AVER CONFERENCES

World Congress on Materials Science Research and Nanotechnology

May 22-23, 2023 | Rome, Italy

Venue: Belstay Roma Aurelia
Email : materialscience@averconferences.com
Website: https://materialscience.averconferences.com/

Day 1: May 22, 2023

Meeting Hall

09:30 - 12:00	**Registrations**
09:45 - 10:00	**Opening Ceremony**

Keynote Forum

10:00 - 10:30	**Title: Superplastic Forming of 1050 Aluminium Alloy** Dr. Mohammad Reza Allazadeh, University of Strathclyde, UK
10:30 - 11:00	**Title: Research Trends on Artificial Intelligence in Medical Imaging and Devices** Dr. Sailesh Iyer, Rai University, Ahmedabad, India
11:00 - 11:30	**Title: Nanohybrid based Coatings on Cotton Fabric for Self-cleaning and Antimicrobial Applications** Dr. Sunirmal Jana, CSIR-Central Glass and Ceramic Research Institute, India

Group Photo

Networking & Refreshment Break 11:35 - 11:45

Plenary Session

11:45 - 12:10	**Title: Fabrication and characterization of Li2WO4-based ULTCC substrates for terahertz applications** Dr. Dorota Szwagierczak, Lukasiewicz Research Network - Institute of Microelectronics, Poland
12:10 - 12:30	**Title: Application of Random Search Method for Investigation of Rheological Properties of Metals, which are Subjected to Corrosive Environments** Dr. Georgy Filtov, Ukrainian State University of Chemical Technology, Ukraine
12:30 - 12:40	**Title: Exploring the Potential of Mixed Ferrite Ferrofluids for Enhanced Magnetic Fluid Hyperthermia in Cancer Treatment** Mr. Prashant Kumar, RMIT-Royal Melbourne Institute of Technology, Australia
12:40 - 13:00	**Title: Polyimides exhibiting the opposite electrorheological effect** Mr. Aksenov Egor, Institute of Applied Mechanics of Russian Academy of Sciences, Russia
13:00 - 13:25	**Title: Nanostructured metal oxide thin films for hydrogen gas sensors** Dr. Yogendra Kumar Gautam, Chaudhary Charan Singh University, India

Lunch Break @ 13:25 - 14:25

Plenary session

14:25- 14:50	**Title: Polymeric colloidal nanocarriers entrapped with Centella asiatica extract** Dr. Maria Helena Ambrosio Zanin, Instituto de Pesquisas Tecnologicas do Estado de Sao Paulo – IPT , Brazil
14:50 - 15:05	**Title: Ultra-low temperature sintering and high frequency dielectric properties of low-weight LiBO2 substrates** Dr. Jan Kulawik, Lukasiewicz Research Network - Institute of Microelectronics and Photonics, Poland
15:05 - 15 :25	**Title: A study of CVD parameters and graphene growth on Ni and Cu** Ms. Elmira Alimohammadzadeh, Newcastle University, UK
15:25 - 15:45	**Title: Evaluation of bioactivity and physicochemical properties of Polycaprolactone/Tricalcium phosphate and Polyurethane/Tricalcium phosphate scaffolds prepared by freeze drying method** Ms. Yasaman Saghafi, Islamic Azad University of Science & Research Branch of Tehran, Iran
15:45 - 16:05	**Title: Algae as a source of biomaterials** Ms. Aleksandra Lawrynowicz, CEO Spiruu, Poland

Networking & Refreshment Break 16:05 - 16:15

16:15 - 16:35	**Title: Meta-Insulator transition in Nickel Nanoparticles** Dr. Gunadhor Singh Okram, UGC-DAE Consortium for Scientific Research, India

E-poster

16:35 - 16:45	**Title: Launch of a pilot line for the production of ecological catalytic systems, taking into account the sustainable recycling of critical raw materials** Mr. Tomasz Debowski, Debowski Tomasz Awg Polonez, Poland

Meeting Adjourns

Day-2: May 23, 2023 (Online)

Microsoft Teams

10:00 - 10:20	**Title : Cellular Population Dynamics Shape The Route To Human Pluripotency Promoted By A Paracrine Hgf-Met-Stat3 Axis** Mrs. Onelia Gagliano, University of Padova, Italy
10:20 - 10:40	**Title : Impact of Defects and Work Function of Electrode in Solar Cell Devices** Dr. Piyush K. Patel, Maulana Azad National Institute of Technology, India
10:40 - 11:00	**Title: Identification of better chelating agent and grain-size dependent physical properties of yttrium orthoferrite derived from soft-chemical route** Dr. Rajasekhar Bhimireddi, Sri Sathya Sai Institute of Higher Learning, India
11:00 - 11:20	**Title : Adsorptive-removal of Cr^{3+} using Fe-Zr binary oxide nanoparticles from aqueous solution** Dr. Rajesh Kumar, S.S.J. University, India
11:20 - 11:40	**Title : Exploring the potential to enhance the performance of Graphene as Hydrogen Gas Sensor using Transition Metals** Dr. Deepa Sharma, Department of Higher Education, Government of Haryana, India

Networking

Meeting Adjourns

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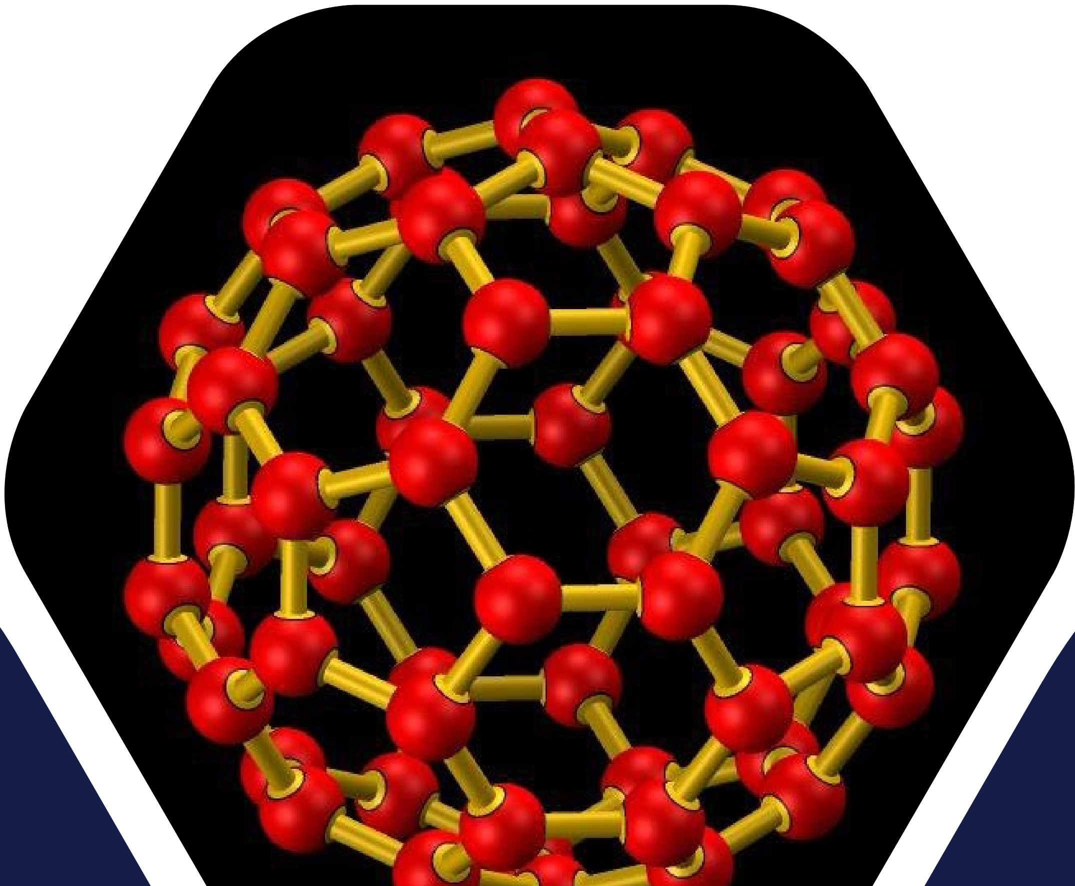

