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11TH EDITION OF

WORLD NANOTECHNOLOGY CONFERENCE

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9TH EDITION OF

INTERNATIONAL CONFERENCE ON

MATERIALS SCIENCE AND ENGINEERING

HYBRID EVENT

23-25

MARCH 2026

IN-PERSON:

Village Hotel Changi

1 Netheravon Rd,

Singapore 508502

VIRTUAL:

Greenwich Mean Time (GMT)

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Keynote Speakers

Deepa Sharma
DHE, Govt. of Haryana, India

Harry Ruda
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M.G.H.Zaidi
G.B.Pant University of Agriculture & Technology, India

Nasimuddin
Institute for Infocomm Research, A*STAR, Singapore

Keynote Speakers

Paulo Cesar De Morais
Catholic University of Brasilia, Brazil

Raman Singh
Monash University, Australia

Ramdas Sawleram Damse
Retired Scientist, HEMRL, India

S.V.A.R.Sastry
Harcourt Butler Technical University, India

Thomas J. Webster
Hebei University of Technology, China

Welcome Message

Dr. M.G.H.Zaidi Professor

G.B.Pant University of Agriculture & Technology

India

Dear esteemed Speakers, Colleagues and Participants

I am extremely delighted to invite the prospective researchers, academia, engineers, technocrats, industrialists, entrepreneurs and stake holders to join and celebrate their scientific excellence at the 9th Edition of International Conference on Materials Science and Engineering (Materials-2026). The conference Materials -2026 is organized by prestigious Magnus Group LLC, at Hotel Village Changi, Singapore and will schedule in hybrid mode from March 23 to 25, 2026 in the pleasant environment at Hotel Village Changi, 1 Netheravon Rd, Singapore.

Materials-2026 aims to foster the insightful scientific and technological interactions and collaborations among the participants from academia and industry though organizing a broad array of the sessions leading to development, applications and future trends in the key areas of emerging materials including: energy, automotives, aerospace, optics, electronics, agriculture, defense and security, artificial intelligence, biomedical technologies, coatings, mining and metallurgy and many more. The areas covered in materials-2026 represent not only the diversity of material research but also its profound impact on society and industry. The theme of Materials-2026 is precisely centered on scientific and industrial research across a wide range of materials science and technology in the dynamically developing world. I trust that, the conference will serve as an appropriate forum for attendees to discuss the technical issues and lay the groundwork for furthering innovative research and developments in the field of material science and technology.

As a member of the organizing committee, I firmly believe that the presentations and panel discussions among the distinguished researchers, scientists, engineers during the various sessions at Materials-2026 will strengthen attendees' knowledge in resolving the crucial difficulties faced by academia and industry in the development of advanced materials.

I extend my warm congratulations to prestigious Magnus Group LLC, Chicago, USA and their brilliant team for organizing the Materials 2026 at Singapore. I'm confident that Materials-2026 will result in successful career outcomes and significant success to professional endeavors of society and industry.

Welcome Message

Prof. Dr. Paulo Cesar De Morais

Catholic University of Brasilia, Brazil

Dear congress visitors, it is an honor and pleasure to write a few welcome notes. Materials Science today takes the central stage in technology and innovation, fostered in the last three decades by the emergence of Nanoscience. This huge avenue represented by Materials has opened up new directions while driving technology and innovation, heavily impacting higher productivity in fields as diverse as storage technologies, biomedicine, 3D printing, environmental, agriculture, and surface engineering and coatings, to mention a few. MATERIALS 2026 will be a three-day conference, gathering together key players of the Materials and Nanomaterials Community. This event aims to attract global community intent on sharing, exchanging and exploring new avenues of Materials Science. Moreover, the conference offers a valuable opportunity to establish new contacts in the covered topics, by providing valuable networking time for you to meet experts in the field.

Welcome Message

Dr Ramdas Damse

Retired Scientist, HEMRL, India

It is an honor and great pleasure to write a few welcome notes for the 9th edition of International Conference on Material Science and Engineering.

Defense and security technologies rely heavily on advanced materials and innovative technologies to enhance capabilities and ensure protection. Key areas include material science for stronger and lighter protective gear like composites and ceramics. Similarly, high energy materials (HEMs) are playing crucial role in both military and civilian applications. The ongoing research is focused on developing new HEMs with enhanced performance and safety. Hence the current trends include the development of insensitive munitions, green energetic materials, thermally stable explosives and nano materials for HEM applications. Consequently, the present conference theme "Advancing material science: Innovations for a changing world "has been found to be quite meaningful and relevant to the present state of arts in the development of high energy materials. There also push towards understanding and improving the reaction rates and mechanisms of HEMs.

High energy materials are at the heart of advancements in various sectors from energy storage and propulsion to national security and aerospace. This conference provides a unique platform for experts, scientists and engineers from around the globe to share their latest findings, exchange ideas, and foster collaborations that will drive future breakthroughs.

We are confident that the diverse range of presentations, workshops and networking opportunities will inspire new perspectives and spark meaningful collaborations. We express our sincere gratitude to the organizing committee, the speakers who are going to share their expertise and each and every one of you for your participation. Your presence here is invaluable in shaping the future of high energy materials research.

We hope you find this conference intellectually stimulating and personally rewarding and that it serves as a catalyst for innovation and progress in this vital field.

About
Magnus Group

About

Magnus Group, a distinguished scientific event organizer, has been at the forefront of fostering knowledge exchange and collaboration since its inception in 2015. With a steadfast commitment to the ethos of Share, receive, grow, Magnus Group has successfully organized over 200 conferences spanning diverse fields, including Healthcare, Medical, Pharmaceutics, Chemistry, Nursing, Agriculture, and Plant Sciences.

The core philosophy of Magnus Group revolves around creating dynamic platforms that facilitate the exchange of cutting-edge research, insights, and innovations within the global scientific community. By bringing together experts, scholars, and professionals from various disciplines, Magnus Group cultivates an environment conducive to intellectual discourse, networking, and interdisciplinary collaboration.

Magnus Group's unwavering dedication to organizing impactful scientific events has positioned it as a key player in the global scientific community. By adhering to the motto of Share, receive, grow, Magnus Group continues to contribute significantly to the advancement of knowledge and the development of innovative solutions in various scientific domains.

About
About CPD Accreditation

Continuing Professional Development (CPD) credits are valuable for Materials & World Nano 2026 attendees as they provide recognition and validation of their ongoing learning and professional development. The number of CPD credits that can be earned is typically based on the number of sessions attended. All the participants have an opportunity to avail 1 CPD credit for each hour of Attendance.

Some benefits of CPD credits include:

Career advancement: CPD credits demonstrate a commitment to ongoing learning and professional development, which can enhance one's reputation and increase chances of career advancement.

Maintenance of professional credentials: Many professions require a minimum number of CPD credits to maintain their certification or license.

Increased knowledge: Attending Materials & World Nano 2026 and earning CPD credits can help attendees stay current with the latest developments and advancements in their field.

Networking opportunities: This Conference provide opportunities for attendees to network with peers and experts, expanding their professional network and building relationships with potential collaborators.

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KEYNOTE PRESENTATIONS

Dr. Deepa Sharma[1,2]

[1]Department of Higher Education, Government of Haryana, India

[2]SUS Government College, Matak-Majri, Haryana, India

Biography: Dr. Deepa Sharma is a theoretical physicist renowned for her expertise in computational nanophysics and simulation-driven materials research. Her work focuses on the modelling of carbon nanomaterials and the prediction of their electronic, spectroscopic, and optical properties using Density Functional Theory and the Tight-Binding framework. A major highlight of her research is the theoretical prediction of proximity-induced superconductivity in single-walled carbon nanotubes, a path-breaking contribution that has opened new avenues for experimental exploration. Dr. Sharma currently serves as an Associate Professor of Physics in the Department of Higher Education, Government of Haryana (India), and is posted at the Department of Physics, Shaheed Udham Singh Government College, Matak-Majri, Haryana.

From electrons to engineering: How DFT-based simulations are transforming materials design

Density Functional Theory (DFT)–based simulations have fundamentally reshaped the way materials are designed, understood, and optimized, enabling a direct connection between electronic-scale phenomena and engineering-scale performance. This keynote summarizes how first-principles simulations have evolved from being primarily explanatory tools to becoming predictive engines that guide materials innovation. By providing quantitative insight into electronic structure, bonding, and energetics, DFT has enabled reliable prediction of structural stability and functional properties such as electronic transport, magnetism, optical response, and dielectric behaviour across diverse classes of materials.

The impact of this transformation is evident in functional systems including oxides, ferrites, semiconductors, and energy-related materials, where DFT-guided design has reduced experimental trial-and-error and accelerated the identification of high-performance compositions. Atomic-scale understanding of defects, interfaces, and dopant effects has translated into improved control over macroscopic properties relevant to electronics, microwave devices, spintronics, and energy applications. In this context, simulations act as a unifying framework that integrates theory, computation, and experiment, allowing materials development to proceed with greater efficiency and confidence.

Beyond individual case studies, the summary highlights the broader shift toward simulation-driven materials engineering, where DFT forms the backbone of high-throughput screening, digital materials databases, and emerging data-centric methodologies. The convergence of DFT with machine learning and automated workflows is enabling rapid exploration of vast compositional and structural spaces, marking a transition toward predictive and sustainable materials design. While challenges related to computational cost, accuracy, and experimental validation remain, the overall trajectory clearly demonstrates that DFT-based simulations now play a central role in translating fundamental electronic insights into practical engineering solutions, redefining the paradigm of modern materials science.

Harry Ruda*, David Lynall, David Gutstein, Selva Nair, Kris Burne, Alex Shik, Igor Savelyev, Marina Blumin, Jacky Lau, Carlos Fernandes, Christina de Souza

Centre for Advanced Nanotechnology, University of Toronto, Canada

Biography: Harry Ruda obtained his BSc from Imperial College in 1979 and PhD from MIT in 1982 for work on optical and transport properties of II-VI based infrared detector materials. As an IBM postdoctoral fellow, he developed one of the first theories for electron transport in selectively doped 2DEG heterostructures. He joined the University of Toronto in 1989 and currently is a full professor, Stanley Meek Chair in Nanotechnology and Director of the Centre for Nanotechnology. He has about 300 journal publications with about 8,800 citations and h-index of 46. He serves on the editorial boards of numerous journals and is a Fellow of the Royal Society of Canada, Fellow of Institute of Physics, Fellow of the Institute of Nanotechnology, Fellow of the Institution of Engineering and Technology, and Fellow of the Canadian Academy of Engineering.

Harnessing the unique properties of engineered nanostructures for sensing

In 1964 Wagner and Ellis presented the first paper on fabrication of micron-scale semiconductor whiskers. Our group was one of the first to apply their ideas in the late 1990's to realise nanowires with diameters of tens of nanometers. We show how strong dielectric confinement, coupled with weak screening in structures of these dimensions presents a unique opportunity for realizing field effect transistor chemical sensors. In particular, we focus on InAs nanowires having exceptional transport properties combined with a nature surface accumulation layer which we show can mediate sensing. Indeed, we showed how electrometry can be performed with such devices to sense charge to levels as low as tens of micro-electron charges per root hertz bandwidth. With such a response, the transduction of adsorption events into electrical signals is shown to permit single molecule level sensing.

Khavkin A.Ya

Department of Subsoil Use and Oil and Gas Engineering of the Peoples' Friendship University of Russia (RUDN), Moscow, Russia

Biography: Alexander Khavkin graduated from the Gubkin Russian University of Oil and Gas in 1975 with a qualification as a Specialist. In 1983, he earned a PhD in Engineering. He received his Doctor of Engineering degree in 1987. He is a Professor at RUDN University. He was awarded the UNESCO Medal for Contributions to the Development of Nanoscience and Nanotechnology in 2010. Participant of international conferences in Australia, England, Brazil, Hungary, Guyana, Denmark, Egypt, Spain, China, Norway, Russia, Romania, Singapore, France, Japan. Published more than 650 scientific articles. First Vice-President of the Russian Nanotechnology Society since 2025.

Carbon nanotechnology in nature

The role of carbon in nanoscale processes of human, animal, and industrial energy activity is considered. Carbon nanoenergy is a branch of energy that uses carbon-based or carbon-related nanotechnology, including the use of carbon materials, coal mining and the ecology of this process, the use of coalbed methane as an energy resource, the extraction and transport of methane hydrate (methane hydrate), oil and gas production and the transport of hydrocarbons. The main areas of sustainable (including green) development in Russia include waste management, energy, construction, industry, transport and industrial equipment, water supply and sanitation, natural landscapes, rivers, reservoirs and biodiversity, agriculture, and sustainable infrastructure.

Human energy is the force that makes elementary particles, organs, and systems in our body interact with each other, and it is what collects and holds the elementary parts together. Human energy is the force that creates everything in our world, including buildings, vehicles, agricultural farms, and television devices. Therefore, energy for sustainable development also includes the provision of energy for the human body.

Carbon is a nanosized bioelement, a structural unit of all organic compounds involved in the construction of organisms and ensuring their vital activity – proteins, carbohydrates, lipids,

nucleic acids, vitamins, hormones. All living things that make up the biosphere are built from carbon compounds.

Carbon-Containing Compounds are Carriers of Life: Proteins, fats, carbohydrates, nucleic acids, vitamins, etc. Carbon is necessary for metabolic processes. During the life activity of organisms, there is an oxidative breakdown of organic compounds with the release of carbon dioxide CO_2 into the external environment. This gas, in solid compounds, dissolved in biological fluids and natural waters, participates in maintaining the optimal acidity of the environment for life: CO–carbon monoxide (II), carbon monoxide gas; H_2CO_3–carbonic acid; $CaCO_3$–calcium carbonate; $C_6H_{12}O_6$–glucose; the equation for photosynthesis: $6{\cdot}CO_2 + 6{\cdot}H_2O \text{ ––> } C_6H_{12}O_6 + 6{\cdot}O_2$.

It turns out that carbon is the most important element of life and energy production for all biodiversity. As noted in the Sustainable Development Strategy, energy is one of the most important conditions for sustainable development. Since all energy processes in biodiversity occur at the molecular level, they can be classified as nano-scale processes, which means that they are carbon-based nano-energy manifestations of the life of all biodiversity. Carbon nanotechnology plays a huge role in industrial energy.

M. G. H. Zaidi

Professor Department of Chemistry, College of Basic Sciences and Humanities and Chief Executive Officer, Intellectual Property Management Centre, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India -263145

Biography: Dr. M.G.H. Zaidi is a full professor in the Department of Chemistry, and C.E.O of the Intellectual Property Management Centre, Govind Ballabh Pant University of Agriculture & Technology, Pantnagar, UK, India. Professor Zaidi has made pioneering contributions to the field of polymer science and technology, which have received immense acclaim among peers across the world. His widely cited research work covers supercritical processing of polymer materials applicable to structural engineering, electronics, agriculture, biomedical sciences, energy conservation, and storage. Professor Zaidi has mentored over 70 master's and doctorate of science and engineering. He has around 200 publications to his name and several patents.

Clean and dry processing of polymer materials in supercritical fluids

Organic solvent-based polymer manufacturing enterprises are currently suffering from several challenges concerning economic burden, safety dangers, and employee health hazards. International environmental advocacy organizations have been urging the polymer manufacturers to adopt the clean and dry manufacturing practices for effective reduction in pollution caused by toxic emissions from industries. This has been in attempt to mitigate the adverse effects resulting from hazardous organic solvents and certain greenhouse gases linked to conventional polymer manufacturing processes. The current lecture focuses on applications of Supercritical Fluids (SCFs) as an inexpensive and environmentally benign alternative to traditional organic solvents employed in production of polymer materials. SCFs refer to the state of matter that exists above the critical point of fluids, where the boundaries between the liquid and gas phases no longer exist. The distinctive environmentally friendly characteristics, combined with gas-like diffusivity and pressure tunable solvation properties, enable SCFs to function as an environmentally benign media for development of a broad range of polymer processes. The lecture will emphasise the success of SCFs in delivering the clean and dry method of production of polymer composites, blends, biocomposites, nanocomposites, functional nanostructures, sustained delivery systems, dyed polymer products and bioenergy. The economic aspects, market potential, and entrepreneurial opportunities related to SCF-mediated polymer processes will be discussed.

Nasimuddin

Institute for Infocomm Research, A*STAR, Singapore

Biography: Dr. Nasimuddin received his M.Tech. and Ph.D. degrees from the University of Delhi. He was a SRF at University of Delhi (1999-2003) and subsequently held the position of ARC Fellow at Macquarie University (2004-2006). He is currently a Principal Scientist at the I2R, A*STAR, Singapore. He is a prolific contributor to the field, with over 260 research publications, 3 edited books, 4 granted and 3 filed patents. His outstanding work has earned him recognition as one of the top 2% of scientists worldwide in 2023, 2024, and 2025. He is a Senior Member of the IEEE and its APS/MTTS, as well as a Life Fellow of WAMS Society. His accolades include the URSI Young Scientist Award (2005) and multiple IEEE AP-T/AWPL Exceptional Performance Reviewer Awards. He serves as an Associate Editor for the IEEE OJAP, Editor-in-Chief of WCL. He served as Chair of IEEE Singapore MTT/AP-Joint Chapter (2021-2022).

Role of tunable materials in next-generation reconfigurable antenna design

Tunable materials are crucial to the realization of reconfigurable antennas for microwave, millimeter-Wave (mmWave), and Terahertz (THz) applications. By enabling controllable modulation of dielectric permittivity, magnetic permeability, and electrical conductivity through external stimuli—such as applied voltage, electric fields, optical excitation, or temperature; materials including liquid crystals, ferrites, VO_2, graphene, and phase-change materials facilitate a broad range of reconfigurable RF components. These components, encompassing antennas, phase shifters, resonators, filters, and RF switches, underpin critical functionalities such as RF signal filtering, beamforming, and beam steering in advanced wireless systems.

Among these candidates, Liquid Crystals (LCs) have emerged as a particularly attractive platform owing to their continuous, bias-controlled tunability, low insertion loss, minimal dispersion, and compatibility with low-cost fabrication processes. This presentation offers a comprehensive overview of tunable material technologies, with an emphasis on liquid crystals-based reconfigurable antennas, including their electromagnetic characterization. An LC-based reconfigurable microstrip antenna is then introduced, demonstrating electronic switching between linear polarization and dual-sense circular polarization. The proposed design employs a square patch antenna incorporating strategically placed LC regions and

parasitic biasing patches to achieve polarization agility. Finally, recent progress in tunable-material-enabled antenna systems; including leaky-wave antennas, phased arrays, and circularly polarized beam-steering architectures; Is reviewed, highlighting frequency agility, dynamic beam steering, and the potential for energy-efficient, adaptive next-generation wireless communication systems.

Paulo Cesar De Morais[1,2]

[1]Genomic Sciences and Biotechnology, Catholic University of Brasilia, Brasilia, DF, Brazil

[2]Institute of Physics, University of Brasilia, Brasilia, DF, Brazil

Biography: Paulo C. DE MORAIS (H-62), PhD, was full Professor of Physics at the University of Brasilia (UnB)–Brazil up to 2013, Appointed as UnB's Emeritus Professor (2014), Appointed as Guest Professor of Huazhong University of Science and Technology–China (2011), Visiting Professor at Huazhong University of Science and Technology (HUST)–China (2012-2015), Appointed as Distinguished Professor at Anhui University (AHU)–China (2016-2019), Appointed as Full Professor at Catholic University of Brasília (UCB)–Brazil (2018), Appointed as CNPq-1A Research Fellowship since 2010. 2007 Master Research Prize from UnB, 2008-member of the European ERA NET Nanoscience Committee, Member of the IEEE-Magnetic Society Technical Committee, Senior Member of the IEEE Society, 2012 China's 1000 Foreign Expert Recipient, and 2012 Academic Excellence Award from Brazilian Professor's Union. He held two-years (1987-1988) post-doc position with Bell Communications Research–New Jersey, USA and received his Doctoral degree in Solid State Physics (1986) from the Federal University of Minas Gerais–Brazil. He graduated in both Chemistry (1976) and Physics (1977) at UnB. Professor Morais is member of the Brazilian Physical Society and the Institute of Electrical and Electronics Engineers – IEEE. Paulo C. DE MORAIS has served as referee for more than 50 technical journals, takes part of the Editorial Board of more than 15 technical journals and has conducted research on nanomaterials for over 40 years. He is known for his research in preparation, characterization and applications of nanosized materials (magnetic fluid, magnetoliposome, magnetic nanoemulsion, magnetic nanocapsule, magnetic nanofilm, magnetic nanocomposite, nanosized semiconductors, polymeric dots, carbon dots, and graphene quantum dots). With more than 500 published papers in peer reviewed journals, more than 14,500 citations, about 300 international invited talks (35 countries), and 16 filed patents. He has appeared in recent World ranking of top scientists, such as 2020-Stanford, 2022-Research.com, 2023-AD Scientific Index, 2023-Research.com, 2024-Elsevier, ONE Research Community, 2025-AD Scientific Index, 2025-Research.com, and 2025-Stanford-Elsevier.

Prospective study of copper sulfide nanofilms

This keynote talk will be devoted to describe hexagonal Cu_2S p-type semiconductor thin film fabrication using DC magnetron sputtering. Nanofilms with thickness gradient were successfully deposited by taking advantage of the deposition geometry and target dimensions. X-Ray Diffraction (XRD) analysis confirmed the exclusive formation of the hexagonal Cu_2S phase. Elemental composition and thickness dependence with sample position were determined using Energy-Dispersive X-ray Spectroscopy (EDS). Optical properties, including the optical bandgap and refractive index were assessed by modeling transmittance spectra. XRD data analysis successfully determined the film thickness as a

function of sample position, aligning well with thickness values derived from transmittance spectra analyses. These results were further supported by film thickness values obtained from cross-sectional Scanning Electron Microscopy (SEM) images. Charge carrier density and mobility, extracted from the optical models, were found to be consistent with DC electrical measurements.

Paulo Cesar De Morais[1,2]

[1]Genomic Sciences and Biotechnology, Catholic University of Brasilia, Brasilia, DF, Brazil

[2]Institute of Physics, University of Brasilia, Brasilia, DF, Brazil

Biography: Paulo C. DE MORAIS (H-62), PhD, was full Professor of Physics at the University of Brasilia (UnB)–Brazil up to 2013, Appointed as UnB's Emeritus Professor (2014), Appointed as Guest Professor of Huazhong University of Science and Technology–China (2011), Visiting Professor at Huazhong University of Science and Technology (HUST)–China (2012-2015), Appointed as Distinguished Professor at Anhui University (AHU)–China (2016-2019), Appointed as Full Professor at Catholic University of Brasília (UCB) – Brazil (2018), Appointed as CNPq-1A Research Fellowship since 2010. 2007 Master Research Prize from UnB, 2008-member of the European ERA NET Nanoscience Committee, Member of the IEEE-Magnetic Society Technical Committee, Senior Member of the IEEE Society, 2012 China's 1000 Foreign Expert Recipient, and 2012 Academic Excellence Award from Brazilian Professor's Union. He held two-years (1987-1988) post-doc position with Bell Communications Research–New Jersey, USA and received his Doctoral degree in Solid State Physics (1986) from the Federal University of Minas Gerais–Brazil. He graduated in both Chemistry (1976) and Physics (1977) at UnB. Professor Morais is member of the Brazilian Physical Society and the Institute of Electrical and Electronics Engineers–IEEE. Paulo C. DE MORAIS has served as referee for more than 50 technical journals, takes part of the Editorial Board of more than 15 technical journals and has conducted research on nanomaterials for over 40 years. He is known for his research in preparation, characterization and applications of nanosized materials (magnetic fluid, magnetoliposome, magnetic nanoemulsion, magnetic nanocapsule, magnetic nanofilm, magnetic nanocomposite, nanosized semiconductors, polymeric dots, carbon dots, and graphene quantum dots). With more than 500 published papers in peer reviewed journals, more than 14,500 citations, about 300 international invited talks (35 countries), and 16 filed patents. He has appeared in recent World ranking of top scientists, such as 2020-Stanford, 2022-Research.com, 2023-AD Scientific Index, 2023-Research.com, 2024-Elsevier, ONE Research Community, 2025-AD Scientific Index, 2025-Research.com, and 2025-Stanford-Elsevier.

Evaluating cytotoxicity of metal-doped tin oxide nanoparticles

In this Keynote Talk, the traditional disc diffusion-test bioassay is revisited within the perspective of using a mathematical approach grounded on the standard as well as on the modified Hill model. Importantly, the Hill model was established in 1910 to account for the binding of oxygen molecules to hemoglobin and since then has been used as a standard model for evaluation of a wide plethora of experimental situations, including cell viability assays. As for the challenging material, Cu-doped tin oxide (SnO_2) spherical nanoparticles (mean size 8.3nm) will be tested against two bacteria cultures, namely the Gram positive *Staphylococcus aureus (S. aureus)* and the Gram negative *Escherichia coli (E. coli).* Although

limited in terms of variety of challenging materials and bacteria cultures, the success of the proposed mathematical approach while explaining the experimental data is quite impressive. The outcomes of the present analysis point quite favorably toward the general use of it in the very near future. New concepts, such as the biological size and the biological size dispersity, for instance, will emerge naturally from the data analysis reported in the talk.

Raman Singh

Department of Mechanical & Aerospace Engineering, Department of Chemical & Biological Engineering, Monash University, Vic, Australia

Biography: Professor Raman Singh's expertise includes Alloy Nano/Microstructure-Corrosion Relationship, Stress Corrosion Cracking (SCC), Corrosion/SCC of Biomaterials, Corrosion Mitigation by Novel Material (e.g., Graphene), Advanced and Environmentally Friendly Coatings, High Temperature Corrosion. He has supervised 60 PhD students. He has published over 285 peer-reviewed international journal publications, 15 books/book chapters and over 100 reviewed conference publications. His distinctions include: Guest Professorships at ETH Zurich (2020, 2023 and 2024), editor-in-chief of two journals, Fellow ASM International and Engineers Australia, over 50 keynote/plenary talks at international conferences (besides numerous invited talks), leadership (as chairperson) of a few international conferences.

Circumventing challenges in developing CVD graphene on steels: A disruptive approach to remarkable and durable corrosion resistance

Graphene has triggered unprecedented research excitement for its exceptional characteristics. The most relevant properties of graphene as corrosion resistance barrier are its remarkable chemical inertness, impermeability and toughness, i.e., the requirements of an ideal surface barrier coating for corrosion resistance. However, the extent of corrosion resistance has been found to vary considerably in different studies. The author's group has demonstrated an ultra-thin graphene coating to improve corrosion resistance of copper by two orders of magnitude in an aggressive chloride solution (i.e., similar to sea-water). In contrast, other reports suggest the graphene coating to actually enhance corrosion rate of copper, particularly during extended exposures. Authors group has investigated the reasons for such contrast in corrosion resistance due to graphene coating as reported by different researchers. On the basis of the findings, author's group has succeeded in demonstration of durable corrosion resistance as result of development of suitable graphene coating. The presentation will also assess the challenges in developing corrosion resistant graphene coating on most common engineering alloys, such as mild steel, and presents results demonstrating circumvention of these challenges.

R S Damse

Retd. Scientist, HEMRL, Sutarwadi, Pune-411021, India

Biography: Dr. R S Damse studied M.Sc (Organic chemistry) from Savitribai Phule University, Pune in 1983. Worked as Scientific Assistant in CSIR at NCL Pune from 1983 to 1985 and Scientist in DRDO at HEMRL Pune from 1985 to 2018. Awarded with PhD degree on the topic 'Studies on RDX-GAP based high energy gun propellants' in 2001 from Savitribai Phule University, Pune. Contributed significantly towards the successful completion of several R&D projects in the field of high energy materials. Presented several research papers in various international seminars/workshops and published about sixty research papers in the reputed national/ international journals and received several international awards/recognitions including International Scientist of Year award in 2007. The author is a recognized guide of PhD from the Savitribai Phule University of Pune.

Evaluation of mineral jelly as suitable waterproofing material for ammonium nitrate

Ammonium nitrate is a versatile inorganic salt. The innocuous nature of combustion products, low cost and easy availability makes it an attractive oxidizer to the propulsion community. However, its usage in high energy materials and space applications has been adversely affected mainly due to its hygroscopicity and phase transition phenomenon. This study explores the possibility of overcoming the problem of hygroscopicity of ammonium nitrate by coating the particles with selected waterproofing materials. Gravimetric analysis of the samples of ammonium nitrate coated with eight different waterproofing materials, vis-à-vis, uncoated ammonium nitrate were conducted at different relative humidity and exposure time. The results indicate that mineral jelly is the promising waterproofing material for ammonium nitrate among the materials tested, viz. Calcium stearate, dioctyl phthalate, kaoline, diethyl phthalate, dinitrotoluene, shellac varnish and bees wax. The superiority of mineral jelly as the waterproofing material to ammonium nitrate has been evaluated on the basis of differential thermal analysis and X-ray diffraction patterns. Further experiments Viz. Infra red spectral analysis using FTIR and scanning electron microscopy also carried out to realize the validity. Suitability of mineral jelly as an additive for the gun propellant was also assessed on the basis of theoretical calculations using 'THERM' program. Attempts are also on to replace the ammonium perchlorate with ammonium nitrate so as to develop green composite propellant suiting the ecological requirements calling for HCL free burning for the future space applications.

Keywords: Hygroscopicity, Phase Transition, Waterproofing Ability, Mineral Jelly, Ammonium Nitrate, High Energy Materials, Coating Materials.

Dr. S V A R Sastry

Department of Chemical Engineering, HBTU Kanpur, India

Biography: Dr. S.V.A.R.Sastry has more than 20 years of teaching and research experience. B.Tech Gold Medalist from NIT Jalandhar, M.Tech Silver Medalist from IIT Delhi and got Best Ph.D Thesis Award from JNTU Kakinada. Authored 12 Patents, 22 International Books and given 20 Keynote lectures in various International Conferences held at Brazil, Dubai, Spain, China and Canada. Published more than 64 Research Papers. Biography published in Marquis Who's Who in the World, 31st, 32nd & 33rd editions consecutively. Recipient of International Awards from IBC, Cambridge, England. Presently, working as the Associate Dean (R&D) at Harcourt Butler Technical University, Kanpur, India.

Nanomaterial-based bio-lubricant additives for improved efficiency and environmental sustainability in automotive applications

Two-Dimensional (2D) nanomaterials synthesised by hydrothermal means have become a key technology in nanotechnology, especially for applications requiring accuracy in particle shape, crystallinity, and surface properties. This process creates well-defined nanostructures by means of chemical reactions in aqueous medium at high pressures and temperatures. The most extensively researched 2D nanomaterials produced by hydrothermal techniques are iron-based nanoparticles, Zinc Oxide (ZnO), and Titanium Dioxide (TiO_2). Advanced lubricants with better tribological properties have been developed through a revolution in the field of lubricants with the addition of nanomaterials. For the purpose of attaining homogeneous dispersion within lubricating matrix, these nanomaterials' size, shape, and surface functionality can be precisely controlled during their hydrothermal production. These two-dimensional nanomaterials can have their surface properties precisely altered through hydrothermal synthesis, which benefits their lubricating system performance. Improved dispersion stability and efficacy of the nanomaterials in the lubricant can result in decreased wear, decreased friction, and enhanced thermal stability. This can be achieved by optimizing the particle size, shape, and surface fictionalization.

Keywords: Hydrothermal Synthesis, Nano Lubricants, Tribology, Two Dimensional Nanoparticles.

Thomas J. Webster

Hebei University of Technology/Brown University and co-founder of over a dozen companies, United States

Biography: Thomas J. Webster's (H index: 135) degrees are in chemical engineering from the University of Pittsburgh (B.S., 1995; USA) and in biomedical engineering from RPI (Ph.D., 2000; USA). He has formed over a dozen companies who have numerous FDA approved medical products currently improving human health in over 30,000 patients. He currently serves as CSO of Novaurum whom is pioneering the use of ALD in medical devices. He is also currently serving as a professor at Brown University, Saveetha University, Hebei University of Technology, UFPI, and others. Dr. Webster has numerous awards including: 2020, World Top 2% Scientist by Citations (PLOS); 2020, SCOPUS Highly Cited Research (Top 1% Materials Science and Mixed Fields); 2021, Clarivate Top 0.1% Most Influential Researchers (Pharmacology and Toxicology); 2022, Best Materials Science Scientist by Citations (Research.com); and is a fellow of over 8 societies. Prof. Webster is a former President of the U.S. Society for Biomaterials and has over 1,350 publications to his credit with over 55,000 citations. He was recently nominated for the Nobel Prize in Chemistry. Prof. Webster also recently formed a fund to support Nigerian student research opportunities in the U.S.

40,000 implants in humans and no failure: The impact of nanomedicine

Nanomedicine is the use of nanomaterials to improve disease prevention, detection, and treatment which has resulted in hundreds of FDA approved medical products. While nanomedicine has been around for several decades, new technological advances are pushing its boundaries. For example, this presentation will present an over 25year journey of commercializing nanomaterials for orthopedic implants now in over 40,000 patients to date showing no signs of failure. Current orthopedic implants face a failure rate of 5–10% and sometimes as high as 60% for bone cancer patients. Further, this talk will present future research directions into using Atomic Layer Deposition (ALD) to create such nanostructures on implants to reduce infection and improve bone growth. Sensors grown off of orthopedic implants using ALD will also be discussed in which cell presence on orthopedic implants can be detected and quantified. Such information can also be communicated to a handheld device to better inform surgeons on chances of implant success or failure. Such sensors can also release pharmaceutical agents and/or nanoparticles on-demand to ensure implant success. Lastly, this talk will cover how Artificial Intelligence (AI) can be combined into today's orthopedic implants to predict implant success or failure in the years that follow.

11TH EDITION OF

WORLD NANOTECHNOLOGY CONFERENCE &

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International Conference on

MATERIALS SCIENCE AND ENGINEERING

HYBRID EVENT

23-25 MARCH 2026

ORAL PRESENTATIONS

Abu M. Fuad[1,2]

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[2]Ahsanullah University of Science and Technology, Bangladesh

Emerging sustainable electric vehicle for developing South-Asian countries

This study proposes a high-performance energy storage system for an electric three-wheeler rickshaw based on Lithium Iron Phosphate (LFP) 32700 cylindrical cells to replace conventional 48 V, 100–120 Ah lead–acid battery packs. A 16S configuration is designed to obtain a nominal pack voltage of 51.2 V with a capacity of 105 Ah (≈ 5.3kWh), ensuring compatibility with typical 800–1200W BLDC motor drive systems. Compared to lead-acid batteries (energy density ≈ 30–40Wh/kg), the developed LFP pack achieves an energy density of about 120–140Wh/kg with nearly 35-40% weight reduction. The system allows an 80–90% usable depth of discharge and delivers more than 3500–4000 charge-discharge cycles at a 1C rate, which is nearly 4–5 times higher than the 500–800 cycle life of lead–acid counterparts. Fast-charging capability (80% within ≈ 1.5 h) and round-trip efficiency above 94% significantly improve daily vehicle utilization and reduce downtime. A smart battery management system is integrated for cell balancing, thermal protection, and accurate state-of-charge estimation. Performance analysis shows an increase in driving range from approximately 70-80 km to 100-120 km per charge under standard urban load conditions. Lifecycle cost assessment indicates a reduction of more than 45% in battery replacement expenses over five years. The proposed LFP 32700-based storage system therefore offers a lightweight, thermally stable, and economically sustainable solution for next-generation electric rickshaws, particularly in developing country transportation sectors.

Biography

Mr. Abu M. Fuad is a Lecturer in the Department of Electrical and Electronic Engineering and an Advisor in Robotics and AI at the University of Scholars, Dhaka, Bangladesh, with a strong background in renewable energy, energy storage, electric vehicles, and robotics research.

He earned his B.Sc. and M.Sc. degrees in EEE from Ahsanullah University of Science and Technology and has authored multiple peer-reviewed quartile journal articles and IEEE conference papers. His research interests include, hybrid renewable energy integration, battery management, machine learning, and automation. Mr. Fuad has actively contributed to interdisciplinary projects involving sustainable technologies and autonomous systems, and his work has been widely cited internationally. Outside academia, he engages in robotics mentorship, professional coaching.

Ahlem Abidi[1,2]

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Improving the similarity between photon-atom quantum state and its coherent state by a coherent superposition added-subtracted photon

The spontaneous interaction (emission or absorption) of a photon by atom is theoretically described in two-dimensional by a state vector $|\psi\rangle$. As an initial solution to the problem, we derive its corresponding coherent state. We analytically find the fidelity between photon-atom eigenstate and its coherent state. We introduce the state of a photon-subtraction, photon-addition and we compute the fidelity of a superposition of pair charge coherent states with the state of photon added-subtracted. We show that the quantum teleportation by creating or annihilating an excitement in the coherent states enhances enormously fidelity, also we schow that by increasing the photon quantity, the coherent state becomes less similar to the eignenstate. This means is reversed by increasing time; the system evolves towards an improved correspondence between the initial superposition coherent state and the state after photon addition-subtraction.

Keywords: Photon-Atom System, Fidelity, Coherent State, Superposition Pair Charge Coherent States, Addition-Subtraction Photon State.

Biography

Dr. Ahlem Abidi, studied Physics at Tunis El Manar University, Tunisia, and graduated as Ms of Quantum Physics in 2014. She then joined the Research Unit of Nuclear and High Energy Physics of Prof. Adel Trabelsi at the Faculty of Sciences of Tunis, University of Tunis El Manar, in collaboration with the University of Tunis, National School of Engineers of Tunis in 2017. She has received her PhD degree in 2022 at the National School of Engineers of Tunis. She

joined the American Journal of Physics and Applications as a reviewer between December 2021 and December 2023, in parallel, a temporary assistant at the University of Jendouba, Higher Institute of Biotechnology of Beja between January, 2022 and 2023. She has awarded to Women Researcher Award at 6th Edition of Internationnal Research awards on Quantum Physics and Quantum technologies in august 2023. Currently, she is an assistant professor at Higher Institute of Technological Studies of Jendouba and member Editor at American Journal of Physics and Applications. She has published 13, between research articles and conference papers, in the fields of: Theoretical quantum Physics, quantum information and mathematical Physics.

Alain Portavoce

Aix-Marseille University/CNRS, IM2NP, Faculté des Sciences de Saint-Jérôme case 142, 13397 Marseille, France

Modeling phase crystallization in Ge-rich Ge-Sb-Te PCRAMs

Ge-rich Ge-Sb-Te (GGST) alloys are already integrated into the Complementary-Metal-Oxide-Semiconductor (CMOS) technology for industrial Phase-Change Random Access Memory (PCRAM) production. This new type of memories allowing low-power system on-chip production and in-memory computing are expected to support emerging technologies for automotive and artificial intelligence applications. However, structure and chemical evolution of the material in the memory cell, during repeated crystallization/amorphyzation (i.e. SET/RESET) cycles, is complex and depend on Ge concentration in the GGST alloy. Memory cell electrical properties being dependent on atomic distribution in the GGST alloy, it is important to be able to simulate cell aging at the material level in order to design the best GGST PCRAMs.

Simulation of atomic redistribution in GGST memory cells is challenging since the Ge-Sb-Te ternary system involves semiconductor, metal and semi-metal elements of different structures, forming four different binary compounds as well as several possible ternary compounds. Furthermore, the simulation of SET/RESET cycles requires the three states amorphous, crystalline, and liquid to be simulated.

We propose to use a simplified Ge-Sb-Te system, able to reproduce the main phenomena occurring during atomic redistribution in GGST memory cells, using atomistic Kinetic Monte Carlo (KMC) simulations based on the tight-biding Ising model and direct exchanges between first-neighbor lattice sites. Order-disorder transitions on a rigid fcc lattice are used to model amorphous-crystalline transitions at low temperature and solid-liquid transitions at high temperature. Simulations of Ge-rich GST film crystallization show good agreements with experiments according to crystallization kinetics and phase formation sequence versus Ge

excess. Simulations of the cycling of a 50nm-wide mushroom-type PCRAM cell show strong atomic redistribution, which suggests significant electrical property variations with cell ageing.

Biography

Alain Portavoce received his PhD in Materials Science in 2002. After working at the University of Virginia (Charlottesvile, USA) with Prof. Robert Hull and at the IBM Thomas J. Watson Research Center (Yorktown Heights, USA) with Prof. Frances M. Ross, he was offered a permanent position by the French National Center of Scientific Research in 2005, for joining the Institute of Materials Microelectronics and Nanoscience of Provence (Marseille). His work mainly concerns nanometer scale solid state diffusion, segregation and reaction in materials involved in the fabrication of microelectronic devices. He coauthored 139 scientific publications.

Andrei V Arzhannikov[1]*, S. L. Sinitsky[1], D. A. Samtsov[1], P. V. Kalinin1, S. A. Kuznetsov[1], V. D. Stepanov[1], S. S. Popov[1], E. S. Sandalov[1], M. G. Atlukhanov[1], A. V. Stankevich[2,3], A. V. Pestov[3], N. A. Nikolaev[4], A. A. Rybak[4]

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Polymeric materials transformation under exposure by a megawatt pulse flux of submillimeter radiation (First realization)

Complex supramolecular structures form the basis of biologically active compositions for pharmaceutical applications, energetic materials, and various functional materials and the materials structure determine their functional properties. The material structure is manifested in the phonon vibration spectrum, which extends from fractions of a terahertz to several terahertz. Exposure of such supramolecular systems to radiation flux in this frequency range enables significant modification of structural changes accompanied by significant modification of the population of states within the phonon spectrum. Thus, the use of intense radiation flux in the terahertz range appears promising not only for the characterization of supramolecular systems but also for the targeted modification of their structural features and functional properties.

As a first step in this line of research, we carried out studies on the effect of pulsed megawatt radiation fluxes in the frequency range of 0.1–0.4 THz on several thin-film polymer materials, with the goal of identifying regularities in the changes of their characteristics within the 0.2–2 THz interval. The test samples were thin polymer films, 16–75 μm thick, fixed in a frame. The exposure was performed using a submillimetre radiation flux generated at the GOL–PET facility. This radiation flux is produced through intense interaction of a relativistic electron beam with a magnetized plasma column. The flux is subsequently delivered into the atmospheric conditions of the experimental hall to irradiate the samples. The spectral characterization of the thin-film samples in the specified frequency range was performed before and after exposure using equipment operating within the frameworks of time-domain spectroscopy

and Backward-Wave Oscillator (BWO) spectroscopy. Relative changes in the real part of the permittivity of individual polyvinylidene fluoride samples were found to reach a level of 0.5 with an initial value of about 3.0, while for polyvinyl chloride samples, no changes in this parameter were registered. For series of various polyuria samples this parameter demonstrated both significant and negligible changes at the exposure. On the base of these obtained results, we can use the tested thin-film polymer materials as substrates for supramolecular complex samples at their irradiation by powerful radiation fluxes. Synchrotron radiation diagnostic—specifically, small-angle X-ray scattering and grazing-incidence X-ray diffraction will be additionally applied to characterize the structure characteristics of these samples.

Biography

Andrei V. Arzhannikov graduated from Physics Department of Novosibirsk State University (NSU) in 1973. From 1973 to present time–research activity at INP (now Head Scientist) and since 1978-teaching activity at the NSU. Received Degrees: Ph.D. and Doctor of Sciences in Physics and Mathematics in 1980 and 1994, respectively. Awarded titles: Senior Scientist in Physics and Chemistry of Plasma in 1985, Associate Professor of General Physics in 1995, and Professor of Physics and Chemistry of Plasma in 1998. Co-author of more than 300 journal articles and more than 400 reports at various scientific conferences.

Dr. Andrey V Shobukhov

Shenzhen MSU-BIT University, PRC, China

Spatially non-uniform steady states in concentration-dependent diffusion

Diffusive processes in dense multi-component mixtures should be described with special concentration-dependent terms. Traditional systems of diffusion equations with constant matrices either ignore interaction between the mixture components (when the diffusion matrix is diagonal), or do not guarantee the positivity of concentrations (even if this matrix is kept symmetric and positively defined). A very interesting approach to this problem consists in using the cell-jump formalism. It produces systems of differential equations with concentration-dependent diffusion matrices that yield positive and bounded solutions.

We apply this method to the description of diffusion in the two-component liquid mixture. The obtained model of the binary mixture diffusion possesses an interesting feature: It has an infinite set of spatially non-uniform steady state solutions. We study the stability of these solutions both analytically and numerically. We outline the criterion of stability and check it for several examples.

Biography

Dr. Shobukhov studied Applied Mathematics at the Lomonosov Moscow State University and graduated as MS in 1985. In 1986 he joined the postgraduate program at the same institution; there he received his PhD degree in 1991. He obtained the Scientific Researcher position at the Laboratory for Mathematical Modelling in Physics at the Department for Computational Mathematics and Cybernetics of the Lomonosov Moscow State University. At present he is also an Associate Professor at the Department of Materials Science of the Shenzhen MSU-BIT University. He has published 42 research papers in various scientific journals.

Chaoyu Xiang*, Chang Gu
Ningbo Institute of Materials Technology and Engineering (NIMTE) of the Chinese Academy of Sciences (CAS), China

Direct photolithography of smart optoelectronic materials for high-resolution display applications

Quantum dot Light-Emitting Diodes (QLEDs) have emerged as pivotal candidates for next-generation displays, owing to their tunable emission wavelengths, narrow spectral bandwidth, high brightness, and solution-processability. However, achieving high-precision Quantum Dot (QD) patterning remains a critical bottleneck for industrial implementation. Conventional inkjet printing suffers from limited resolution (<5μm) and coffee-ring artifacts, whereas traditional photolithography compromises QD performance during photoresist processing. Direct photolithography has recently emerged as an innovative approach to bypass these limitations by simplifying traditional photolithographic workflows. This methodology integrates QDs with photosensitive molecules, enabling efficient fabrication of ultra-high-resolution patterns with large-area uniformity while maintaining compatibility with semiconductor manufacturing protocols. Nevertheless, existing direct lithography techniques typically require stringent environmental controls and precise exposure parameters. Developing an air-processable direct lithography method compatible with large-scale semiconductor manufacturing therefore holds critical significance.

Leveraging photo-click chemistry's advantages of mild reaction conditions, high selectivity, and rapid kinetics, we propose a UV-triggered azide-alkyne cycloaddition strategy for QD patterning. Distinct from prior inert-atmosphere-dependent methods, our approach utilizes ambient air conditions with standard 365 nm UV irradiation, ensuring seamless integration with semiconductor fabrication lines. The reaction achieves efficient QD film crosslinking, enabling submicron-resolution patterning while preserving intrinsic optoelectronic properties. Notably, the crosslinked QD layers achieved a record External Quantum Efficiency (EQE) of 20.05% in

QLED devices, attributed to suppressed interfacial defects and optimized charge balance. By synergizing click chemistry precision with semiconductor-grade manufacturability, we establish a universal platform for high-resolution optoelectronic patterning, accelerating industrial adoption of QLEDs and related quantum dot technologies.

We further extend this direct photolithography to functional layers including PEDOT: PSS and Metal Oxides (WO_X, MoO_3). Through controlled photochemical processes involving crosslinking and ligand exchange, we achieved solubility modulation of these materials, enabling ultrahigh-resolution patterning exceeding 3,300PPI. This advancement demonstrates compatibility with multilayer device architectures and addresses a critical challenge in RGB full-color QLED commercialization.

Biography

Chaoyu Xiang, researcher and Ph.D. supervisor at Ningbo Institute of Materials Technology and Engineering of the CAS, has long focused On Novel Light-Emitting Devices (OLED & QLED). With 15 years' experience in organic and quantum-dot LEDs, he pioneered deep-blue QLEDs. His technologies enabled the world's first 5-inch full-color AM-QLED and 31-inch AM-HQLED prototypes. He has authored 60+ SCI papers and 100+ granted patents.

Chayanika Baishya[1*], Amarnath Kumar[2], Sisir Kumar Nayak[2], Harshal B. Nemade[2]

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A broadband, angle-insensitive aluminium-based Near Infra-Red absorber for protecting warfighters and sensitive optics technologies

Near-Infrared (NIR) laser threats have become increasingly prevalent in modern military operations, posing significant risks to personnel and sensitive optics-based technologies. Effective protection against these threats requires advanced absorber materials capable of efficiently mitigating laser radiation. Currently, Aluminium (Al) based absorbers are gaining attention due to their lightweight nature, cost- effectiveness, and ease of fabrication. Current solutions use filters based on organic dyes or reflective films, which have limitations such as poor stability or angle-dependent performance. To address these challenges, a NIR absorber with broadband absorption, high stability, and angle-insensitive performance is needed. In this study, we present and numerically investigate a novel ultra-broadband incident angle-insensitive absorber via simulation. By employing nanostructured configurations of Metal-Dielectric-Metal (MDM), it is achieved near-perfect absorption over the NIR spectrum. Integrating these nanomaterials into thin films enabled broad-spectrum NIR absorption while maintaining high visible light transmittance. Existing research on IR absorbers has predominantly focused on applications in energy harvesting and spectroscopy, with relatively limited exploration of their potential for defense-related uses.

In real-world military scenarios, laser threats can originate from unpredictable directions and rapidly changing angles due to the movement of platforms or personnel. An absorber insensitive to incident angle ensures consistent performance regardless of orientation or positioning, providing reliable protection under dynamic battlefield conditions. Additionally, Al based materials offer advantages in terms of weight reduction and mechanical robustness, which are critical for integration into protective gear and sensitive optical devices. The

development of an AI-based NIR absorber with an angle-insensitive design represents a critical advancement for military operations. This technology addresses the limitations of traditional absorbers by providing consistent protection against laser threats from diverse angles and dynamic battlefield conditions. These absorbers can offer improved shielding for personnel and safeguard sensitive optical systems, ultimately enhancing safety and operational effectiveness.

Biography

Chayanika Baishya is currently pursuing a Ph.D. at IIT Guwahati, specializing in Nanoantenna research. She has contributed to the field through a journal publication and a conference paper. Actively involved in research projects, she is working on the development of a Wireless Power Transmission System (WPTS) for insect-scale Micro Air Vehicles (MAVs) and the design of a Remote Ignition System with Pilot Burner Flame Detection for open-ground flares. She completed her B.E. in Electrical Engineering from Bineswar Brahma Engineering College, Kokrajhar, and has undertaken internships at Namrup Thermal Power Station and Indian Oil Corporation Limited.

Daneti Saradhi Babu

Technical Manager–Concrete Specialist, Alliance Concrete Singapore Pte Ltd, Singapore

Applications of fibre-reinforced concrete in building and infrastructure projects in Singapore

Concrete is a brittle material that exhibits high compressive strength but relatively low tensile strength and limited tensile strain capacity. This inherent weakness in tension is typically addressed by incorporating steel reinforcing bars in the tensile zones of concrete structures to carry tensile stresses. Steel reinforcement is also essential for controlling crack widths to satisfy serviceability requirements. Fiber-Reinforced Concrete (FRC) is a type of concrete that incorporates discrete fibers to enhance its mechanical and durability performance. Common fiber types used in FRC include steel, synthetic, glass, and natural fibers. When properly designed, an FRC mix can significantly reduce crack widths and lengths under service loads, modify crack morphology, and improve ductility and durability.

The use of FRC has increased in recent years due to growing acceptance among designers, consultants, and project owners. This trend has been supported by improved design guidance through standards, the availability of robust construction equipment, and advancements in construction methodologies. Furthermore, developments in materials technology and innovative production techniques at precast and ready-mixed concrete plants have enabled higher quality control, broader application ranges, and enhanced post-cracking behaviour and durability. These advancements have collectively driven the wider adoption of FRC.

This presentation highlights case studies on the use of Fibre-Reinforced Concrete (FRC) in Singapore's building and infrastructure projects, including applications of steel, polypropylene (micro and macro), and alkali-resistant glass fibres across tunnelling, rail, and industrial building works.

Biography

Dr. Daneti is currently serving as Technical Manager–Concrete Specialist at Alliance Concrete Singapore (ACS) Pte. Ltd. He holds a Doctor of Philosophy degree from the National University of Singapore (NUS), awarded in 2009, and a Master of Technology degree from the Indian Institute of Technology Madras (IITM), completed in 2002. Prior to transitioning to the ready-mixed concrete industry in 2011, Dr. Daneti worked for four years as a Research Engineer and Research Fellow at NUS. Dr. Daneti has authored and co-authored over 25 research papers published in international journals and conference proceedings. His research interests include cement and concrete composites, lightweight concrete, fiber-reinforced concrete, low-carbon concretes, and issues related to durability and sustainability. He is an active member of the American Concrete Institute–Singapore Chapter (ACI-SC), where he serves on the Board of Directors. Dr. Daneti is also a member of the Institution of Engineers Singapore (IES) and the Singapore Concrete Institute (SCI). In addition, Dr. Daneti serves as a workgroup member for several Singapore Standards, including SS EN 206, SS 544 Parts 1 and 2, and SS EN 12620. Dr. Daneti has received recognition for outstanding technical papers presented at international conferences, including OWICS 2015 in Singapore and ConMat'05 in Vancouver, Canada. In 2023, he attained certification as a Construction Environmental Product Declaration (EPD) Specialist.

Dr. Dharmendra Kumar

Faculty of Pharmacy, Swami Vivekanand Subharti University, Meerut, Uttar Pradesh, India, 250005

Improvement of pharmacokinetic parameters of BCS class IV drug for cancer treatment using nanotechnology

Polymeric nanoparticles are widely explored for drug delivery, though challenges remain in drug loading, entrapment, and release. In this study, starch nanoparticles were prepared from unripe banana fruit, which contains amylose (26–28%) and amylopectin (72–74%). Amylose promotes immediate release, while amylopectin supports sustained release, making banana starch a promising drug carrier. Quercetin-loaded starch nanoparticles were synthesized via nanoprecipitation. They showed 51.9% drug loading, particle sizes of 66.67–113.33 nm (SEM), and cumulative release of 44.84% in 1 h and 96.96% in 12 h. Antioxidant activity reached 98% inhibition in the DPPH assay. Cancer cell inhibition was dose-dependent, with nanoparticles showing stronger effects (3.11–83.48%) compared to isolated quercetin (2.11–72.45%). Histopathological studies confirmed wound healing within 21 days and suppression of inflammatory responses. These findings highlight banana starch nanoparticles as an effective carrier for quercetin with dual-release and therapeutic potential.

Biography

Dr. Dharmendra Kumar is an Associate Professor at Faculty of Pharmacy, Swami Vivekanand Subharti University, Meerut, India. Dr. Kumar has published over 15 Patents, 12 books and more than 35 research papers in prestigious journals indexed by SCI and Scopus. He is actively involved with various publishing houses worldwide as an editor, author, and reviewer.

Ernestine Atangana[1*], Maryam Meskini[2], Simon Marieka Gryzenhout[2], Hendrik Swart[3], Paul Johan Oberholster[1]

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Covalent crosslinking of cellulose-chitosan biopolymers via aldehyde linkers: Synthesis, characterization, and enhanced antibacterial functionality

The increasing threat of antibiotic-resistant pathogens and the need for environmentally sustainable materials have accelerated research into biopolymer-based antimicrobial agents. This study addresses the question: *Can natural polymers from agricultural and marine waste be engineered into potent, eco-friendly antibacterial materials through chemical modification?* To explore this, we synthesized cellulose-chitosan biopolymer beads using cellulose derived from chemically treated maize corn cobs and commercial shrimp chitosan. Covalent crosslinking was achieved via Schiff base reactions using glutaraldehyde and formaldehyde as aldehyde linkers. The resulting gel beads were structurally and chemically characterized using SEM, FTIR, XRD, UV-Vis, and EDS techniques. Surface morphology analysis revealed that aldehyde crosslinking introduced globular, densely packed structures with increased amorphicity and enhanced crystallinity, especially in formaldehyde-linked composites. Spectroscopic analysis confirmed successful crosslink formation, with shifts in key vibrational bands indicating new covalent interactions between cellulose and chitosan. Antibacterial assays against *Staphylococcus aureus* and *Seudomonas Aeruginosa* demonstrated significantly enhanced activity of the crosslinked gels, with Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) values as low as 9.37mg/mL and 18.75mg/mL, respectively, far outperforming untreated or uncrosslinked controls. These findings suggest that covalent aldehyde crosslinking not only improves structural stability but also dramatically boosts the antimicrobial efficacy of cellulose-chitosan biopolymers. Academically, the study expands the toolbox of natural polymer modification strategies and offers spectroscopic insights into Schiff base chemistry. Socially and environmentally, it promotes the valorization of agricultural and marine waste into sustainable biomedical materials. Such materials could be applied in

wound dressings, medical devices, or antimicrobial coatings, aligning with circular economy principles and public health goals.

Keywords: Cellulose-Chitosan Biopolymer, Aldehyde Crosslinking, Antibacterial Activity, Maize Corn Cob Waste, Schiff Base Reaction.

Biography

Dr. Ernestine Atangana is an environmental chemist and researcher at the Centre for Environmental Management, University of the Free State (UFS), specialising in waste valorisation, water quality assessment, and sustainable resource management. She holds a PhD in Environmental Science from the Central University of Technology and multiple chemistry degrees from UFS. Her research focuses on developing biopolymer-based adsorbents for wastewater treatment and integrating modelling, chemistry, and sustainability science to address water pollution challenges in Africa. She has published over 25 peer-reviewed articles and 2 book chapters in high-impact international journals, with her work earning more than 440 citations and recognition through NRF, NAS, and TIA-funded projects. An experienced postgraduate supervisor and Guest Editor for Polymers (MDPI), Dr. Atangana's contributions advance green chemistry and environmental innovation, aligning closely with the UN Sustainable Development Goals 6, 12, and 13 to promote clean water, responsible production, and climate resilience across Africa.

Evgeny Grigoryev[1*], Vladimir Goltsev[2], Oleg Kuznechik[3], Stanislav Nescoromniy[4], Andrey Osintsev[2], Evgeny Strizhakov[4], Alexander Chumakov[5]

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Features of high-voltage consolidation of powder materials

The main features of the method of high-voltage consolidation of powder materials and the resulting advantages and limitations of this method are considered. The method of high-voltage consolidation of powders is effective for the production of refractory composite materials that retain their strength properties at ultrahigh temperatures under aggressive external influences. The short duration of high-temperature exposure in the process of high-voltage consolidation makes it possible to preserve the structural-phase state of the initial powder material in the consolidated compact material. A feature of this method is the high density concentration of the released energy in the area of contacts between powder particles. In this case, the initial state of the surface of powder particles (the thickness and structure of oxide films, the presence of foreign impurities, etc.), the shape of powder particles and their sizes significantly affect the regularities of high-voltage consolidation processes. Along with the characteristics of the powder, the determining factors are: The rate of input of the energy of the electromagnetic field into the powder material, the magnitude and nature of the mechanical pressure acting on the powder compact in the process of high- voltage consolidation. The high energy density in the particle contact zones leads to a local change in the state of aggregation of the powder substance in these zones. Along with the inhomogeneity of powder heating in interparticle contacts, a macroscopically inhomogeneous distribution of the current density in the volume of the consolidated sample is possible. The formation of the structure of a powder material during high-voltage consolidation is determined by processes of different scales occurring at interparticle contacts, in powder particles, in the bulk of the entire sample, and by the mutual influence of these processes.

Further development of this method is associated with a detailed experimental study of thermal processes during high-voltage consolidation of powders of refractory materials using pulsed photometry. Experimental studies of the parameters of high-voltage electrical impulse action in the process of consolidation of high-temperature TaC and HfC powder compositions have been carried out. Registration of the parameters of a high-voltage current pulse and the intensity of thermal radiation of the consolidated powder materials was carried out using a measuring complex developed by the authors. This complex includes: A Rogowski coil with an integrating circuit, which registers the parameters of a high-voltage current pulse; photodiode sensors that register the intensity of thermal radiation, which is transmitted through a special optical waveguide from consolidated powder compacts; systems for triggering and synchronizing the components of the measuring complex. The analysis of the emerging thermal electromagnetic radiation from the surface of the consolidated powder sample in the process of high-voltage consolidation is carried out in the visible radiation range, ranging from λ_r=650 nm to λ_r=950 nm.

A criterion has been established that determines the range of optimal technological parameters of high-voltage consolidation for the creation of refractory high-density materials. Possible directions for further research into the process of high-voltage consolidation of powder materials are proposed.

Biography

Dr. Evgeny Grigoryev studied theoretical nuclear physics at Moscow Engineering Physics Institute, Russia and graduated as MS in 1975. He received his PhD degree in 1980 at the same institution. He has the next work experience In Moscow Engineering Physics Institute: From Researcher, to Chief of Key Laboratory of Electromagnetic Field-Assisted Methods for Processing of Novel Materials. Since 2017 to the present, Grigoryev is the Head of the Laboratory of High-Energy Methods for the Synthesis of Ultrahigh-Temperature Ceramic Materials in ISMAN. He has published more than 180 research articles in SCI(E) journals, 23 patents.

H. Jadhav*, Y. Gupta, A. K. Patro, S. S. V. Tatiparti, S. S. Pande, R. G. Mote

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Eeffect of surface texture on self organization of titania nanotubes

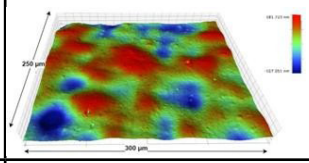
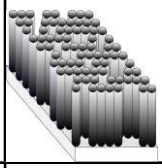
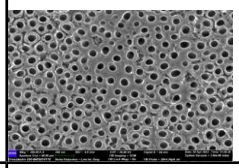
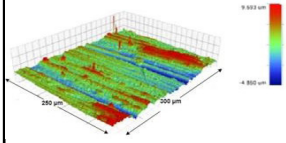
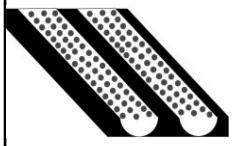
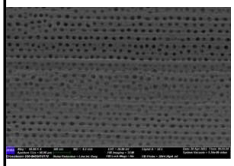
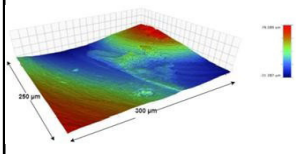
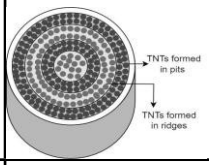
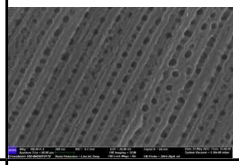
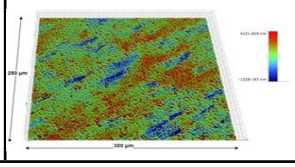
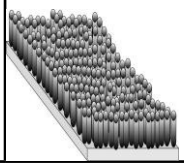
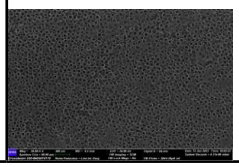
The ordered development of TiO_2 nanotubes has been of special interest in various biomedical applications such as their usage in drug delivery systems, anti-microbial medicines, and enhancing osseointegration in implants. Previous works have also explored the effect of surface roughness on the length, growth rate and degree of self-organization of the obtained NT arrays. The surface profile of the titanium sample also influences the growth characteristics of nanotubes. Surface defects and features such as micro valleys and peaks can significantly impact the growth behavior of titania nanotubes. These sites can act as preferential locations of nucleation for the initiation and growth of nanotubes. This study investigates the effects of the lay and textures of various surface machining methods on nanotube growth and organization. Various machining processes were used to modify the surface i.e. polishing, grinding, facing and lapping. Their surface characterization was done using white light interferometry to understand the surface profile. Various surface parameters such as surface roughness (Ra) and texture aspect ratio (Str) were derived.

Anodization experiments were conducted on samples after surface modification. The experimental setup which consisted of a two-electrode system with platinum mesh as the cathode, and titanium as the anode had ethylene glycol+2.5%v/v H20+0.5%w/w NH4F as an electrolyte with an aging of 5 hours. The experiments were conducted at room temperature at 45V for 15 minutes. The current transients were analyzed for all the samples. The nanotube morphology was analyzed and quantified using FE-SEM. Table. 1 summarises the findings of this study. It links the typical surface topographies, FE-SEM images and schematic diagrams of nanotube distribution to the machining operations. The Ra values for four surfaces i.e.

polishing, grinding, facing and lapping were 22nm, 525nm, 4330nm and 63nm respectively while the texture aspect ratio (Str) were 0.621, 0.14, 0.245 and 0.572 respectively. Surface roughness dictates the nucleation time and growth of TNTs. It was observed that nanotubes were formed on polished and lapped surfaces while nanopores were formed on ground and faced samples. The directionality in the growth of nanotubes was governed by Str ratio. It was observed that a low Str ratio in the case of ground and faced samples favored an organized growth of nanopores while a high Str ratio in polished and lapped samples generated dense growth of nanotubes with no organization.

SEM images show the formation of nanotubes in the case of polished and lapped samples, while the formation of ordered nanotubes in the case of ground and faced samples. This is in line with the proposed hypothesis. The pores/tubes had a mean diameter of 63 nm which is dependent on the input conditions i.e. applied anodization voltage, time and choice of electrolyte whichwere kept constant for all the samples. It was found that the nanotubes grew in circular grooves on faced samples and in linear grooves on ground samples. While a dense development of nanotubes was seen on samples that had been mechanically polished and lapped.

Table 1: Schematic correlation of machining processes, surface topographies and titania nanotube/nanopore growth.

Machining process	Surface Topography	Schematic growth of TNTs	FE-SEM Image
Mechanical mirror polishing			
Grinding			
Facing			
Lapping			

Biography

Hrishikesh Jadhav is a Ph.D. scholar from IIT Bombay, India working in the field of nano-structure fabrication. He has interests in an interdisciplinary study that involves the study of electrochemistry, corrosion science, material characterization, and advanced imaging and spectroscopy techniques. His research interests include titania nanotube (TiNT) growth investigation on metal alloys and freeform surfaces and advanced metallurgical characterization that includes FIB-SEM, EDS, XRD, CV, EIS, and Nanoindentation. Non-conventional micromachining is another area of his interest that focuses on manufacturing components with micron tolerances. He is a gold medalist of his M.tech batch of 2018 from NIT Arunachal Pradesh, India with a specialization in Manufacturing Engg. He is currently working on SERB India funded project titled 'Development of titania nanotubes (TiNT) surfaces with tailored surface properties'.

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Low-temperature plasma-engineered hafnia ferroelectrics for high performance flexible thin-film transistors

The demand for energy-efficient and flexible electronics has accelerated research into ferroelectric materials compatible with low-temperature processing. Hafnium-based ferroelectrics, particularly Hafnium Zirconium Oxide ($Hf_{0.5}Zr_{0.5}O_2$, HZO), have attracted significant attention due to their CMOS compatibility, scalability, and robust polarization at nanometer thicknesses. However, conventional crystallization of HZO requires annealing temperatures above 400°C, which limits its integration on temperature-sensitive substrates and Two-Dimensional (2D) materials.

In this work, we present a plasma-assisted approach that enables low-temperature stabilization of the ferroelectric orthorhombic phase in sputtered HZO thin films. Controlled argon plasma irradiation generates a moderate concentration of oxygen vacancies, which induce non-centrosymmetric lattice distortions and defect dipoles favorable for ferroelectricity. Structural and chemical analyses confirm that plasma treatment enhances the orthorhombic phase fraction without causing interfacial degradation. The resulting HZO films exhibit strong remanent polarization (>15μC/cm^2), low coercive field, and outstanding endurance exceeding 10^7 switching cycles.

When integrated into Indium-Gallium-Zinc-Oxide (IGZO) thin-film transistors on flexible polyimide substrates, the plasma-engineered ferroelectric gate stack achieves a steep subthreshold swing below 60mV/dec and a high ON/OFF ratio greater than 10^6. These results demonstrate that plasma processing can effectively activate and tune ferroelectric behavior

at a reduced thermal budget, thereby overcoming one of the major bottlenecks for flexible and monolithic 3D integrated electronics.

This study highlights the role of plasma irradiation both a crystallization enhancer and a defect-control tool for hafnia-based ferroelectrics. The demonstrated plasma-engineered ferroelectric transistors represent a viable route toward low-power, high-performance, and mechanically flexible device architectures, paving the way for next-generation intelligent systems and energy-efficient neuromorphic electronics.

Biography

Hyunyeol Rho is a Ph.D. candidate in the Department of Advanced Materials Science and Engineering at Sungkyunkwan University, South Korea. His research focuses on hafnia-based ferroelectric thin films, plasma-assisted low-temperature processing, and flexible electronic devices. He has published a paper on plasma-engineered ferroelectrics and their integration into advanced transistor architectures. His current work aims to enable low-power, flexible and 3D integration with ferroelectric devices for next-generation electronics.

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Biopolymer filled rubber compounds with applied low molecular weight plasticizers

The depletion of resources, global warming, and negative environmental impacts have increased awareness of the bio-economy and green technologies. Lignocellulosic raw materials are promising alternatives to petroleum-based products because they are abundant, sustainable, and contribute positively to reducing global greenhouse gas emissions. Lignin is the second most abundant biopolymer worldwide, offering significant potential for various applications. Each year, about 50 to 70 million tons of technical lignin are produced, but only 1 to 2% of this amount is used to create value-added products. The remainder is either landfilled or burned for energy generation or chemical recovery. Lignin has a highly branched, amorphous aromatic structure with a variety of functional groups such as carboxyl, carbonyl, hydroxyl, and methoxy groups. These groups give lignin desirable properties, including antimicrobial activity, antioxidant effects, UV absorption, adhesive qualities, and hydrophobicity.

Its high availability, eco-friendliness, biodegradability, and ability to reinforce make it an ideal candidate as a filler or component in rubber compounds to create innovative green composite materials. Through the augmentation of polar groups, electrostatic attraction, and hydrogen bonding, it can establish a connected network with certain polar polymers. However, due to the formation of strong intramolecular interactions between the macromolecular chains, its compatibility and adhesion with non-polar polymers tend to be poor. Therefore, the incorporation of lignin in its original, unmodified form into polymer compounds usually results in the deterioration in the physical–mechanical and utility properties of the final materials.

Different modification methods have been employed to enhance the dispersion of lignin within rubber matrices and to improve the compatibility between the two components. The results have demonstrated very promising prospects and pointed to the high application

potential of lignin into rubber compounds. However, many of these modification processes are time-intensive and involve additional costs. In some cases, opting for a straightforward approach to increase the uniformity and compatibility of rubber blend components is more practical, especially for products manufactured on an industrial scale.

In this work, calcium lignosulfonate as a biopolymer component was incorporated into acrylonitrile-butadiene rubber in the amount of 50phr (parts per hundred rubber). To improve the adhesion and homogeneity between the rubber and the biopolymer, three low-molecular-weight plasticizers were used, namely 1,4-butanediol, ethylene glycol, and glycerol. Those plasticizers are highly available and cost-effective and were incorporated into rubber compounds in the amount ranging from 5 to 30phr. The results revealed that plasticizers softened both the rubber matrix as well as the biopolymer filler. The higher the polarity of the plasticizer, the higher the plasticizing effect on lignosulfonate. The plasticizing effect increased in the following order: 1,4-butanediol<ethylene glycol<glycerol. Softened lignosulfonate formed small soft filler like domains well distributed within the rubber matrix. Good compatibility and adhesion between the rubber and the biopolymer on their interface was observed leading to the enhancement in tensile characteristics of composites plasticized with ethylene glycol and glycerol.

Acknowledgements: This work was supported by the Slovak Research and Development Agency under the contract No. APVV-22-0011 and by grant agency VEGA under the contract No. 1/0056/24.

Biography

Ján Kruželák is experienced from the study of preparation and characterization of rubber compounds based on various elastomers filled with traditional fillers used in rubber industry as well as with magnetic active fillers and biopolymer fillers. His area of expertise is also research and development of vulcanization systems used for cross-linking of rubber matrices. He has been a member of the IRCO, an international organization bringing together representatives of rubber industry research associations and production organizations of each member country.

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Theoretical guided discovery of 2D materials: From metal to MXene and XMene layers

Since the successful discovery and isolation of graphene in 2004, and the subsequent explosion and continuation of Two-Dimensional (2D) materials are undergoing and lasting until now. Although the layered semiconductors and heterostructures beyond graphene have in a stage of rapid growth. The metal or metallic layers are still in the stage of infancy. Here, we will provide an outlook for the applications of computational approaches to selected metallic 2D materials synthesis, properties and applications. Through electron beam irradiation, we synthesized a novel 2D Ti nanosheet using a suspension of Ti0.91O2 nanosheets. Density Functional Theory (DFT) calculations confirmed that this material is a non-magnetic superconductor with a moderate level of electron-phonon coupling and showing an excellent stability under strain and are prone to electronic topological transformations. In the realm of 2D metal carbides and borides, we introduced two innovative criteria to evaluate the potential for exfoliating MXenes from the 36 M2AC MAX phases. Our analysis identified nine promising MAX phases, called Ti_2AlC, Ti_2GaC, Ti_2InC, Ti_2SnC, Ti_2TeC, V_2AlC, V_2GaC, V_2InC, and V_2SbC, suitable for exfoliation, with their stable MXenes (Ti_2C and V_2C) siblings. Expanding the exploration from MXenes into XMenes (anti- MXenes), the monolayer FeB with Pmma orthorhombic lattice was revealed to be a ferromagnetic metal with estimated critical temperature of 425 K, out-of-plane easy-axis and high magnetic anisotropic energy of 416.6μeV/Fe. Further, this novel 2D FeB material holds promise in spin-polarized current injection. These recent discoveries of 2D metallic monolayers, spanning from 2D metals to MXenes and to XMenes, present excellent candidates for further experimental investigations, concurrently enabling advancements in quantum and spintronic device applications.

Keywords: Metallic 2D materials, Superconductor, Exfoliating, Ferromagnetic.

Biography

Jiawei Tang is a PhD candidate at Southeast University. His research focuses on the computational study of metallic and low-dimensional materials using first-principles calculations and machine learning. His current work explores the structural stability, electronic properties, and potential applications of two-dimensional (2D) systems.

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Yunnan Key Laboratory of Metal-Organic Molecular Materials and Device, School of Chemistry and Chemical Engineering, Kunming University, China

Platinum-based nanocatalysts for fuel cells: Design, synthesis, and performance evaluation

As the global energy structure shifts toward clean and low-carbon solutions, Proton Exchange Membrane Fuel Cells (PEMFCs) have become one of the core technologies for new energy vehicles and distributed energy systems, owing to their high energy conversion efficiency and zero carbon emissions. However, the large-scale commercialization of fuel cells still faces critical challenges: The sluggish kinetics of the cathodic Oxygen Reduction Reaction (ORR) require reliance on high-loading Platinum (Pt)-based catalysts, leading to elevated costs. Furthermore, during the actual operation of fuel cells, the disordered arrangement of atoms can cause more reactive alloy elements to be susceptible to acid corrosion, thereby compromising the overall structure of the platinum alloy and significantly reducing the catalyst's activity and stability. Consequently, developing ORR catalysts with high activity, high stability, and low Pt usage is central to advancing fuel cell technology. Ordered structures, by enabling atomic-level precision in regulating the geometric, electronic, and interfacial properties of catalysts, can significantly enhance the performance of fuel cell catalysts. The design and application of ordered-structure catalysts offer a new pathway toward achieving high efficiency, low cost, and long lifespan in fuel cells. The design and synthesis of ordered-structure catalytic materials are closely related to the structure, composition, and phase diagrams of alloy systems. This study employs a phase diagram- guided approach encompassing the "design-synthesis-performance evaluation" of Pt-based nanocatalytic materials, laying the foundation for accelerating breakthroughs in key fuel cell catalyst technologies.

Biography

Jieqiong Hu Ph.D., is a researcher and Master's supervisor currently engaged in teaching and research at Kunming University. Her primary research focuses on nanomaterial chemistry and phase diagram thermodynamics. In recent years, She has led two projects funded by the National Natural Science Foundation of China and five provincial and ministerial-level projects. She has published over 30 research papers as first author or corresponding author, obtained three national invention patents, and developed one group standard as the primary contributor.

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Supercritical assisted synthesis of controlled release formulations for sustainable agriculture

Water scarcity, soil degradation, and inefficient agrochemical delivery are critical constraints to sustainable and climate resilient agriculture. This study presents the synthesis of Controlled Release Formulations (CRFs) using Supercritical Carbon Dioxide (SCC) as an environmentally sustainable processing approach that eliminates toxic organic solvents. The designed CRFs aim to enhance soil water retention, enable controlled herbicide delivery, and undergo complete biodegradation without generating harmful residues. Biomass processing involved sequential dewaxing and fractionation, yielding 7.48% wax, 44.3% cellulose, 48% lignin, and 0.19% hemicellulose, confirming its suitability as a renewable and sustainable structural framework. Herbicide loading was subsequently achieved using SCC as a solvent free and green medium. The CRFs were synthesised by incorporating the herbicide into a pre-synthesized biohydrogels matrix via polymerization of acrylamide, using bisacrylamide as the crosslinker and AIBN as the initiator, followed by grafting onto biomass derived components. Morphological and physicochemical analyses verified the formation of a network structure loaded with herbicide and influenced by SCC processing parameters. The results demonstrates that under simulated soil conditions, the synthesized CRFs exhibited up to 200% water absorption capacity, high porosity, and progressive biodegradation driven by microbial activity. Electrochemical modelling of release kinetics demonstrated a sustained and controlled herbicide release profile, effectively reducing leaching and environmental persistence. Overall, these multifunctional CRFs function as eco-friendly soil conditioners that integrate water conservation with efficient herbicide delivery, offering a scalable and low impact strategy for sustainable and climate resilient agricultural systems.

Biography

Jyoti Maheshwari is a research scholar at G. B. Pant University of Agriculture and Technology, Uttarakhand, India. Her entire academic journey has been completed in India. She obtained her bachelor's degree in science (2018) and master's degree in science (2020) from D.S.B. Campus, Nainital, Uttarakhand, and is currently pursuing a Doctor of Philosophy under the guidance of Professor M. G. H. Zaidi in the Department of Chemistry at G. B. Pant University of Agriculture and Technology. Her research contributions span polymer science, electrochemistry, and supercritical technology. She serves as the Principal Investigator of a project supported by the Department of Science & Technology, focused on advancing research dissemination in science and technology. Jyoti Maheshwari is a meticulous, analytical, and problem-solving researcher with seven scholarly publications, including research articles and book chapters.

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Polymer nanocomposites for microbial fuel cells

With the burgeoning energy demand, an alternative source for energy recovery has been under rapid investigation recently. Microbial Fuel Cells (MFC) a bioelectrochemical device that utilizes the oxidation of organic compounds directly into electricity. The recent massive research on MFC can be related to its dual application in bioelectricity production, along with simultaneous wastewater treatment. Among the parameters studied, membranes in MFC play an ideal role of electrode separation, inhibiting crossover, and maintaining the integrity. Traditionally, Nafion®117 has been utilized as the standard for many types of fuel cells. However, the fluorinated backbone, cost, and fuel crossover research have been oriented towards alternative polymers with superior characteristics. Our research group focuses on biodegradable polymers such as 1,4-Polyphenylene Ether Ether Sulfone (PEES) and Polyether Ether Ketone (PEEK), which have been sulphonated to improve ion conductivity. The direct sulphonation promotes better ion transfer compared to Nafion, where the proton heads responsible for ion exchange are located in the side chain. Additionally, nanoparticles in the sulphonated form were dispersed in the polymer solution to create polymer nanocomposites, promoting both the Grotthus and vehicular mechanisms of ion transfer. The present research will emphasize various polymer nanocomposites and their improved characteristics for their application in MFC. Major characterization techniques used for identification and the membrane properties required are discussed in detail. Further, the performance of polymer nanocomposites will be elaborated.

Biography

Dr. K. Vaidhegi is an Assistant Professor in the School of Life Sciences, Crescent University, India. She received her Ph.D. under the guidance of Prof. Dr. D. Sangeetha at Anna University, India, in 2021. Her research area is Environmental Biochemical engineering, focusing on polymer nanocomposites for bioelectricity production and wastewater treatment. Additionally, she also

works on microbial communities involved in electron transfer and polymer nanocomposite hydrogels for biological applications. She has published more than 15 journal articles in reputed journals and about 5 book chapters.

Keisuke Kataoka*, Bun Tsuchiya, Shigeya Naritsu
Meijo University, Japan

Registry-dependent adhesion and corrugation tendency of graphene on Al_2O_3(0001): DFT energy landscapes and continuum insights

Graphene on sapphire (Al_2O_3(0001)) is an important model system for scalable growth and device integration, yet atomistic predictions of long-wavelength corrugation and its sensitivity to in-plane strain and registry remain unsettled. Here we combine Density-Functional Theory (DFT) calculations with a minimal continuum interpretation to quantify how the substrate potential and graphene elasticity compete to select (or suppress) corrugation.

Using Quantum ESPRESSO with PAW pseudopotentials and the PBEsol functional, we map the vertical adhesion landscape E(z) for multiple lateral registries within commensurate supercells (e.g., 3×3 and 6×6) under a few-percent in-plane mismatch representative of experimental conditions. We assess robustness of the equilibrium separation and curvature against common interface treatments, including Grimme-D3 dispersion and dipole corrections for asymmetric slabs. Across these settings, the equilibrium separation is reproduced consistently, while the curvature of E(z) can change measurably, providing a practical metric for how vdW and electrostatic corrections modify the effective out-of-plane restoring force.

To probe corrugation, we introduce controlled single-mode height modulations and relax ionic positions starting from finite amplitudes. Within the accessible cell sizes, the system frequently relaxes back toward a flat graphene sheet, indicating that spontaneous symmetry breaking into a corrugated state is not guaranteed at short wavelengths. Interpreting the DFT-derived E(z) as an effective substrate potential Vsub(h), we connect these observations to a continuum balance between bending rigidity, in-plane stretching, and the weak lateral periodicity of the substrate potential. This framework clarifies why a critical wavelength (and/or strain) is expected for buckling-type instabilities and suggests an efficient route to estimate the onset by combining DFT energy curvatures with elastic constants.

Our results provide a reproducible protocol for registry-resolved adhesion energetics and a transparent explanation for when corrugation should (or should not) emerge in DFT, offering guidance for future large-supercell calculations and for interpreting experimentally reported moiré-scale rippling on sapphire-supported graphene.

Biography

Keisuke Kataoka is a faculty member at Meijo University, Japan. His research broadly centers on computational physics approaches to condensed matter and materials systems, with particular interest in oxide and two-dimensional material interfaces. He employs large-scale first-principles simulations using density functional theory, together with multiscale modeling frameworks, to study interface energetics, structural corrugation, and strain-driven instabilities. His work aims to provide a unified understanding of how atomic-scale interactions and mechanical effects shape emergent behaviors in complex material interfaces.

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Research on degradation and failure mechanisms of Un-clamped-Inductive-Switching characteristics of p-GaN HEMT device

Single UIS and repetitive UIS experiment are performed in this article to expound physical failure mechanisms in P-GaN HEMT devices. Vpeak and Ipeak are used as the metrics to evaluate the degradation of electrical parameters. In the single UIS tests, different load inductors, off-gate voltage and ambient temperature are chosen as var-iables to observe the failure phenomena in the Device Under Test (DUT), while in the repeated UIS tests, the threshold voltage, on-state resistance, blocking characteristics and gate leakage current degradation and recovery are concluded and analyzed that V^{th} presents a negative shift, Ron and BV are restored to their initial value, and gate leakage shows a significant reduction at first and then, after a duration of lagging, gradually recovers to some extent, but is unable to achieve its initial value. Combining failure point analysis via decapping with TCAD simulation and validation, it is found that hole trapping/detrapping in the p-GaN region dominate Vth and Igss degradation, while electron traps in the buffer dominate Ron and BV degradation.

Biography

Li Liu, now associated professor in School of Microelectronics of Xidian University, my research field is around Novel devices of Wide band gap semiconductor and its reliability. During 2013.07-2014.07, I acted as a associated research in Wide band lab in Auburn University, hosted by Dr. Sarit Dhar, in 2017.7-2017.10, as a visiting scholar in EE lab in Auburn university, in 2022.4-2023.4, as a visiting scholar in University of Bristol, and hosted by Dr. Saeed Jahdi.

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Microstructure and texture evolution of hydro formed austenitic stainless steel tubes

Tube hydro forming is carried out to produce hollow shaped components using tubular blanks. These components find extensive application in automobile and aerospace engineering. In this work, TIG welded tubes of austenitic stainless steel (304) of different lengths, deformed into bulge shape using hydraulic press with the help of water intensifier system and tube bulging setup. Microstructure, texture evolved of deformed tubes were evaluated.

Biography

Dr. Krishnam Raju was a Ph.D. graduate from IIT Bombay, with specialization in Mechanical Metallurgy. His areas of research includes tube hydroforming and texture evolution, Tailor weld blank forming and texture evolution, sheet forming through deep drawing and texture evolution and cryogenic forming of austenitic stainless steel sheets.

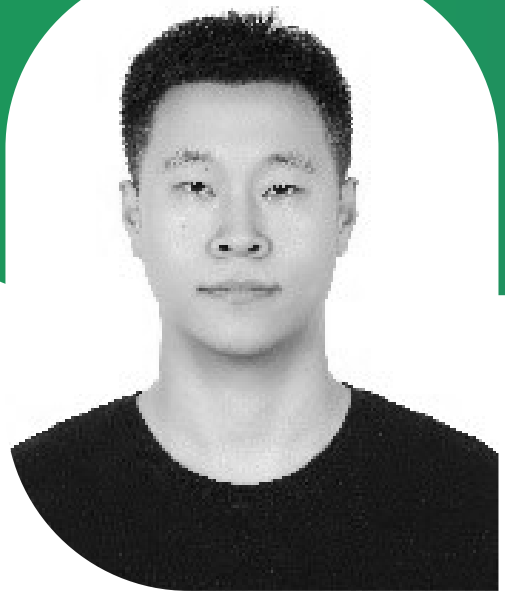
Dr. Małgorzata Obrycka
University of Gdańsk, Poland

Nanotechnology and eyetracking: Ethical challenges in educational research

Nanotechnology and eye tracking are two distinct fields that have the potential to complement each other, revolutionizing how we explore and interact with our surroundings, such as between students and schools. Nanotechnology, engineering at the atomic and molecular level, has the potential to significantly improve current eye tracking systems. Currently, eye tracking technologies often rely on bulky infrared cameras and sensors. Nanotechnology allows for the creation of smaller, more efficient, and more discreet devices.

Biography

Malgorzata Obrycka is a Doctor of Social Sciences, educator, and psychologist. Author of eye-tracking, phenomenographic, and social studies reports. Her research interests include research methodology, including research on interpersonal and interspecies humanitarianism, with particular focus on the analysis of the development of human moral identity in the context of contemporary civilizational and cultural dilemmas, independent ethics, communication, technology, praxeology, posthumanism, and transhumanism. Her research to date encompasses research commercialization, the impact of science on the economy and society, as well as issues related to ethical education, family pedagogy, the history of education, social research methodology, and social relations, including assessing the usefulness of research methods, techniques, and tools appropriate for identifying educational phenomena.



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Investigation on forming limits under complex loading paths considering intermediate annealing: Experiments and multi-scale simulations

Multi-stage forming processes typically involve complex loading and annealing sequences that substantially alter the microstructure and macroscopic formability. The process-induced microstructural changes, such as lattice rotation, dislocation accumulation, and recrystallization, make it challenging to accurately predict forming limits using conventional approaches. An integrated multi-scale simulation framework was developed that coupled Crystal Plasticity Finite Element simulations (CPFE) with a Cellular Automaton (CA) model and incorporated the Marciniak–Kuczynski (MK) instability criterion to evaluate forming limits under various multi-stage processing routes. The two-stage loading tests were performed under uniaxial and biaxial prestrain conditions to quantify the influence of loading path history on subsequent instability behaviour. Additional annealing experiments following different prestrain levels were carried out to assess the extent of formability recovery. Based on the experimental results, the CPFE and CA models were employed to simulate the deformation and annealing processes, respectively.

The results indicate that prestrain significantly reduces the forming limit during subsequent loading, and the extent of degradation strongly depends on the strain path. The dislocations accumulated during the prestrain process diminish the material's ability to undergo subsequent uniform plastic deformation. As the prestrain increases, the internal dislocation density and local defects become more pronounced, further reducing the strain-hardening capacity of the material and making critical instability more prone to occur. Annealing after prestrain effectively restores formability by reducing dislocation density and promoting recrystallization. Particularly under higher prestrain conditions, annealing produces the

most pronounced improvement in the forming limit near the plane-strain state, while the enhancement of the uniaxial and equi-biaxial tensile strain points is relatively comparable. Under different prestrains, the forming limit curves after annealing become relatively close to one another, indicating that the annealing treatment mitigates the influence of prestrain level differences on the forming limits. The established CPFE–CA–MK simulation framework effectively captures the combined effects of deformation accumulation and recrystallization on forming limits during the reloading process, successfully reproducing the evolution of forming limits under various prestrain and annealing conditions, and showing good agreement with the experimental results. The proposed multi-scale coupled simulation model provides a reliable basis for process design and formability evaluation in multi-stage forming of complex thin-walled components.

Biography

Mingliang Men is currently a Ph.D. candidate from School of Mechanical Engineering and Automation of Beihang University in China. Research interests focus on multi-process forming and multi-scale simulation of complex thin-walled metal components. The current work emphasizes integrating experimental characterization with computational modelling to understand microstructure–property relationships and to improve the formability of advanced alloys.

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Pulsed laser deposited YIG nanolayers on silicon for spintronic applications

Yttrium Iron Garnet ($Y_3Fe_5O_{12}$, YIG) is a benchmark magnetic insulator that has attracted sustained interest for spintronic and magnonic applications due to its exceptionally low magnetic damping, high saturation magnetization, excellent microwave performance, and outstanding radiation stability. In addition, YIG exhibits a high Curie temperature and a simple cubic crystal structure, making it an ideal platform for low-loss spin-wave propagation and coherent spin transport. For practical implementation in next-generation spin-based and hybrid electronic devices, the integration of high-quality YIG thin films with semiconductor technology—particularly silicon—remains a critical materials challenge because of lattice mismatch, interfacial strain, and stringent phase-stability requirements. In the present work, YIG nanolayers were deposited on silicon substrates using Pulsed Laser Deposition (PLD) under carefully optimized growth conditions. High-density YIG targets were fabricated from powders synthesized via a citrate combustion route, employing stoichiometric metal nitrates and controlled thermal processing to ensure phase purity. Thin-film deposition was carried out at substrate temperatures in the range of 500–600°C under high vacuum, followed by in situ post-deposition annealing at 700°C to improve crystallinity and phase formation. X-ray diffraction analysis confirms the successful formation of the crystalline YIG phase on silicon substrates, with film thicknesses ranging from approximately 70 to 140nm. A systematic investigation of the structural and magnetic properties of the deposited nanolayers is presented, with particular emphasis on the influence of deposition parameters on phase stabilization, crystallinity, and magnetic response. The results indicate that appropriate control of growth and annealing conditions enables the realization of magnetically functional YIG nanolayers on silicon. Overall, this study demonstrates a viable materials-processing route for integrating YIG nanolayers with silicon platforms. The findings are relevant for the development of silicon-

compatible spintronic and magnonic devices and provide insights into the structure–property relationships governing garnet thin films grown on technologically important semiconductor substrates.

Biography

Dr. Mukesh C. Dimri is an experimental physicist with extensive expertise in magnetic materials, multiferroic oxides, and functional thin films. His research focuses on understanding structure–property correlations, magnetic phase evolution, and spin-dependent phenomena in oxide materials relevant to spintronic and magnonic applications. He has significant experience in thin-film growth, structural characterization, and magnetic measurements, with particular emphasis on garnet and perovskite oxide systems. Dr. Dimri is currently an Assistant Professor of Physics at Jaypee University of Engineering and Technology, Guna, India, where he is actively engaged in teaching, research supervision, and the development of advanced materials research programs.

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Harnessing silver nanoparticles with pretomanid for enhanced antimycobacterial therapy

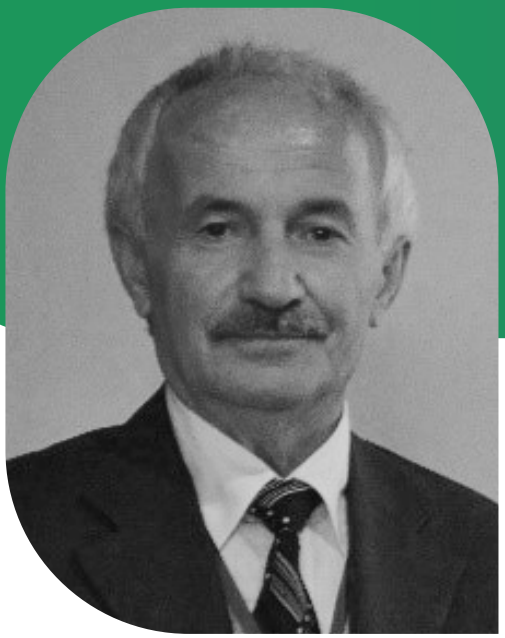
The emergence of Multidrug-Resistant Mycobacterium Tuberculosis (MDR-TB) necessitates the development of novel therapeutic strategies to enhance antimycobacterial efficacy. This work explores the potential synergy between Silver Nanoparticles (AgNPs) and Pretomanid, a novel nitroimidazo-oxazine anti-TB agent, to improve drug distribution and bactericidal action. AgNPs were produced using a green chemical reduction technique, and they were subsequently loaded with Pretomanid to form a stable nanosystem. The nanoconjugates were examined using Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM). SEM investigation showed mostly spherical nanoparticles with sizes between 15 and 25nm, a homogeneous dispersion, and little aggregation. Pretomanid's internalization within the AgNP matrix was verified by TEM imaging, which also showed distinct electron-dense cores, signifying effective drug loading and stable encapsulation. Increased surface area, which is essential for contact with mycobacterial cells, was suggested by the surface morphology. AgNP-Pretomanid conjugates showed far more inhibitory efficacy against the M. tuberculosis H37Rv strain than free Pretomanid, with A Minimum Inhibitory Concentration (MIC) reduction of about 40%, according to in vitro antimycobacterial studies. The enhanced effectiveness is caused by two mechanisms of action: premanid-induced respiratory inhibition in hypoxic environments and silver-mediated bacterial cell membrane disruption. Cytotoxicity tests on human macrophage cell lines confirmed the biocompatibility of the nanoconjugates at therapeutically relevant concentrations. This study highlights the potential of AgNP-based drug delivery systems to boost the efficacy of currently available anti-TB medications. The importance of nanoparticles in enhanced antimycobacterial activity was confirmed by SEM and TEM studies, which provided vital information about their size distribution, shape, and drug loading effectiveness. All things considered, by improving drug delivery and generating

synergistic antibacterial effects, the AgNP-Pretomanid nanoconjugates present a possible treatment approach for drug-resistant tuberculosis.

Keywords: Silver Nanoparticles, Pretomanid, Antimycobacterial Therapy, Cytotoxicity, Stability.

Biography

Nitasha Pathak Joshi is an experienced pharmaceutical professional with over ten years of expertise in drug discovery, regulatory compliance, and analytical research. She holds an M.Pharm in Drug Discovery and is currently working as a Research Scientist at the Indian Pharmacopeia Commission, Ghaziabad. Her work includes regulatory document review, analytical method validation, stability studies, and handling advanced instruments such as HPLC and LC–MS. She has led major regulatory audits and training programs and is recognized for her strong analytical, leadership, and compliance-oriented approach.



Osman Adiguzel
Firat University, Department of Physics, Elazig, Turkey

Shape reversibility and the role of thermomechanical treatments in memory behavior of shape memory alloys

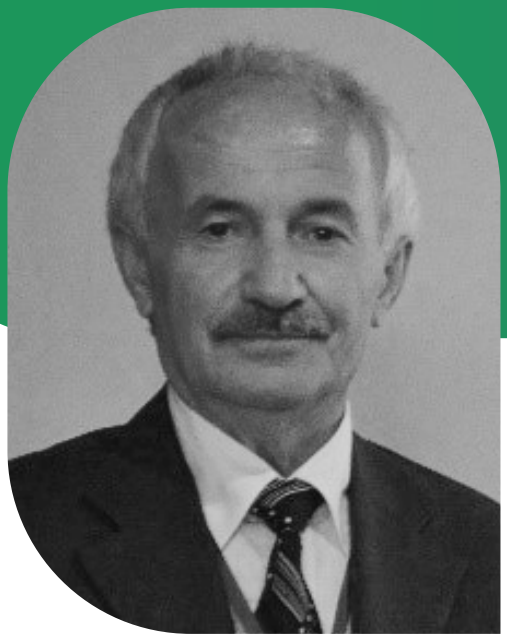
Shape memory alloys are thermoresponsive materials and take place in a class of advanced smart materials by exhibiting dual memory characteristics, shape memory effect and superelasticity. Shape memory effect is initiated with thermomechanical processes on cooling and deformation and performed thermally on heating and cooling, with which shape of the material cycles between original and deformed shapes in reversible way, and this behavior can be called thermoelasticity. Shape memory effect is governed by thermomechanical transformations, in crystallographic level, thermal and stress induced martensitic transformations. Thermal induced martensitic transformation occurs on cooling with cooperative movement of atoms in <110> -type directions on {110} - type close packed planes of austenite matrix, along with lattice twinning and ordered parent phase structures turn into the twinned martensite structures, and twinned structures turn into detwinned martensite structures by means of stress induced martensitic transformations with deformation. Atomic movements are confined to the nearest atom distances, and martensitic transformations have diffusionless character. Superelasticity is performed with stressing and releasing the material in elasticity limit at a constant temperature in the parent austenite phase region, and shape recovery occurs immediately upon releasing, by exhibiting elastic material behavior. Superelasticity is also result of stress induced martensitic transformation, and the ordered parent phase structures turn into the detwinned martensite structures with stressing. However, thermomechanical processes play important role in Thermoelasticity, whereas Superelasticity is performed mechanically. Copper based alloys exhibit this property in metastable β-phase region. Lattice twinning is not uniform in these alloys, and the ordered parent phase structures undergo the layered structures with martensitic transformation.

In the present contribution, x-ray and electron diffraction studies were carried out on ternary copper based CuZnAl and CuAlMn alloys. X-ray diffraction profiles and electron diffraction patterns exhibit super lattice reflections. A series of x-ray diffractogram were taken during aging. X-ray diffractograms taken in a long-time interval show that locations and intensities of diffraction peaks change with the aging time at room temperature, and this result refers to the redistribution of atoms in diffusive manner.

Keywords: Shape Memory Effect, Martensitic Transformation, Thermoelasticity, Superelasticity, Twinning, Detwinning.

Biography

Dr. Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey. He 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 230 online conferences in the same way in pandemic period of 2020-2024. He supervised 5 PhD- theses and 3 M.Sc- theses. Dr. Adiguzel 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.



Osman Adiguzel
Department of Physics, Firat University, Elazig, Turkey

Dual memory characteristics and crystallographic transformations in shape memory alloys

Shape memory alloys take place in a class of advanced smart materials by exhibiting dual memory characteristics, shape memory effect and superelasticity. Shape memory effect is initiated with thermomechanical processes on cooling and deformation and performed thermally on heating and cooling, with which shape of the materials cycle between original and deformed shapes in reversible way. Therefore- this behavior can be called Thermoelasticity. This phenomenon is governed by crystallographic transformations, thermal and stress induced martensitic transformations. Thermal induced martensitic transformation occurs on cooling with cooperative movements of atoms by means of lattice invariant shears in <110> -type directions on the {110}-type planes of austenite matrix, along with lattice twinning and ordered parent phase structures turn into the twinned martensite structures. The twinned structures turn into the detwinned structures by means of stress induced martensitic transformation with deformation in the martensitic condition. Third step is heating, and crystal structure of the materials turn into ordered parent phase structure by means of reverse austenitic transformation.

Superelasticity is performed with stressing and releasing the material in elasticity limit at a constant temperature in parent phase region, and shape recovery is performed simultaneously upon releasing, by exhibiting elastic material behavior. Superelasticity is also result of stress induced martensitic transformation and ordered parent phase structures turn into detwinned martensite structure with stressing. However, crystal structure of the materials cycles between detwinned martensite and ordered parent phase structures on stressing and releasing.

Copper- based alloys exhibit this property in metastable β-phase region, which has bcc-

based structures at parent phase field. Lattice twinning is not uniform in these alloys and gives rise to the formation of complex layered structures. The layered structures can be described by different unit cells as 3R, 9R or 18R depending on the stacking sequences on the close-packed planes of the ordered lattice.

In the present contribution, x-ray and electron diffraction studies were carried out on two copper- based CuAlMn and CuZnAl alloys. X-ray diffraction profiles and electron diffraction patterns exhibit super lattice reflections. X-ray diffractograms taken in a long-time interval show that diffraction angles and intensities of diffraction peaks change with the aging duration at room temperature. This result refers to the rearrangement of atoms in diffusive manner.

Keywords: Shape Memory Effect, Martensitic Transformation, Thermoelasticity, Superelasticity, Twinning, Detwinning.

Biography

Dr. Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey. He studied at Surrey University, Guildford, UK, as a post-doctoral research scientist in 1986-1987, and studied were focused on shape memory effect in shape memory alloys. He worked as research assistant, in 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. He supervised 5 PhD- theses and 3 M.Sc- theses and 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 230 online conferences in the same way in pandemic period of 2020-2024. 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.

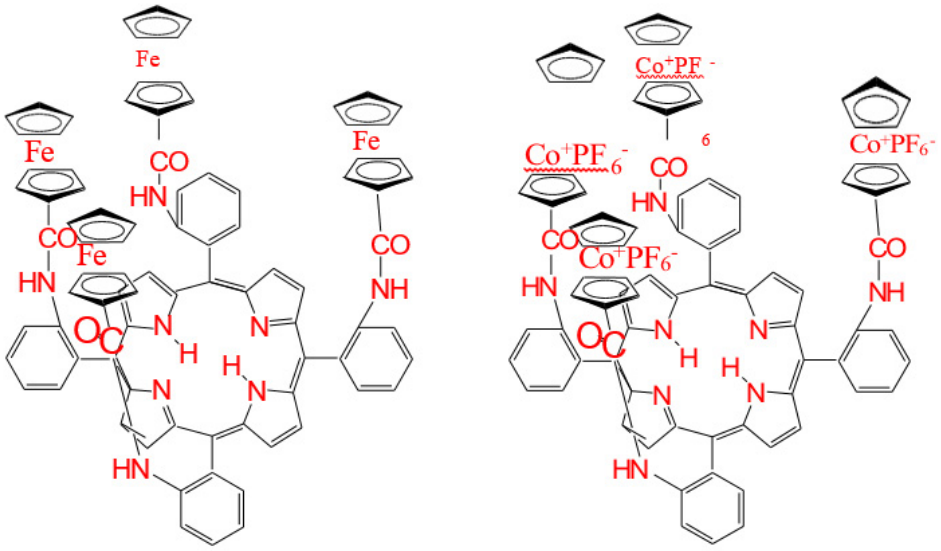
Raymond C. Jagessar

Department of Chemistry, Faculty of Natural Sciences, Turkeyen Campus, Greater Georgetown, Guyana, South America

Porphyrins as Nanosensors

Nanosensors are one type of sensors. Others include bio-sensors, catalytic sensors, electrochemical sensors. Nanosensors are nanoscale devices that are constructed to identify a particular molecule, biological, medicinal or environmental component and operate within the nanoscale dimensions. Nanosensors convert chemical data such as the concentration of a single sample component to complete composition analysis into an analytically usuable signal. Nanosensors are quite superior to conventional sensor and possess several advantages over conventional sensors. These include amongst others: greater adsorptive capacity due to large surface area to volume ratio, greater modulation of electrical properties such as capacitance, resistance etc. upon exposure to analytes, exceptional electrical conductivity and compatibility with biological systems. Porphyrins nanosensors have been receiving increasing attention. Recent years have seen a significant advancement in the development of porphyrin-based nanoarchitectures for sensing applications. Porphyrins, the tetrapyrrolic pigments of life are known for their remarkable electronic, optical, and catalytic properties. Their rich 18π electron conjucated nature have made it possible for their use as optical electrochemical sensors. They have been innovatively integrated into various nanoarchitectures such as nanoparticles, nanocomposites, nanotubes, nanosheets, and other nanostructures, each offering unique advantages for specific sensing scenarios. Advances in porphyrin chemistry have provided novel materials and exciting technologies for bioanalysis such as Colorimetric Sensor Array (CSA), Photo-Electrochemical (PEC) biosensing, and nanocomposites as peroxidase mimetics for glucose detection. This presentation outlines some recent advances using Porphyrins as nanosensors.

Keywords: Nanosensors, Nanoscale Dimensions, Porphyrins Nanosensors, Opto Electronic, Calorimetric Sensor Array.



Biography

Prof. R.C. Jagessar, BSc, PhD, PDF, CChem, FRSC, DipEd (higher edu.), FCAS Prof. Raymond Jagessar obtained his BSc (Distinction) in Chemistry/Biology from the University of Guyana (1992) and his PhD from the UK (1995). He was Assistant Lecturer at the University of Guyana, 1991-1992. He held three Post Doctoral Research Fellowships (PDF) at the University of South Carolina, Columbia (USA), Wichita State University, Kansas (USA) and the University of the West Indies during the period, 1996-1999. He is also accredited with a distinction in DiPEd (higher education) at the University of Guyana in 2022. He has several international awards, amongst them are Chartered Chemist, CChem, Fellow of the Royal Society of Chemistry, FRSC, UK, Research Grants etc. He is an awardee of the Guyana Innovation Prize and a Fellow of the Caribbean Academy of Sciences. His research interests are broad, covering the spectrum of Pure and Applied Chemistry, Chemical Biology and Pharmaceutical Chemistry. He has published over one hundred (100) research articles, five book chapters, one book, three e-books and presented at over 100 conferences locally, regionally and internationally. He has given keynote presentations at several conferences at the international forum. He is a member of several editorial boards and reviewer to several journals. He is currently Professor of Chemistry at the University of Guyana (South America), former President of the Caribbean Academy of Sciences (2020-2023) and currently, Foreign Secretary of the Caribbean Academy of Sciences.

Raymond C. Jagessar

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Porphyrin nanocomposites in nanotechnology

Nanocomposite is a multiphase solid material where one of the phases has one, two or three dimensions of less than 100 nanometers (nm) or structures having nano-scale repeat distances between the different phases that make up the material. Incorporation of the different phases seem to enchance the use of either single phase. Porphyrins are tetrapyrrolic compounds and have been called the "pigments of life". They have been used in Photodynamic and Sonodynamic therapy, magnetic resonance, fluorescence and photoacoustic imaging. However, their use in clinical medicine is limited due to their high hydrophilicity and stacking properties. Porphyrin solubility have been improved via the formation of some porphyrin composites. Porphyrins have been successfully incorporated into nanocomposites, showcasing their versatility and potential in various applications. Some of these nanocomposites have been prepared using the solution casting process. Examples of porphyrin nanocomposites include: Chitosan-Porphyrin Nanocomposite Films, Multifunctional Nanoparticles, CeO2/ Porphyrin Nanocomposites, Porphyrin, Phthalo cyanines nanocomposites etc. Porphyrin nanocomposite films have exhibited enhanced optical characteristics, including a reduced band gap and increased refractive index, due to the incorporation of porphyrin. This has potential applications in solar cells and other optical devices. Porphyrin nanocomposites have found application in biomedicine, Photodynamic Therapy (PDT), catalysis, electronics, and sensors, enhanced photocatalytic efficiency for degrading organic pollutants in environmental remediation. Some porphyrins composites due to their improved hydrophilicity has allowed for drug delivery, healing and repairing of damaged organs etc. This presentation outlines recent advances in Porphyrins nanocomposites and their applications.

Keywords: Porphyrins Nanocomposites,, Nanotechnology, Chitosan-Porphyrin Nanocomposites, CeO2/Porphyrin Nanocomposites.

Biography

Prof. R.C. Jagessar, BSc, PhD, PDF, CChem, FRSC, DipEd (higher edu.), FCAS Prof. Raymond Jagessar obtained his BSc (Distinction) in Chemistry/Biology from the University of Guyana (1992) and his PhD from the UK (1995). He was Assistant Lecturer at the University of Guyana, 1991-1992. He held three Post Doctoral Research Fellowships (PDF) at the University of South Carolina, Columbia (USA), Wichita State University, Kansas (USA) and the University of the West Indies during the period, 1996-1999. He is also accredited with a distinction in DiPEd (higher education) at the University of Guyana in 2022. He has several international awards, amongst them are Chartered Chemist, CChem, Fellow of the Royal Society of Chemistry, FRSC, UK, Research Grants etc. He is an awardee of the Guyana Innovation Prize and a Fellow of the Caribbean Academy of Sciences. His research interests are broad, covering the spectrum of Pure and Applied Chemistry, Chemical Biology and Pharmaceutical Chemistry. He has published over one hundred (100) research articles, five book chapters, one book, three e-books and presented at over 100 conferences locally, regionally and internationally. He has given keynote presentations at several conferences at the international forum. He is a member of several editorial boards and reviewer to several journals. He is currently Professor of Chemistry at the University of Guyana (South America), former President of the Caribbean Academy of Sciences (2020-2023) and currently, Foreign Secretary of the Caribbean Academy of Sciences.

Saida Benhmida

Higher Institute of Medical Technology, Tunis El Manar University, Tunisia

Finite element simulation of tibial insert mechanical behavior using polyethylene materials

Tibial inserts in total knee prostheses are designed to replicate the mechanical properties of native articular cartilage by ensuring load distribution, stress absorption, and low-friction articulation. The mechanical properties of three polyethylene-based materials—Ultra-High Molecular Weight Polyethylene (UHMWPE), Crosslinked Polyethylene (XLPE), and Highly Crosslinked Polyethylene (HXLPE)—that are frequently utilized for tibial implants are examined in this work. The tibial insert geometry, material property assignment, meshing, boundary condition definition, and application of compressive loading representative of physiological knee joint forces were all part of the structured workflow used to carry out finite element simulations using SolidWorks Simulation. Simulation outcomes reveal marked differences in the mechanical response of the three materials. While XLPE showed intermediate stiffness with balanced deformation and stress distribution, UHMWPE showed the most deformation and most compliant load-bearing behavior. Reduced deformation but increased stress concentrations were the results of HXLPE's maximum stiffness and lowest strain. These results indicate that UHMWPE behaves more similarly to a compliant insert, whereas HXLPE provides greater structural stability but may transmit higher stresses to adjacent components. This work provides a comparative mechanical evaluation of polyethylene materials for tibial inserts and offers quantitative data to guide material selection in knee prosthesis design, durability assessment, and computational modeling of joint biomechanics.

Biography

Saida Benhmida is a researcher specializing in biomechanics. She obtained her Ph.D. in Biophysics, Medical Physics and Medical Imaging from Tunis EL Manar University in 2021. She

worked as a post doc researcher at the Laboratory of Biophysics and Medical Technologies at the Higher Institute of Medical Technologies in Tunis. Where she worked on the numerical modeling of the viscoelastic behavior of human trabecular bone. Her work focuses mainly on multiphysics simulation, the rheology of biological fluids, and the mechanical analysis of musculoskeletal tissues. She has published several articles in indexed scientific journals, presented her work at international conferences, and supervises master's students. His research interests include tissue viscoelasticity, advanced numerical simulation (Python, Abaqus, and SolidWorks), biomaterial mechanics, and the application of constitutive models to osteoarticular pathologies.

Sanchez Amono María Paz

CEVE (Experimental Center for Affordable Housing) AVE-CONICET. Córdoba, Argentina

Innovative and sustainable building components. Study case: Rubber and plastic roofing tiles

Currently, the excessive generation of waste constitutes one of the most serious environmental problems, aggravated by social consumption models.

At the Experimental Center for Economic Housing, a research institute dependent on the Association of Economic Housing-AVE and the National Council for Scientific and Technical Research-CONICET, one of the research areas called the New Materials Area-NM, focuses on the use of waste for the production of construction components, and subsequent transfer. The components developed are innovative due to their composition, as they utilize urban and industrial waste. This waste comes from the separate collection of household waste, or from the scrap resulting from the production process. These components have been used to build homes that are ecologically sustainable, technically sound, and low cost.

To date, the following have been developed: PET bricks, fungal mycelium boards, Tetra Pak panels, plastic lumber, WEEE bricks, etc. Another development is the production of roof tiles and ridge tiles made from recycled rubber and plastic.

This technology is manufactured using two abundant waste materials: Rubber and polyethylene. They offer excellent technical advantages: Lower specific weight, low water absorption, resistance to hail, flexing, and freezing, and low thermal conductivity. They have a certificate of technical suitability and a patent.

Biography

Sanchez Amono María Paz is an Architect, graduated from the Faculty of Architecture at the Catholic University of Córdoba, and holds a Diploma in Circular Economy and Sustainability Strategies from UNC-EnteBioCba. She completed her PhD in Materials Engineering at the National Technological University-FRC. She has worked as a Labeler for the Housing Labeling Program at the National Energy Secretariat and serves as an Assistant Researcher in the New Materials Area at CEVE, CONICET's Center for Experimental Housing for Affordable Housing. In addition, she is an undergraduate and graduate professor. Her roofing tile project has obtained a certificate of technical suitability and a patent, received funding from the 3C Acceleration Fund, and was awarded Best Tire-Derived Product at the 2021 Recircle Awards.

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[2]Department of Chemistry, University of Miami, Florida, 33143

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[4]Department of Materials Engineering, Czech Technical University, Prague, 16000

[5]School of Energy Materials, Mahatma Gandhi University, Kottayam, Kerala, India, 686560

Investigation of effect of nano kaolinite as a filler in the coarse wool-vinyl ester composite

In the reported work, wool fabric was coated with vinyl ester resin and subsequently composites were developed. To increase the mechanical properties of the composite, nano kaolinite was used as a filler. The effect of nano kaolinite in the physico-mechanical properties, surface morphology, moisture content, water contact angle, water diffusion and aging characteristics of the wool-vinyl ester resin composite was analyzed using various analytical methods. The inclusion of nano kaolinite significantly improved the tensile and impact strength of wool-vinyl ester resin composite. The SEM images depict a good adhesion between the wool fibre and the vinyl ester resin. The presence of nano kaolinite in the composite caused marginal reduction in the water contact angle and increase in the water diffusion properties. The FTIR spectra showed absence of chemical interaction between the nano kaolinite, wool fibre and vinyl ester resin. The thermal and UV aging properties of the wool- vinyl ester composites were improved with the addition of nano kaolinite, however the developed composites showed poor biodegradation.

Biography

Seiko Jose is a scientist, working at Central Sheep and Wool Research Institute, Avikanagar, Rajasthan, India. He is specialized in Textile Chemistry and having more than 19 years of experience in textiles. He is having seven years of experience in the cotton, silk, and linen processing industry. In the past ten years of his research, he has handled many natural fibres like, jute, pineapple leaf fibre, coconut fibre, flax, silk, wool, ramie, etc. He contributed to 62 research articles and 23 book chapters. His major research areas are extraction and characterization of natural fibre, utilization of agro residues, textile dyeing and finishing, eco-friendly textile processing, nano technology and fibre composites. His Google citations are more than 2300. He edited 6 books in the field of textiles, and composites with reputed publishers namely Wiley and Elsevier. He managed 17 industrial consultancy works in the national and international level. Currently is holding the position of Editor in 6 Journals. Research Interest: Natural fibre, wool, fibre composites, sustainable materials.

Sergey G. Lebedev

Department of experimental Physics, Institute for Nuclear Research of Russian Academy of Sciences Moscow, Russian Federation

Pseudo magnetic field, with a strength of hundreds of teslas in the nanographite films

Report describes some unusual electromagnetics things of Nanocrystalline Graphite (NG) films. One of them is conductivity switching from high to very small value when the transport current goes beyond a certain critical magnitude (this may be used in electrical commutator) In the report, an attempt is made to explain the appearance of coherent optical radiation upon conductivity switching in NG films by the occurrence of pseudo magnetic field in the NG film.

Biography

Sergey G. Lebedev was born in 1956 in the city of Kursk, Russia. Dr. Sergey G. Lebedev has graduated from the Moscow Physical Engineering Institute in 1980. In 1983 S. G. Lebedev has graduated from Dept. of Mathematics of the Lomonosov Moscow State University. Since 1980 up to now he has worked at the Institute for Nuclear Research of Russian Academy of Sciences. In 1990 S. G. Lebedev has obtained his PhD. Dr. Lebedev is the author of about 150 scientific articles. The whole point of his life is in science and his whole life devoted to science. The prime interests of S. G. Lebedev are in the solid-state physics and superconductivity. Now he occupied the position of Senior Scientist, Head of research team.

Silvie Maria Tanu Halim[1*], Eugene Ng[2]

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Determination of phase stress flow curves in dual phase steels through micromechanical adaptive iteration algorithm

Finite Element (FE) micromechanical modelling has significantly advanced the simulation of Dual- Phase (DP) steels by incorporating key microstructural features such as phase distribution and strain partitioning. A major ongoing challenge, however, is the accurate determination of individual phase stress flow curves—essential inputs for predictive model accuracy. Conventional methods often depend on empirical equations derived from extensive experimental studies, which may not adapt well to variations in alloy composition or phase fractions.

This research introduces a numerical approach that integrates experimental uniaxial tensile test data with FE micromechanical models to address this challenge. Central to this methodology is the Micromechanical Adaptive Iteration Algorithm (MAIA), which iteratively solves for ferrite and martensite stress flow curves with minimal experimental data. MAIA operates in three main stages: Initialization, adaptive iteration, and validation. Its core strength lies in the adaptive iteration process, which accounts for strain partitioning between soft ferrite and hard martensite phases across different strain levels. The algorithm achieves convergence within two iterations, maintaining an error margin of 2–3%, and significantly reduces the need for extensive material characterization or empirical parameter fitting.

The method was applied to various DP steel types, including fine-grained DP steel alloyed with vanadium, DP steel with an equiaxed microstructure, and DP steel with an elongated microstructure. MAIA effectively captured the influence of vanadium on phase behavior, particularly the reduction of ferrite's strain contribution due to the increased strength of

martensite. It also successfully calculated stress flow curves for ferrite and martensite across samples with different chemical compositions and microstructures. In all cases, the model accurately reproduced experimental tensile responses by the second iteration, demonstrating strong predictive performance.

Despite these strengths, the approach has limitations. The current modelling framework does not account for fracture mechanisms, grain size variations and grain boundary effects. As a result, while MAIA provides reliable estimates of flow behavior and strain hardening at early to intermediate strains, it is less accurate in predicting Ultimate Tensile Strength (UTS) and uniform elongation and fracture strain.

In conclusion, MAIA presents a robust and efficient numerical method for extracting phase-specific stress flow curves in DP steels, reducing dependence on complex experimental methods. Its ability to adapt to different alloy systems and microstructures with limited input makes it a valuable tool for expanding the utility of FE micromechanical modelling in material design and analysis.

Biography

Dr. Tanu Halim earned her PhD in 2024 from McMaster University under the supervision of Dr. Eu-Gene Ng, specializing in FE micromechanical modelling. Her PhD work aimed to numerically derive individual phase stress flow curves, resulting in three journal publications. She previously completed her MASc in 2008 on FE modelling of machining processes. She worked as a mechanical design engineer at Atomic Energy of Canada before transitioning to academia. Balancing full-time work, family responsibilities, and part-time doctoral studies, Dr. Tanu Halim brings a unique combination of industry experience and research expertise to her field.

Su Mon Thit[1,2*], Boon Kiat Lim[2], Hui Ying Yang[3], Lit Song Glen Ding[2], Yixiang Li[1], Leonard Tok[2], Tan Mei Chee[1]

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[3]National University of Singapore, Singapore

Thickness-driven efficacy: The role of conformal coating thickness in electrochemical corrosion protection

This study evaluates how conformal coating thickness influences corrosion resistance in miniaturized hearing aids exposed to moisture, bias voltages, and sweat. ENIG-plated copper pads were coated with either a UV-cured acrylate urethane (Coating A) or a solvent-based modified alkylate resin (Coating B), chosen to analyse how distinct polymer chemistries and thickness influence moisture ingress and electrochemical degradation. By integrating electrochemistry, copper ion quantification, and both surface and cross-sectional scanning electron microscopy with energy-dispersive X-ray spectroscopy, this study establishes a multi-modal framework for diagnosing coating failure. Unlike prior studies relying on isolated electrochemical methods or purely morphological/chemical analyses, this approach bridges kinetics, dissolution, and microstructures responding to recent calls for multi-scale characterization. In addition to confirming known limitations in UV-cured and solvent-based acrylic systems, scanning electron microscopy analysis result evidence unique failure morphologies such as sweat ingress channels, granular decohesion, and volcano-like rupture. These features offer direct evidence of bottom-up failure in ultra-thin coatings, challenge conventional blistering and acrylic degradation models, and emphasize the role of localized phase separation and pressure-driven rupture in electrolyte ingress.

Biography

Ms. Su Mon Thit is a PhD candidate under the Industrial Postgraduate Programme at the Singapore University of Technology and Design (SUTD), in collaboration with WS Audiology. Her research focuses on corrosion-resistant coatings and material reliability for miniaturized electronic components operating in sweat-rich and humid environments. She specializes in electrochemical methods, surface characterization, and the evaluation of liquid conformal

coating performance. Her current work investigates the relationship between coating thickness and electrochemical corrosion protection, aiming to establish practical design guidelines for electronic packaging in medical and wearable devices.

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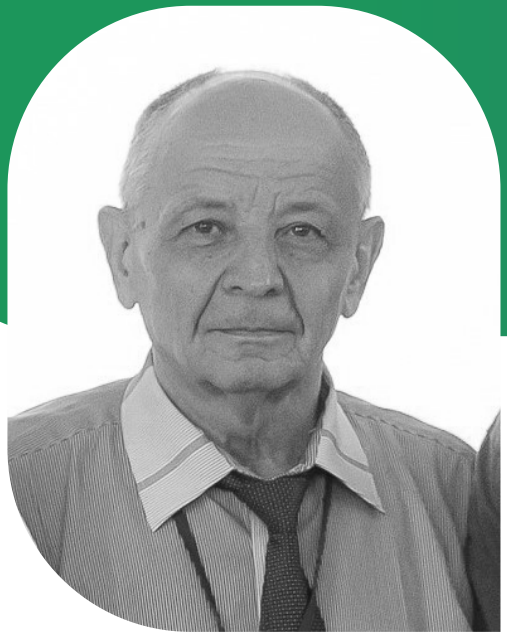
Self-assembly of nobiletin into nanoparticles for improved therapeutic potential

Nobiletin, a biologically active polymethoxyflavone derived from citrus peel has attracted considerable attention due to its demonstrated antioxidant, anti-inflammatory and anticancer properties. However, its clinical translation remains significantly restricted by two major limitations: low aqueous solubility and poor oral bioavailability. To address these limitations, this study investigates a carrier-free strategy in which nobiletin molecules themselves form nanoscale assemblies, which enables a self-assembled nanoparticle formulation. Using molecular dynamics simulations, the molecular mechanism governing the spontaneous clustering and aggregation of nobiletin in aqueous media is explored. It is clear from the study that nobiletin molecules undergo rapid nucleation, followed by growth into stable nanoaggregates driven by intermolecular hydrogen bonding, hydrophobic interactions and π-π stacking between aromatic rings. Structural stability was evaluated through RMSD, radius of gyration, and binding energy analysis, confirming that the nanoparticle configuration is energetically favourable. Visualisation and cluster size evolution further support the aggregation of nobiletin nanoparticle formation. This carrier-free nano self-assembly approach offers a promising pathway to increase the aqueous solubility and potential bioavailability of nobiletin. The findings provide a mechanistic foundation for future experimental validation, including nano-formulation synthesis and cellular uptake studies. Overall, this MD-driven design strategy positions nobiletin nanoparticles as a viable therapeutic delivery concept and aligns with minimal excipients drug delivery.

Biography

Vaishnavi Khalas is a Ph.D. research scholar at Pandit Deendayal Energy University. Her research involves computational modelling techniques including Density Functional Theory (DFT) and Molecular Dynamics (MD) simulations, alongside experimental work using Pulsed Laser Ablation in Liquid (PLAL) to synthesize nanoparticles for biomedical applications. