulus¹, Natalia Miler¹, Jacek Wojnarowicz²

¹Bydgoszcz University of Science and Technology, Poland, ²Polish Academy of Sciences, Poland,

Nanomaterials in improving micropropagation and breeding techniques of horticultural plants

Exposure of plants to engineered nanoparticles is a novel trend and still not a fully explored area of research, especially for horticultural purposes. The performed studies aimed to analyze the usefulness of silver, gold, and zinc oxide nanoparticles in the improvement of micropropagation and breeding techniques of selected, worldwide popular, and economically important ornamentals and vegetable crops.

The effects of silver and gold nanoparticles (spherical; 20 nm-in-size; 10 and 30 ppm) on the efficiency of in vitro adventitious organogenesis in *Chrysanthemum × grandiflorum* (Ramat.) Kitam. 'Bydgoszczanka', *Gerbera × jamesonii* H. Bol 'Suri', and *Streptocarpus × hybridus* Voss. were assessed. Chrysanthemum shoot fragments and gerbera rosettes cultured on the media supplemented with silver nanoparticles regenerated less adventitious roots than the control explants nontreated with nanoparticles. The regenerated roots were also of the smallest area and diameter, but the length of the longest root was the highest in the experiment. As for gerbera, the highest efficiency of adventitious roots formation was found as a result of gold nanoparticles application at the concentration of 10 ppm. Chrysanthemum roots on the media with 10 and 30 ppm of gold nanoparticles had the highest values of root diameter. The most efficient stimulation of adventitious shoots regeneration on the leaf explants in *S. × hybridus* was reported when 10 ppm silver or gold nanoparticles were added to the culture medium.

In the other experiment, silver nanoparticles (spherical; 20 nm-in-size; 5, 10, and 20 ppm) were added to the medium for adventitious shoots regeneration from internodes in chrysanthemum 'Lilac Wonder'. Nanoparticles affected the content of chlorophylls, carotenoids, and phenolic compounds in plant tissues, and, at the highest concentration tested, the inhibition of shoots regeneration was reported. *In vitro* rooted shoots were subjected to phenotype and genotype stability evaluation during cultivation in the glasshouse. Phenotype mutations concerning variations in the inflorescence color or shape were detected in six plants; one from 10 ppm and five from 20 ppm silver nanoparticles treatments. Polymorphic loci were detected in 12 and 9 silver nanoparticles-treated-plants by randomly amplified polymorphic DNA (RAPD) and inter sequence simple repeat (ISSR) markers, respectively. Therefore, it was demonstrated that silver nanoparticles may be an attractive and easy-to-apply alternative to other commonly used mutagens in breeding.

The next study aimed to investigate the effects of ZnO nanoparticles (homogeneous spherical morphology; 30 nm-in-size) at the concentrations of 50, 100, 200, 400, 800, 1600, and 3200 mg·L-1 on the process of *in vitro* seed germination and seedling growth in onion (*Allium cepa L.* 'Sochaczewska'). The highest share of germinating seeds was found for 800 mg·L-1 ZnO nanoparticles. It was demonstrated that zinc oxide nanoparticles, at the concentration range from 50 to 1600 mg·L-1, can be used to stimulate the germination of onion seeds, without negatively affecting the growth and development of seedlings.

The statistically proven effects of nanoparticles on the efficiency of *in vitro* propagation or variation induction in ornamental and vegetable plants, not only encourage undertaking further research in this area but can be directly implemented in horticultural practice.

What will audience learn from your presentation?

- The results of our studies provide a better understanding of the effects of nanoparticles on plants at the biometrical, biochemical, genetic, and phenotype levels.
- The results can find practical application in the micropropagation and breeding of horticultural plants.
- The possibility of establishing worldwide scientific cooperation with other scientists and employees of the economic sector.

Biography

Dr. Alicja Tymoszuk graduated in Biotechnology in 2007 at the University of Technology and Life Sciences in Bydgoszcz (Poland) and defended a doctoral dissertation in biology in 2012 at the Nicolaus Copernicus University in Toruń (Poland). She currently works as a Professor (Assistant) at the Laboratory of Ornamental Plants and Vegetable Crops of the Bydgoszcz University of Science and Technology and conducts research related to plant biotechnology and nanobiotechnology. Her particular interests include the use of nanomaterials in plant micropropagation and breeding. Dr. Tymoszuk published over 20 scientific articles in international journals.