Keynote Forum

Dr. Mohammad Reza Allazadeh

University of Strathclyde, United Kingdom

Superplastic forming of 1050 Aluminium alloy

Superplastic forming (SPF) was implemented to form aluminium alloy 1050H14 (AA1050H14) for industrial applications. A number of ABAQUS numerical simulations were developed to predict the formation behavior of the AA1050H14 sheet at different temperatures by embedding the built-in creep material model. The published data was deployed in the FEM models for AA1050 flow stress curves at different uniaxial loading strain rates and testing temperatures. The m-value of AA1050 was obtained from the previous publication. The AA1050 sheets were blown into the die cavity by hot gas pressure according to the extracted pressure cycles from the FEM outcomes. The simulation mimics the formation of the SPF part in the press for both geometrical and formation time, which in turn captures the material flow rate using the creep model. The elongation of AA1050 sheets via SPF is within the limitation reached in the uniaxial test results published by the author but the lead time is suitable for forming AA1050 complex boxes used in the food industry or the relevant sectors.

Biography:

Dr. Allazadeh graduated with BS/MSc degree in manufacturing technology from the University of Miskolc in Hungary. He attained his second MSc degree in mechanical engineering from Brown University in the USA. He received his Ph.D. in mechanical engineering and material science from the University of Pittsburgh in the USA. He completed two post-doc contracts at two different faculties in the engineering school of Pittsburgh University. He became an assistant professor, research fellow, and associate professor at Pannon University, the Hungarian academy of sciences, and Obudai University in Hungary, successively. His past industrial engineering job includes working in General Electric, BayZoltan research institute collaborating with Alcoa Company, TechnoSoft, and ANSYS. He has CEng MIMechE chartered engineering status from the Institution of Mechanical Engineers since 2016. Currently, he works at the National Manufacturing Institute Scotland affiliated with the University of Strathclyde in the UK.

Dr. Sailesh Iyer

Rai University, Ahmedabad, India

Research Trends on Artificial Intelligence in Medical Imaging and Devices

The global AI in Medical Imaging Market was valued at USD 1.7 Billion in 2022 and is projected to reach USD 20.9 Billion by 2030, growing at a CAGR of 36.87% from 2023 to 2030. Imaging in medicine now involves sophisticated ways of analyzing every data point to distinguish disease from health and signal from noise. This talk would focus on Predictive Healthcare and how AI can transform Medical Imaging to predict health in advance and suggest corrective action. Research Trends of AI in Medical Imaging include the prediction of Diabetic Retinopathy, Glaucoma, Cancer detection and prediction, Preventive Healthcare, and overall Healthcare Management. Automated Healthcare AI-based medical devices can also be instrumental in providing Healthcare tips and monitoring. Various AI algorithms and Medical Imaging devices would be discussed with due focus on future Research Trends.

Biography:

Dr. Sailesh Iyer has a Ph.D. (Computer Science), pursuing a Post Doc from the University of Louisiana, Lafayette, USA (Public University ranked among the top 100 Public Universities) and currently serving as a Professor at Rai University, Ahmedabad. He has more than 23 years of experience in Academics, Industry, and Corporate Training out of which 18 years are in core Academics. He has been awarded Research Excellence Award for the year 2021 by Rai University and was an Honorary Adjunct Research Scientist at Neurolabs International under Dana Brain Health Institute, Iran from August 2022 to August 2025. He has 2 Patents granted and one patent published to his credit and is involved as an Editor for various book projects with IGI Global (USA), CRC PressTaylor and Francis (UK), and Bentham Science (UAE). He has been invited as Keynote Speaker at various International Conferences held in China, Indonesia, the Philippines, Saudi Arabia, Haiti, Ukraine, Italy, and India. A hardcore Academician and Administrator, he has excelled in Corporate Training, and delivered 95+ Expert Talks in various AICTE-sponsored STTPs, ATAL FDPs, Reputed Universities, Government organized Workshops, Orientation and Refresher Courses organized by HRDC, Gujarat University. Research Contributions include reputed Publications, Track Chair at ICDLAIR 2020 (Springer Italy), icSoftComp 2020, IEMIS 2020 (Springer), ICRITO 2020 (IEEE), ARISE-2021, FTSE-2021 and TPC Member of various reputed International and National Conferences, Reviewer of International Journals like Multimedia Tools and Applications (Springer), Journal of Computer Science (Scopus Indexed), International Journal of Big Data Analytics in Healthcare (IGI Global), Journal of Renewable Energy and Environment and Editor in various Journals. Expert Talk on Research-based topics in various Universities and Conferences in addition to guiding Research Scholars as Supervisor. He has also been invited as a Judge for various events, an Examiner for Reputed Universities, a Computer Society of India Lifetime Member, and also served as a Managing Committee (MC) Member, of CSI Ahmedabad Chapter from 2018-2020.

Dr. Sunirmal Jana

CSIR-Central Glass and Ceramic Research Institute, India

Nanohybrid based Coatings on Cotton Fabric for Self-cleaning and Antimicrobial Applications

Among the biodegradable polymers, cotton fabric is one of them that has plenty of applications in diverse industries including the apparel industry. However, the early degradation of the fabric may cause due to high water absorption capacity and ease of microbial infestation, limiting the materials for potential applications. Pristine cotton fabric is super hydrophilic in nature and could be converted into superhydrophobic (contact angle ≥150°, sliding angle ≤10°) by strategic surface modification using low-energy materials like toxic fluorine-based precursors. However, organic-inorganic nanohybrid-based materials are fairly used to fabricate the coatings. A wide range of nanomaterials are being used to acquire antimicrobial properties. The most notable non-metallic nanoparticles are chitosan and graphene / reduced graphene oxide. On the other hand, extensively used metal or metal oxide nanoparticles such as Ag, Cu, Cu_2O, CuO, TiO_2, and ZnO as antimicrobial materials. Scientific and technological innovations are rapidly taking place in every research field including functional nanomaterials where hierarchically structured nanomaterials (HSNs) with antimicrobial properties are most important owing to their enormous potential applications especially biomedical, wastewater management, energy storage, and sensing. Several green chemicals and physical and biological methods are known to produce metal and metal oxide-based HSNs because these are energy-efficient methods where environmentally benign solvents and reagents are being used. It is worth noting that sustainable superhydrophobic fabrics possess antibacterial, antifungal, and self-cleaning properties having tremendous prospective for applications as antimicrobial and anti-staining textiles.

In this talk, a part of our recent research findings on hierarchically structured organic-inorganic nanohybrid superhydrophobic coatings composed of transition metal oxide/hydroxide with low-energy biocompatible materials on cotton fabrics will be shared. It is noteworthy that a solution fabrication of HSNs-based nanohybrid coatings on cotton fabrics involving the green synthesis method has been performed. Finally, the application of the coated fabrics for self-cleaning and antimicrobial applications will be discussed before the August gathering.

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Day 1
Plenary Sessions

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Mr. Tomasz Debowski, Debowski Tomasz Awg Polonez, Poland

Fabrication and characterization of Li2WO4-based ULTCC substrates for terahertz applications

Dr. Dorota Szwagierczak
Lukasiewicz Research Network-Institute of Microelectronics and Photonics, Poland

The permanent progress in high-frequency electronics, including 5G and 6G communication systems, creates a strong demand for new materials for substrates and packages which demonstrate well-tailored dielectric properties. The reduction of processing costs and environmental impact by lowering the sintering temperature also is an important objective. This study presents the fabrication procedure and a comprehensive investigation of the properties of Li2WO4-based ultra-low temperature cofired (ULTCC) substrates. Lithium tungstate Li2WO4 was synthesized by the solid-state reaction and used for the preparation of green tapes and ULTCC test structures with cofired internal conductive layers. Several methods comprising X-ray diffractometry, energy dispersive spectroscopy, scanning electron microscopy, hot-stage microscope observations, differential thermal analysis, thermogravimetry, analysis by an optical profilometer, and time domain spectroscopy were used for characterizing the composition, microstructure, sintering behavior, surface roughness, and terahertz dielectric properties. The main focus was on the investigation of the influence of frequency, temperature, the addition of AlF3-CaB4O7 and CuBi2O4 dopants, and sintering temperature on the dielectric properties in the terahertz frequency range. The developed Li2WO4-based substrates are promising candidates for ULTCC high-frequency applications owing to an ultra-low sintering temperature of 590-630°C, a dense microstructure, a low and stable dielectric permittivity of 5.0-5.8 in the broad 0.2-2 THz range and a low dielectric loss of 0.008-0.01 at 1 THz.

Biography:

Dorota Szwagierczak received an M.Sc. degree in materials science, in 1976, a Ph.D. degree in chemical sciences, in 1980 at AGH University of Science and Technology, Krakow, Poland, and a D.Sc. degree in electronic engineering, in 2012 at the Institute of Electron Technology, Warsaw, Poland. She currently works at Łukasiewicz Research Network Institute of Microelectronics and Photonics, Krakow Division, Poland, in the position of the leader of the research area. She was the author/co-author of over 200 papers in scientific journals and conference proceedings, co-inventor of 20 Polish patents, and investigator in over 20 national and 5 European projects. Her research interests include the fabrication and characterization of new ceramic materials for passive electronic components, thick film technology, tape casting, LTCC technology, pH sensors, microwave ceramics, and terahertz dielectric properties.

Application of Random Search Method for Investigation of Rheological Properties of Metals, which are Subjected to Corrosive Environments

Dr. Georgy Filtov
Ukrainian State University of Chemical Technology, Ukraine

In the article is proposed the use of a random search method to identify the mathematical models of corrosion destruction, taking into account the rheological properties of metals: changing the value of the ultimate strength of steel and elastic modulus when exposed to the aggressive environment during the time at the changing of the temperature of samples.

Biography:

Lecturer at the Department of Materials Science of the Ukrainian State University of Chemical Technology (USCTU), Assistant, Senior Lecturer, Associate Professor, Professor, specialty Strength of Materials -March 1968-October 2020. A computer program “Training system” was created on the strength of materials” - 2009 7 resistance tutorials published materials in the publishing houses of USCTU, Liro-K (Kiev),2001-2009 Palmarium (Germany) – 2014. An evolutionary theory of identification of mathematical models of corrosion destruction was developed in 2006, and a monograph was prepared based on the results of the research. Published in the publishing house USCTU-2007 and in the publishing house LAP LAMBERT in Germany - 2014. He graduated from the Dnipro State Transport University, Faculty of Industrial and Civil Construction, in 1964.

Exploring the Potential of Mixed Ferrite Ferrofluids for Enhanced Magnetic Fluid Hyperthermia in Cancer Treatment

Mr. Prashant Kumar
RMIT-Royal Melbourne Institute of Technology, Australia

In this study, we have achieved an exceptionally high specific absorption rate (SAR) performance in superparamagnetic (SPM) nanoparticles made of Zn-substituted magnetite, ZnxFe3-xO4 (0<x<0.4), which is crucial for magnetic hyperthermia (MHT) based cancer treatment. Magnetic fluid hyperthermia has the potential for effective cancer treatment; however, low heating performance, agglomeration of MNPs in blood veins, cytotoxicity, and hemocompatibility pose critical challenges for clinical use. To address these issues, we adopted a reverse micelles co-precipitation synthesis approach to prevent agglomeration of MNPs and optimized the substitution of Zn ions in magnetite, resulting in improved heating performance. We achieved a high calorimetric SAR value of 118 and 181 W/g using the initial slope method and Box Lucas method, respectively, for the superparamagnetic magnetite nanoparticles. By optimizing the substitution of Zn2+ ions in magnetite, we dramatically increased the SAR value, achieving SAR values of 325 W/g and 579 W/g using ISM and BLM, respectively, for ZnxFe3xO4 (0<x<0.4) (x=0.3), representing a greater than 300% increase. This increase in SAR value is due to the enhanced saturation magnetization (12-24 kJ/m3) and optimized magnetocrystalline anisotropy obtained from static dc magnetic measurements. The increase in saturation magnetization can be attributed to the higher magnetic moment with an increase in Zn concentration up to x=0.3, resulting from the strengthening of the JAB interaction. However, a further increase in Zn2+ concentration results in a decrease in saturation magnetization due to non-collinearity, which is explained by the Yafet-Kittle model. Additionally, the improved heating performance ensures that low concentrations of MNPs are required for treatment, reducing potential toxicity effects. Further room temperature FRM spectra show a narrowing resonance signal because Zn2+ (3d10) is non-magnetic and happens to reduce the magneto-dipolar interactions leading to a narrowing of line width [1-2].

Polyimides exhibit the opposite electrorheological effect

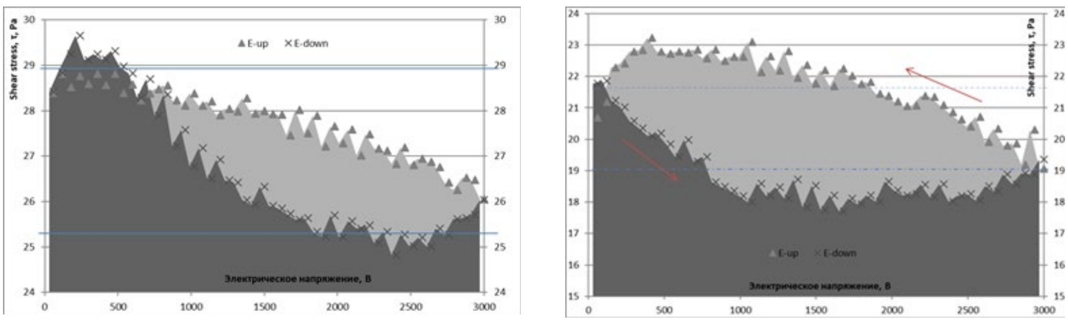
Mr. Aksenov Egor
Institute of Applied Mechanics of Russian Academy of Sciences, Russia

Electroreological (ER) fluids are colloidal suspensions consisting of a polarizing, liquid, or solid dispersed phase and a dielectric dispersion medium. Rheological properties in such fluids change rapidly and reversibly with the application of an electric field [1].

At the moment, two types of electroreological materials are being considered in the world: ER of a direct-acting liquid, and ER of a reverse-action fluid [2].

In the ER of a direct-acting fluid with the application of an electric field, mechanical characteristics such as viscosity and shear modulus instantly increase, and in the ERs of retroactive fluids, the mechanical characteristics drop sharply.

The reverse effect in ERs of liquids is accompanied by two factors: the electrobrasion of particles (Quincke rotation) and phase separation, which is clearly demonstrated by suspensions of polyimides of various compositions.



Rice. 1. The dependence of tangential voltages on the electric field, at a constant shear rate of 30c-1: left at a temperature of 25oC; right-at temperature of 40oC

The results of studies of 10% polyimide suspension at 24° C (Fig. 1 on the left) and 40°C (Fig. 1 from the right) in the medium of polydimethylsiloxane liquid show a steady decrease in the dynamic viscosity of the system with an increase in the electric field at a constant shear rate of 30c -1.

It can be seen how the suspension is completely restored with the removal of the electric field, which indicates the reversibility of this effect. Also, the test results indicate that with an increase in temperature, the contribution of the medium to the rheological properties of the suspension decreases.

Nanostructured metal oxide thin films for hydrogen gas sensors

Dr. Yogendra Kumar Gautam
Chaudhary Charan Singh University, India

Hydrogen has great potential as a clean and renewable energy carrier. Very efficient sensors are required to detect hydrogen gas leaks in industries, mines, and the automotive sector, etc. because hydrogen is a highly flammable gas when mixed with air.

Recently, chemo resistive metal oxide (MOS) thin films-based sensors have great interest for their possible use as gas sensing devices. These gas sensors are easy to fabricate and have various advantages compared to other sensor device structures. The sensors have the ability to detect a wide range of hydrogen with high sensitivity. However, the operating temperature, selectivity, and mechanical and environmental stability of hydrogen gas sensors are still under investigation to fulfill the demand for the use of hydrogen. The nanostructured MOS thin films have pronounced potential to overcome these issues. The CuO thin film sensor presents a remarkable sensing performance with fast response/recovery time for hydrogen gas at a low concentration. The sensor is observed to be highly selective towards hydrogen gas against other gases carbon monoxide and ammonia. The SnO2 thin film sensor exhibits good sensitivity at moderate working temperatures for the detection of a wide range of concentrations of hydrogen. These sensors are found stable in highly humid conditions, have long-term mechanical stability, and are highly selective to hydrogen gas. Thus, NMOS thin films can be used to design simple and low-cost sensors to detect low concentrations of H2 gas for use in hydrogen-driven industries.

Biography:

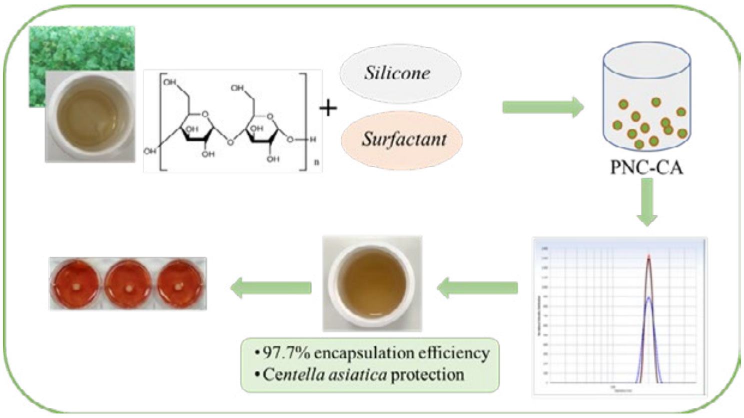
Dr. Yogendra Kumar Gautam is working as an Assistant Professor in the Department of Physics, at Chaudhary Charan University (CCSU), Meerut, U.P., India since 2015. He worked as an Assistant Professor in the Department of Physics, JUET Guna, M. P., India (2013-2015). He received his MTech. (Solid State Materials) at Indian Institute of Technology (IIT) Delhi, India in 2007. He received his Ph.D. (Material Science) at the Indian Institute of Technology (IIT) Roorkee, India in 2013. He has published 35 research articles in reputable journals. He has published 4 national patents. His research areas are focused on gas sensors, solid-state hydrogen storage, energy storage devices, and photocatalytic activity.

Polymeric colloidal nanocarriers entrapped with Centella Asiatica extract

Dr. Maria Helena Ambrosio Zanin
Instituto de Pesquisas TecnolÃ³gicas do Estado de SÃ£o Paulo - IPT, Brazil

The medicinal Centell Asiatica plant known for treating various types of symptoms and diseases presents lower bioavailability in vivo and drug delivery systems due to its poor lipid solubility and undesired molecular size.

Nanoparticle technology plays an important role in loading active ingredients and being able to increase their stability and performance. In this work, Centella asiatica extract, a plant with known dermatological and cosmetic applications, was incorporated into colloidal polymer nanocarriers, and dispersed in a silicophilic medium. Nanocarriers were prepared and characterized for particle size (Dynamic Light Scattering), morphology (Scanning Electron Microscopy), and entrapment efficiency of madecassoside. The physical and chemical stability of the encapsulated extract was monitored for 60 days of storage under specific conditions (25 and 40 °C), quantifying the content of madecassoside by HPLC and the particle size distribution. In vitro safety assays, including halo diffusion, cell viability, and cell transformation assay were evaluated for free and encapsulated extracts. Nanocarriers showed an average diameter of around 210 nm (Polidispersity Index—PDI 0.2) and an entrapment efficiency of 97.7%. The concentration of madecassoside remained stable over time, indicating that the nanocarriers proposed here were able to protect madecassoside against degradation. In addition, nanocarriers showed non-cytotoxic effects and did not induce cell transformation.



Biography:

Chemical Engineer with a Ph.D. in Chemical Processes from the University of Campinas (UNICAMP), visiting researcher at the Fraunhofer Gesellschaft, Germany, Postdoctoral at National Renewable Energy Laboratory - NREL, Colorado – USA, and currently senior researcher at Chemical Processes and Particle Technology Laboratory at the Bionanomanufacturing - Instituto de Pesquisas Tecnológicas (IPT). Extensive experience in R&D projects developing new materials focused on the technology of encapsulation developing micro and nanostructured particles and also electrospinning to develop micro and nanofibers based on polymers on several areas of application concerning to the particles and fibers focused on new materials opening possibilities to the product innovations.

Ultra-low temperature sintering and high-frequency dielectric properties of low-weight LiBO2 substrates

Dr. Jan Kulawik
Lukasiewicz Research Network - Institute of Microelectronics and Photonics, Poland

The development of new substrate materials with a low dielectric permittivity at very high frequencies suitable for 5G and 6G communication systems and an ultra-low sintering temperature is an important and challenging goal. This work reports on a new application of lithium borate LiBO2 as a substrate material for high-frequency electronic circuits. Lithium borate was synthesized by the solid-state reaction method. Ceramic pellets of undoped LiBO2 and LiBO2 doped with AlF3-CaB4O7 were prepared by ball-milling, uniaxial pressing, and sintering at 630-700°C. The sintering range and melting points of the fabricated materials were determined by observations during heating in a hot stage microscope. The phase composition, microstructure, and elemental composition were studied using X-ray diffraction analysis, scanning electron microscopy, and energy dispersive spectroscopy. The dielectric properties were investigated in a broad frequency range of 0.1-3.5 THz and in the temperature range of 20-100°C using time-domain spectroscopy (TDS). The advantageous features of the developed materials comprised an ultra-low sintering temperature, a very low and frequency-stable dielectric permittivity (4.7-5.3 at 1 THz), a low dielectric loss tangent (0.007-0.01 at 1 THz), a high densification degree and a low specific weight. The variations of the dielectric permittivity were small while increasing frequency in the range of 0.2-1.4 THz and temperature in the range 20-55°C.

Biography:

Jan Kulawik received an M.Sc. degree in physical chemistry from Jagiellonian University, Krakow, Poland, in 1978 and a Ph.D. degree in electronics from AGH University of Science and Technology, Krakow, Poland, in 2002. He currently works at Łukasiewicz Research Network-Institute of Microelectronics and Photonics, Krakow Division, Poland, in the position of the leader of the research area. He was the author/co-author of over 200 papers in scientific journals and conference proceedings, co-inventor of 22 Polish patents, and investigator in over 30 national/international projects. His research interests comprise new ceramic materials for passive electronic components, thick film technology, tape casting and LTCC technology, pH sensors, detectors of particles, microwave ceramics, and solid oxide fuel cells.

A study of CVD parameters and graphene growth on Ni and Cu

Ms. Elmira Alimohammadzadeh
Newcastle University, UK

Graphene is a two-dimensional carbon allotrope with remarkable properties that make it desirable for biological sensing, in particular its biocompatibility and large surface area/volume ratio. Over the last decade, bottom-up chemical vapour deposition (CVD) has emerged as a promising approach to producing small-scale, few-layer graphene with high area coverage on nickel (Ni) and copper (Cu) [1,2]. The CVD of hydrocarbons for graphene production on Cu occurs by the adsorption of carbon atoms. In contrast, segregation and precipitation lead to the formation of graphene sheets on Ni because of a higher carbon solubility rate and the negligible lattice mismatch with graphene [3]. It is also worth noting that CVD is a subtle process thus, minor changes in the growth conditions can have a substantial impact on the quality of graphene produced [4]. The challenge is to optimize the growth parameters to facilitate high-quality graphene fabrication appropriate for medical research.

In this work, metal catalysts were annealed at different temperatures ranging from 900 °C to 1050 °C, and their impact on the growth quality was investigated. The importance of the annealing gases nitrogen and hydrogen in distinguishing the growth thickness and kinetics was also assessed. CVD graphene production on Ni and Cu was carried out at various total pressures under the flow of hydrocarbon methane (CH4). The data demonstrate that graphene produced on Cu was continuous and of higher quality at higher temperatures, ranging from monolayers to few layers, as assessed by Raman peaks. In contrast, defects on the graphene surface formed on Ni were present with the bulk of the surface covered by multilayer graphitic structures.

Evaluation of bioactivity and physicochemical properties of Polycaprolactone/ Tricalcium phosphate and Polyurethane/Tricalcium phosphate scaffolds prepared by freeze-drying method

Ms. Yasaman Saghafi
Islamic Azad University of Science & Research Branch of Tehran, Iran

Considering the natural bone composite structure, by designing polymer-ceramic composite materials, an ideal scaffold can be obtained for bone tissue engineering in order to increase mechanical, biological, and physical properties. The purpose of the present study is to investigate the effect of Tricalcium phosphate on the bioactivity of composite scaffolds, Polycaprolactone/ Tricalcium phosphate, and polyurethane/ Tricalcium phosphate and the amount of hydroxyapatite deposition in these scaffolds. In this study, Polyurethane/ Tricalcium phosphate and Polycaprolactone/Tricalcium phosphate scaffolds were prepared for use in bone tissue engineering applications by freeze-drying. The properties of the scaffolds prepared using tests such as scanning electron microscope (SEM) (to evaluate morphology), infrared spectroscopy (FTIR) (to study the chemical structure of the samples, mechanical (pressure) properties, bioactivity and swelling In PBS, to estimate the percentage of water absorption of the samples, to check the degradation rate, the migration rate of osteocyte cells and the biocompatibility of the produced scaffolds have been evaluated.

The images obtained from SEM show that the scaffolds prepared by this method are porous and interconnected. Adding Tricalcium phosphate particles to polyurethane causes regularity in the shape and size of pores with random orientation. Polyurethane/ Tricalcium phosphate scaffold is very flexible while Polycaprolactone/ Tricalcium phosphate scaffold has too much elastomeric state. The biocompatibility study shows that scaffolds do not have a negative effect on cell viability. Also, the bioactivity of the scaffolds prepared by immersion in simulated body solution (SBF) and examining PH changes shows the formation of a hydroxyapatite layer on the surface of the samples. According to the obtained results, the amount of apatite deposition can be seen on the surface of the Polyurethane/Tricalcium phosphate scaffold. Therefore, it seems that freeze-dried Polyurethane/Tricalcium phosphate scaffold containing hydroxyapatite-formed particles could be candidates for biomedical applications.

Algae as a source of biomaterials

Ms. Aleksandra Lawrynowicz
CEO Spiruu, Poland

Arthrospira spp. being photosynthetic bacteria possess a basic level in the food chain, so that is useful in biotechnology as producers of organic compounds that work as food, feed, and medicines also gases such as oxygen, hydrogen, and particles as electrons for energy needs. That is why have also become model organisms in space science, being used as a part of life support systems mainly in long-term missions, allowing breathing, eating, curing, power supplies, and material. As algae can be grown in open ponds, closed bioreactors, or photobioreactors, it is possible to define quality and scale up the production process. Humans can be easy. incorporated in this process in isolated conditions by water, micro/ macro elements, and gasses cycles, as it occurs naturally on Earth. Progress is being made in material science. enhances not only new ways of the algae production process e.g., carbon nanofilters, source of light e.g., graphene bulbs, power supply, and storage, but also more precise laboratory research and quality control methods. Research on algae is mainly focused on the optimization of bioreactor parameters for optimal growth and production of compounds, part of which are medicinal applications, such as cures for human diseases. How broad that range is, shows research being made on different cancer cells, that reveals new details of algal mechanisms responsible for killing that type of cells, so that in the future algae can become a part of medical devices and how to achieve this goal will be discussed in detail.

Biography:

Masters in biotechnology in molecular diagnostics of viruses. Salesman of laboratory equipment at Pol-aura. Researcher in the confocal laboratory at Nencki Institute of Experimental Biology. Salesman of optical microscopes for in vitro and hepatology equipment at Kawaska. Project manager at Pomeranian Science and Technology Park. CEO of Spiruu- bioreactors for algae production. Business development manager at Selvita- biotech and pharmaceutical analysis for drug development. Founder of Astro- bistro with astronaut diet for curing people with a plant-based diet.

Meta-Insulator Transition in Nickel Nanoparticles

Dr. Gunadhor S. Okram
UGC-DAE Consortium for Scientific Research, India

Nanoscale metallic nanoparticles (NPs) are of special interest for exploring their novel electronic and thermal transport properties at the nanoscale. It is because they may have an insulating matrix or surfactant/s as well as collective and correlation-driven effects between the NPs producing novel properties relative to bulk counterparts. The transport properties of NPs depend on the competition of mean energy level spacing, Coulomb charging energy for a single particle, and tunnel energy associated with the inter-particle coupling. We investigated the electrical and thermal transport properties of compacted nickel NPs with crystallite size from 23.1±0.3 to 1.3±0.3 nm. They exhibit an evolution of metal to insulator transition, change in the conduction type from n- to p-type, anomalously large Lorenz number, colossal Seebeck coefficient of 1.87±0.07 mVK−1, and ultralow thermal conductivity of 0.52±0.05 Wm−1K−1 at 300 K as the crystallite size drops. The electrical resistivity analysis reveals a dramatic change in the electronic excitation spectrum indicating the opening of an energy gap, cotunneling, and Coulomb blockade of the charge carriers. Seebeck coefficient shows transport energy degradation of charge carriers as the transport level moves away from the Fermi level with a decrease in crystallite size. The Lorenz number rises to about four orders of magnitude in the metallic regime with the decrease in crystallite size and shows a vivid violation of the Wiedemann–Franz law. Such an observation provides compelling confirmation for unconventional quasiparticle dynamics where the transport of charge and heat is independent of each other. Therefore, these NPs provide an intriguing platform to tune the charge and heat transport, which may be useful for thermoelectrics and heat dissipation in nanocrystal array-based electronics.

Biography:

Dr. G. S. Okram did his Ph.D. at the Indian Institute of Technology, Bombay (1995), India. He worked at some research institutes including the National Institute of Materials Science, Tsukuba, Japan (1996-98) before joining the present institute in 2001. He is now Scientist G and has guided 4 Ph.D., 6 MPhil, 4 M Tech, 54 MSc, and 5 BSc project students, delivered over 89 invited lectures at different national and international conferences, reviewed several journal papers including Nature, published over 155 peer-reviewed journal papers and 116 conference proceeding presentations with 2343 times citations with a main interest in nanoscale materials.

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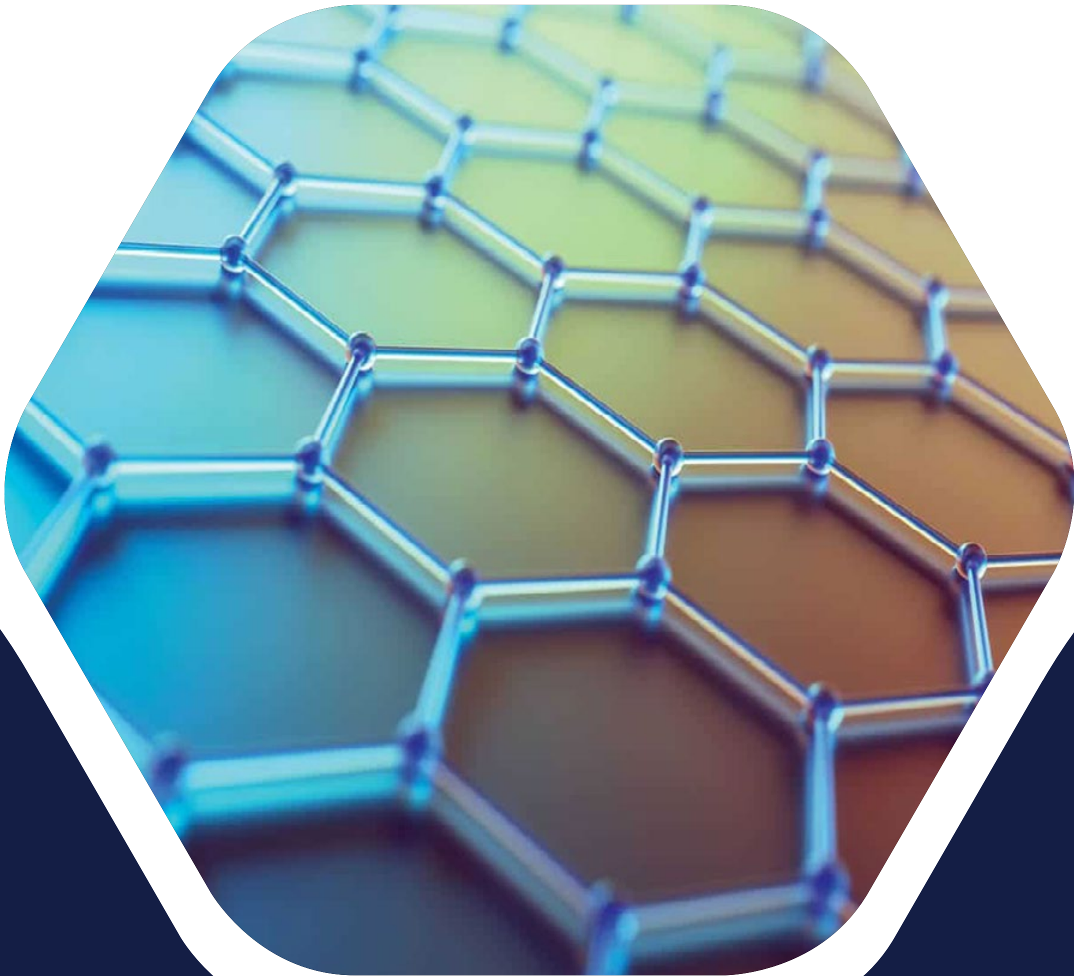

E-Poster

Launch of a pilot line for the production of ecological catalytic systems, taking into account the sustainable recycling of critical raw materials

Mr. Tomasz Debowski
Debowski Tomasz Awg Polonez, Poland

Mr. Marcin Karpinski
Lukasiewicz Research Network – Institute of Non-Ferrous Metals, Poland

Nanoscale metallic nanoparticles (NPs) are of special interest for exploring their novel electronic and thermal transport The subject of the project is the verification on a real scale of the technology for producing a catalytic system of engine exhaust gases with a mass reduction of approx.20%, meeting the Euro IV, V, and VI emission standards using an innovative method of using waste, the so-called „wash coat" from the recovery of precious metals used to make the active layer of the catalyst. The share of recycled precious metals is up to 20%. The intermediate layer consists of a 70% wash coat mainly containing aluminium oxide and up to 20% wash coat with recycled precious metals. The active layer consists of precious metals, i.e., platinum, palladium, and rhodium, in the right ratio and amount per 1 litre of the catalytic block to achieve the specified emission standard. The qualification of rare earth materials as critical allows for a reduction in the use of raw materials to 20% depending on the monolith model. The project integrates activities aimed at economic growth with social activities and contributes to maintaining natural balance. The project focuses on a low-carbon economy and resilience to climate change.

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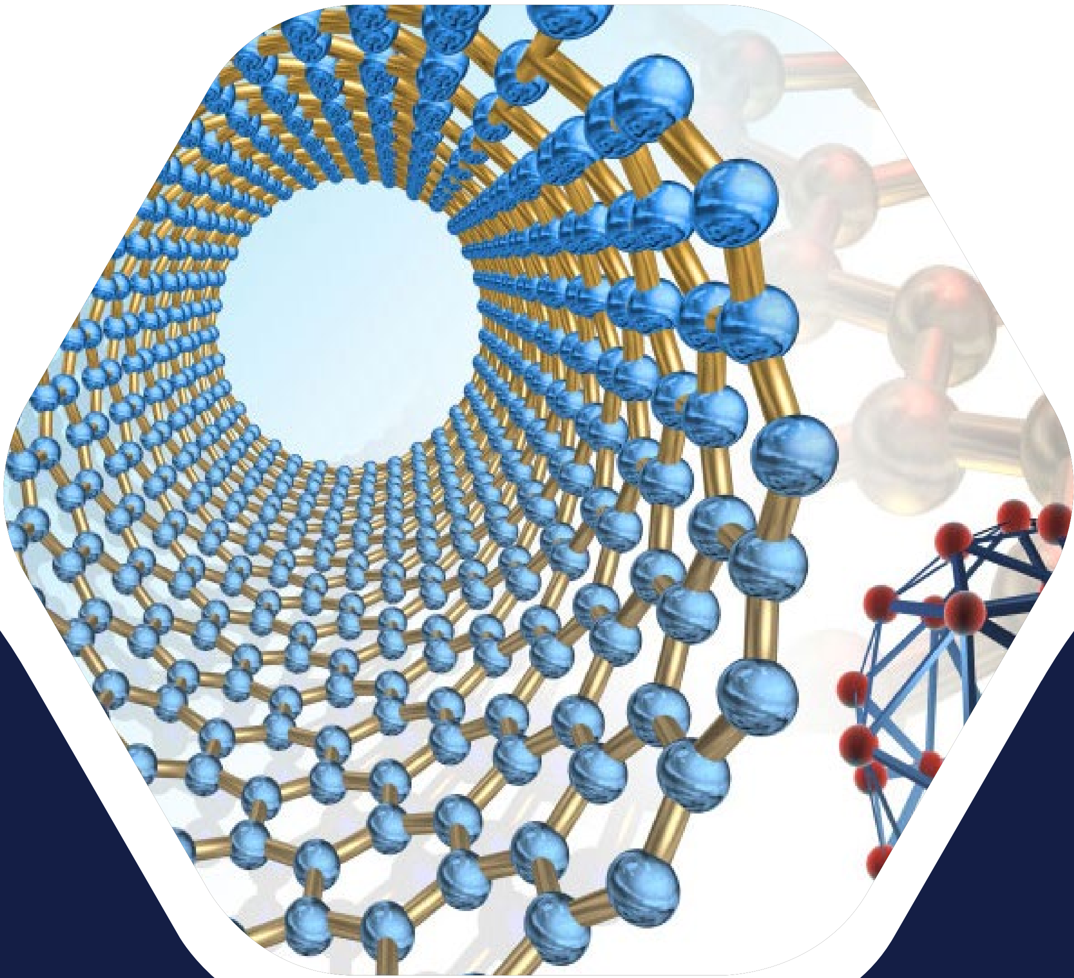

Day 2
Plenary Sessions

Cellular population dynamics shape the route to human pluripotency promoted by a paracrine hgf-met-stat3 axis

Mrs. Onelia Gagliano
University of Padova, Italy

The route to induced pluripotency via human cellular reprogramming is characterized by plastic intermediate stages whose features are still largely unknown. This has long hindered the efficiency of human reprogramming. By taking advantage of a microfluidic approach, we perform reprogramming with high efficiency, thus highlighting an active and pivotal role of a confined microenvironment. To profile the dynamic reciprocity between reprogramming cells and their microenvironment, we profile the time course of secretome and single-cell transcriptome. This reveals the functional role of extrinsic pathways across subpopulations emerging along reprogramming trajectories. This protein communication dynamically shapes a permissive extracellular environment resembling primitive node formation during embryo development. Among other factors, we pinpoint the HGF/MET/STAT3 axis as a potent enhancer of reprogramming, which acts via HGF accumulation within the confined system of microfluidics, and in conventional dishes needs to be supplied exogenously to enhance efficiency. Our data integrate the notion of human cellular reprogramming as a transcription factor-driven process with the concept that it is deeply dependent on extracellular context and cell population determinants.

Impact of Defects and Work Function of Electrode in Solar Cell Devices

Dr. Piyush K. Patel
Maulana Azad National Institute of Technology, India

To provide experimental guidance, a theoretical study was performed on transparent conduction oxide (FTO)/ZnO/interface defect layer 1/CH3NH3SnI3/interface defect layer 2/Cu2O/ back contact solar cell. The simulation was performed under the illumination of 1000 W/m2, at 300 K, and an air mass of AM 1.5G. The diffusion lengths of the electron and hole were set to 260 nm and 560 nm in the absorber layer, respectively. The set value is very near to recently observed experimental results. The device performance is severely influenced by the thickness of the absorber layer, acceptor density, defect density, and work function of various back contact electrode materials. The role of oxidation of Sn-based perovskite and its effect on band offset was emphasized at Cu2O/CH3NH3SnI3 and CH3NH3SnI3/ZnO interfaces. The PCE has been enhanced to 23.23% by optimizing the defect density in the absorber layer. Further, various back contact electrodes such as Al, Ag, Cu, Au, and Pt were investigated. Finally, the optimized photovoltaic parameters of the intended solar cell are found to be a Jsc of 38.56 mA/cm2, Voc of 1.18 V, FF of 66.22%, and PCE of 28.47%. This theoretical simulation provides an appropriate direction for devolving photovoltaic technology.

Biography:

Piyush K. Patel is currently working at Maulana Azad National Institute of Technology Bhopal, India as an Assistant Professor in the Department of Physics. He has done Ph.D. from I.I.T. Roorkee, India. In his academic carrier, he has published more than 25 research papers in reputed Journals. He is the conqueror of the Materials Today Cover Competition, 2016. He was granted the best research paper award in NCAP-2012, I.I.T. Roorkee, and iCAM 2022. His major research interests are Photovoltaic Solar Cell Devices, Functional Nanomaterials, Dielectric, Polymer, and Quantum dots. His recent research interest is focused on designing and development of photovoltaic devices.

Identification of better chelating agent and grain-size dependent physical properties of yttrium orthoferrite derived from the soft-chemical route

Dr. Rajasekhar Bhimireddi
Sri Sathya Sai Institute of Higher Learning, India

The physical properties of any material are significantly influenced by the synthesis route, and especially in the soft chemical route it mainly depends on the chelating agents used in the synthesis process. To identify the better chelating agent, YFeO3 (YFO) nanomaterials were prepared using different organic complex or chelating agents, such as citric acid, tartaric acid, oxalic acid, and sucrose via the sol-gel technique. Using a better chelating agent, the different crystallite sizes (ranging from 0.4 to 2.11 μm) of YFeO3 (YFO) was fabricated by changing the sintering temperatures (in the range of 1173 K to 1623 K). The synthesized samples were analyzed using different characterization techniques, such as thermos-gravimetric analysis (TGA), X-ray powder diffraction (XRD), scanning electron microscopy (SEM), Raman spectroscopy, UV-VIS spectroscopy, and vibrating sample magnetometer (VSM).

Adsorptive-removal of Cr3+ using Fe-Zr binary oxide nanoparticles from aqueous solution

Dr. Rajesh Kumar
Department of Chemistry, S.S.J. University, India

The adsorption of Cr3+ from aqueous solutions is a significant issue because it has a number of negative impacts on human health and the environment. The purpose of this study was to investigate the possible application of Fe-Zr binary oxide nanoparticles as adsorbents for the removal of Cr3+ from aqueous solutions. XRD pattern, TGA, FT-IR spectroscopy, BET surface area analysis, TEM, SEM-EDX, and Zeta potential measurement were used to evaluate the synthesized nanoparticles. In brief, solutions of FeCl3.6H2O and ZrOCl2.8H2O were mixed and heated to approximately 60°C. A solution of NaOH was gradually added to this hot mixture while stirring continuously until the pH reached 10. The precipitate that formed was filtered, washed, dried, and crushed into minute particles. The batch adsorption method was utilized to adsorb Cr3+ on synthesized nanoparticles, and the Cr3+ concentration after adsorption was measured by Atomic Absorption Spectroscopy. The adsorption data were discovered to follow the Langmuir adsorption isotherm more successfully than the Freundlich and Temkin isotherms. This study shows that synthesized nanoparticles can be used as an effective adsorbent for the removal of Cr3+ from aqueous solutions. It is a low-cost and environmentally benign method of reducing toxic heavy metal ions and using it as an adsorbent.

Biography:

I received a Ph.D. degree in Chemistry from Kumaun University, Nainital in 2021, an M.Sc. (Chemistry), and a B.Sc. degree from the same University with first division. I have a Qualified CSIR-NET, GATE, and U-SET exam in Chemistry. I have received several awards, such as Young Scientist Award-2022, Young Scientist Award-2019, and the Best Abstract Award-2017. I have received JRF and SRF- fellowship from UGC-New Delhi. I have published 14 research papers in reputed international journals and one book chapter. I have also been called an invited speaker in many conferences and I also worked as a member of the organizing committee in many conferences. I have presented 20 research papers in conferences and involved as a participant in 22 seminars. I currently serve as an Editorial Board Member of 5 journals, including the AJAC (ISSN: 2330-8753), IJCS (ISSN: 2250-1770), OJC (ISSN: 2770-1913), IJERT (ISSN: 2278-0181), and ASTESJ (ISSN: 2415-6698). I am a lifetime member of various scientific professional bodies, such as ISCA-Kolkata, ISCA-Haridwar Chapter, TERA, and STRA. My research interest is in the synthesis of binary mixed oxide nanoparticles, such as, iron-zirconium mixed oxides, metal-doped cerium oxide, metalhexacyanocobaltate, and metal-hexacyanoferrate using the co-precipitation method and shows their application as an adsorbent, catalyst, and photocatalyst. M. Sc. students have completed their dissertations under my guidance. At present, I am working as an Assistant Professor in the Department of Chemistry at S.S.J.University, Campus Almora. Currently, I am working on the green method for the preparation of nanomaterials and Graphene including its environmental applications.

Exploring the potential to enhance the performance of Graphene as a Hydrogen Gas Sensor using Transition Metals

Dr. Deepa Sharma
Department of Higher Education, India

Graphene is known to have good hydrogen gas sensing capability and a lot of research is going on to improve its sensitivity as a Hydrogen gas sensor. Novel modified derivatives of Graphene are being tried and tested to make its sensing capabilities more and more effective. Doping with N or Si or Sb has been confirmed to improve the sensing performance of graphene. We propose doping graphene with transition metals of comparable size to enhance its hydrogen sensing properties. We investigated the sensitivity of pristine graphene, Pt-doped graphene; Cu-doped graphene, and Pt-Cu co-doped graphene surface towards hydrogen molecule adsorption using density functional theory (DFT) by ab initio method. The adsorption energies for the optimized geometries were calculated to probe the suitability and effectiveness of the modified graphene structures for Hydrogen sensing. In addition, the electronic properties for instance charge transfer analysis, band gap, and density of states were also taken into consideration. The results reveal that doping with transition metals Cu & Pt undoubtedly enhances the adsorption of hydrogen on the simulated surface of graphene, Cu being more effective as compared to Pt. Further, it was observed that the simultaneous doping of Cu, as well as Pt, increases the hydrogen sensing capability of graphene even more effectively.

Biography:

Dr. Deepa Sharma is a theoretical physicist with expertise in computational nanophysics. Her research work is focused on the simulation and modeling of carbon nanomaterials and the calculation of their electronic, spectroscopic, and optical properties based on the Density Functional Theory and Tight Binding Model. Her recent theoretical prediction of the possibility of proximity-induced superconductivity in single-walled carbon nanotubes has proven to be path-breaking, paving a novel research pathway for the experimentalists to explore. She is further exploring the potential to expand her work on the suitability and improvisation of different carbon nanomaterials as gas sensors and the use of machine learning methods to exploit spectroscopic data to deliver novel information on carbon nanomaterials. She is serving as an assistant professor of Physics in the Department of Higher Education, Government of Haryana (India) and is currently posted at the Department of Physics, Shaheed Udham Singh Government College, Matak-Majri (Haryana) India.

Metal-Decorated Silicon Carbide Nanotubes for Hydrogen storage

Dr. Ram Sevak Singh
OP Jindal University, India

Hydrogen is a pollution-free source of energy that can be used in various applications, such as portable power for transportation, aircraft, vehicles, etc. Therefore, extensive research to find suitable materials for hydrogen storage is ongoing. Silicon carbide nanotubes are predicted to have great potential for hydrogen storage. Unlike carbon nanotubes, silicon carbide nanotubes have heteronuclear and large band lengths which facilitate the adsorption of hydrogen molecules. In this talk, I shall present my study on hydrogen adsorption properties of metal (Pt, Ni, and Al) decorated SiCNTs using density functional theory. The calculated density of states, energy band structures, adsorption energy, and charge transfer will be discussed in detail.

Biography:

Dr. Ram Sevak Singh is currently working as an associate professor in the Department of Physics, OP Jindal University, Raigarh, Chhattisgarh, India. He received his Ph.D. in physics from the National University of Singapore, M.Tech. in materials science and engineering from IIT Kharagpur, and MSc in physics from Banaras Hindu University. He also served as an assistant professor in Physics Department, at NIT Kurukshetra, India, and as a post-doctoral research fellow in the Centre for Nano and Soft Matter Sciences, Bangalore, India, Nanyang Technological University, Singapore, and the National University of Singapore. He has also received the prestigious NUS Research Scholarship, Singapore, and IETE-CEOT (94) Award (Biennial)-2014, India. He is a member of the American Chemical Society, the Materials Research Society of India, and the Graphene Council. Dr. Singh has several years of research and teaching experience in the areas of physics, materials science, and nanotechnology and has published many research articles in journals of international repute, including ACS Nano, Nano Letters, Carbon, Renewable Energy, and Applied Physics Letters. He has also published books and book chapters with referred publishers CRC Press-Taylor & Francis Group, Wiley, and Elsevier. He is also a reviewer of several reputed international journals. His areas of interest include materials physics; nanomaterials including nanotubes, graphene, and other two-dimensional materials; optoelectronic devices; and materials for sensors, corrosion protection, energy conversion, and storage.

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Accepted Abstracts

3D Manufacturing of Metal Matrix Composites

Dr. Jian Liu

PolarOnyx, USA

A review of laser 3D manufacturing of a variety of metal matrix composites will be discussed. Material selection along with process parameters include laser power, scan speed, hatching space, layer thickness, and patterning strategy have been investigated. Mechanical and thermal properties have been investigated towards excellent mechanical and thermal properties. A new frontier of structured components will also be included in the presentation to achieve light weight low CTE opto-mechanic components.

Preparation and characterization of ZrO_2-Y_2O_3-Al_2O_3 coatings for steels used in CSP applications

Dr. Justo García Sanz-Calcedo

University of Extremadura, Spain

In recent years, the use of molten salts as heat transfer fluid in concentrated solar power (CSP) has been implemented, which allows operating at higher temperatures, generating larger enthalpy jumps and improving its competitiveness. The aim of this work is to show the preparation and characterization procedure of ZrO_2-Y_2O_3-Al_2O_3 coatings applicable to CSP technologies. For this purpose, we have experimented with different proportions of its components, combining the sol-gel methodology and the dip-coating technique to obtain the coatings on AISI-316L steel substrates. In addition, spectrophotometry and micro-indentation techniques have been used for the optical characterization and determination of the optical properties of the coatings. The results show that the presence of Al_2O_3 hinders the formation of the cubic phase of the zirconia, and the tetragonal phase appears with high Al_2O_3 contents. It was also observed that the thickness decreases, and the porosity of the coatings increases, the Young's modulus and the hardness of the deposited layers decrease slightly, although their behavior under thermal shock increases notably. These results have important implications for the performance of the protective coatings, in terms of their optical properties and their power to capture solar energy, as well as their mechanical resistance.

Improved Interfacial Charge Transfer on Noble Metal-Free Biomimetic CdS-Based Tertiary Heterostructure @ 2DMoS2-CdS-Cu2O with Enhanced Photocatalytic Water Splitting

Dr. Sudeshna Das Chakraborty

CSIR-National Metallurgical Laboratory, India

High charge separation efficiency with a wide optical absorption window is the prime requirement for the scale up of a stable solar photocatalytic hydrogen generation process. A new noble metal-free heterostructure of 2D MoS2-CdS-Cu2O is designed by depositing cauliflower-shaped CdS and nano-sized Cu2O on exfoliated 2D MoS2. Characterization by XPS, high-resolution transmission electron microscopy (HRTEM), and UV-visible spectra confirms the formation of nanosized Cu2O with desired interface formation with MoS2 sheet and CdS thus extending the optical absorption range up to 900 nm. Water splitting activity in the presence of lactic acid is found to be 7.89 and 11.53 mmol g−1 h−1 on MoS2-CdS and MoS2-CdS-Cu2O, respectively, with good repeatability under visible light. Efficient interfacial charge separation is manifested from demised photoluminescence (PL) intensity which supports the suppression of hole-electron recombination in the tertiary heterostructure. In addition, the formation of dual p-n junction as indicated from Mott–Schottky analysis further strengthen the faster electron and holes separation objective. Compared to the pure CdS, hydrogen efficiency is 20.96 times higher on a noble metal-free tertiary catalyst with an apparent quantum efficiency of 8.75%. Hopefully, the 2D material-based architecture of dual p-n junction with desired interface engineering will facilitate the catalyst design with increased water splitting activity under solar/visible light.

Biography:

Dr Sudeshna Das Chakraborty has experties in synthesis of nanomaterials for functional applications. She has worked in the field of 2D materials, metallic nano materials and magnetic materials synthesis and application. She has developed many hetero-structured materials of 2D@magnetic/plasmonic for energy application. The present work is selected as hot topics by Willey. She has worked on biomimetic materials development too. Her developed, nature inspired materials are showing promising potential towards green energy generation both photochemically and electrochemically.

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