Diogo M.F. Santos*1, Dušan Mladenović2, Elif Daş3, Ayşe B. Yurtcan4, Šćepan Miljanić2, Biljana Šljukić1,2

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- ⁴Atatürk University, Turkey

Towards effective green hydrogen production by enhancing oxygen electrode kinetics with transition metals (Ni, Fe, Cu) alloyed to platinum supported on graphene nanoplatelets

lkaline water electrolysis is the most mature technology for hydrogen production. If the required electricity comes $m{\Lambda}$ from renewable energy sources (e.g., solar, wind), green hydrogen will be generated. Improving hydrogen (HER) and oxygen evolution reaction (OER) efficiency is essential to make electrolysis more competitive with dominant fossil fuelbased technologies. That requires developing efficient electrocatalytic materials for fuel and oxygen electrodes. In this study, PtM (M = Ni, Fe, Cu) nanoparticles were supported on graphene nanoplatelets (GNPs) and tested as electrocatalysts for the positive electrode of unitized regenerative fuel cells (URFCs), i.e., both for the oxygen reduction (ORR) and oxygen evolution (OER) reactions. URFCs work in two operation modes: electrolysis mode, converting water to hydrogen and oxygen when there is a surplus of electricity, and fuel cell mode, in which hydrogen and oxygen are consumed when there is a need for extra power. These PtM/GNPs catalysts were synthesized via simultaneous supercritical carbon dioxide (scCO₂) deposition technique, where the primary metal (Pt) and secondary metal (Ni, Fe, Cu) were deposited onto GNPs by scCO₂ in the same step. This resulted in ca. 20 wt.% Pt loading and M loading in the 1.4 - 3.4 wt.% range. Morphology analysis by TEM revealed the formation of metal nanoparticles of 2-3 nm size uniformly distributed over GNPs, while XPS was used to determine their oxidation states. The produced materials were tested as electrocatalysts for ORR and OER, assessing their potential application in URFCs and rechargeable metal-air batteries. The electrocatalytic activity towards ORR was investigated in 0.1 M KOH by performing a series of linear scan voltammetry experiments at different rotation rates to calculate the number of exchanged electrons, n, and the Tafel slope, b, two key parameters for electrocatalysts' evaluation. PtFe/GNPs exhibited favorable ORR kinetics in terms of the highest diffusion-limited current density, low Tafel slope, and high number of exchanged electrons (n = 3.66), which might be attributed to its high double-layer capacitance and, thus, high electrochemically active surface area. Furthermore, this material performance was comparable to that of commercial Pt/C electrocatalyst containing double the amount of Pt. PtFe/GNPs also showed the best performance toward OER as evidenced by the high current density, the lowest overpotential to reach a current density of 10 mA cm⁻², and the lowest Tafel slope. The results show great promise of the synthesized PtFe/GNPs as bifunctional catalysts for OER/ORR in URFCs.

What will audience learn from your presentation?

- This presentation will present the fundamentals of green hydrogen production by alkaline water electrolysis.
- Then, a particular study on the development of bifunctional catalysts for OER/ORR will show the possibility of incorporating such catalysts in the oxygen electrode of unitized regenerative fuel cells for enhancing the efficiency of green hydrogen production (electrolysis mode) and simultaneously boosting the oxygen reduction reaction kinetics (fuel cell mode).

Biography

Diogo M.F. Santos is an Invited Assistant Professor at Instituto Superior Técnico (ULisboa, Portugal) and Researcher in the Center of Physics and Engineering of Advanced Materials, studying electrodes and membranes for application in direct liquid fuel cells. D.M.F. Santos has authored 120 journal papers and 90 conference proceedings, and his current h index is 30. He is in the "World's Top 2% Scientists list" of Stanford University for the impact in 2020. D.M.F. Santos has presented more than 50 oral communications and 80 posters at international conferences. His main research interests are related to electrochemical energy conversion and storage.



Prieto-Abello, Leonardo*^{1,2}, Salguero, Gustavo¹, Camacho, Bernardo¹,Perilla, Jairo Ernesto², Silva-Cote, Ingrid¹

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Evaluation of polycaprolactone and glycine electrospun biocomposite as scaffold for tissue construct skin

Chronic wounds such as diabetic ulcers are injuries that do not repair properly, they usually occur in up to 25% of diabetic patients and their complications can cause amputations or death. An alternative to promote the repair of this type of wound is the application of tissue constructs obtained from electrospun scaffolds with biomaterials that, functionalized with Wharton's jelly mesenchymal stromal cells (WJ-MSC), have a great potential for tissue repair.

In this work, polycaprolactone (PCL) and glycine scaffolds were fabricated using the electrospinning technique by changing the injected volume of the polymeric solution between 0.3ml and 0.5 ml, and adding 5% glycine, in order to evaluate how glycine and the deposition of a higher number of fibers affect the morphology, mechanical behavior of the scaffolds and cell viability.

Characterizations by FTIR, SEM, measurement of Young's modulus and viability of WJ-MSC were performed to evaluate their potential use as a scaffold in a tissue construct. FTIR analysis showed that both materials are integrated into the obtained fibers. Likewise, the scaffolds with glycine had smaller fiber diameters and higher estimate porosity than those made only with PCL. The Young's modulus of the scaffolds with glycine and lower injected volume shows that these scaffolds have a better elastic behavior suitable for skin applications. Regarding to the results of biological characterization, it was obtained that scaffolds with glycine support the viability of WJ-MSC.

The results shown that with the lower level of the injected volume and the addition of glycine to the scaffolds, the morphological and mechanical characteristics are improved for skin repair applications. This shows the potential of these scaffolds in the generation of tissue constructs.

Keywords: Electrospinning, biomaterials, polycaprolactone, glycine, Wharton's jelly mesenchymal stromal cells. Composites

What will audience learn from your presentation?

- Electrospinning of Polycaprolactone and glycine scaffolds that seeks to be used in tissue constructs for skin repair.
- Evaluation of electrospun scaffolds by means of SEM, FTIR, Young's modulus and cell viability

Biography

Mr. Leonardo Prieto Abello, studied chemical engineering at the Universidad Nacional de Colombia and is an active student of the master program in chemical engineering in the same institution. He is a researcher at the Instituto Distrital de Ciencia, Biotecnología e Innovación en Salud (IDCBIS) in the field of tissue engineering focused in skin repair applications.



Najam ul Hassan *1,2, Ishfaq Ahmad Shah², Shania Rehman³, Muhammad Farooq Khan³

¹University of Education, Pakistan ²Nanjing University of Science and Technology, China ³Sejong University, Korea

Tunable martensitic transformation and magnetic properties of Sm doped NiMnSn ferromagnetic shape memory alloys

NimSn ferromagnetic shape memory alloys exhibit martensitic transformation at low temperature restricting from the applications. Therefore, it is a key factor to improve martensitic transformation temperature which is effectively carried out by proper element doping. In this research work, we have investigated the martensitic transformation and magnetic properties of $Ni_{43}Mn_{46-x}$ Sm_xSn_{11} (x=0, 1, 2, 3) alloys on the basis of structural and magnetic measurements. X-ray diffraction shows that the crystal structure transforms from cubic L21 to orthorhombic martensite and gamma (γ) phase. The reverse martensitic and martensitic transformations are indicated by exothermic and endothermic peaks in differential scanning calorimetry. The martensitic transformation temperature increases considerably with Sm doping and goes over room temperature for Sm=3 at. %. The Ni43Mn45SmSn11 alloy exhibits magneto structural transformation, leading to large magnetocaloric effect near room temperature. The existence of thermal hysteresis and metamagnetic behavior of $Ni_{43}Mn_{45}SmSn11$ confirms the first order magneto structural transition. The magnetic entropy change reaches 20 $J\cdot kg^{-1}\cdot K^{-1}$ at 266 K $Ni_{43}Mn_{45}SmSn_{11}$ and refrigeration capacity ~ 162 $J\cdot Kg^{-1}$ under magnetic field variation of 0-5 T.

What will audience learn from your presentation?

- Martensitic Transformation, Magnetocaloric effect, Magnetic refrigeration.
- The materials showing martensitic transformation (MT) exhibit various multifunctional phenomena such as magnetocaloric effect (MCE), exchange bias (EB), magnetothermal conductivity (MC) and magnetoresistance (MR). This coupled transition is obtained around the MT temperature.
- The MCE is a magneto-thermodynamic phenomenon in which temperature is changed in the material when exposed to the external-non-constant magnetic field.
- Magnetic refrigeration is a best alternate conventional gas cooling technology, showing many, such as environment friendly, high refrigerant efficiency, low cast, occupying less space, low mechanical vibration, and harmlessness

Biography

Dr. Hassan is working as Assistant Professor at Department of Physics, Division of Science & Technology, University of Education, Lahore, Pakistan. Before this he has worked as Assistant Professor of Physics at department of Physics, University of Central Punjab, Lahore, Pakistan. He has published more than 25 research papers in well-known International journals of Physics & Materials Science. He has also served as committee member, reviewer and keynote speaker in various International Conferences/Symposiums.

Dr. Hassan did his Ph.D. in Materials Science & Engineering from Nanjing University of Science & Technology, Nanjing, China. Before commencing his doctoral degree, he has worked as subject specialist in Higher Education Department, Punjab Province, Pakistan.

Participants List

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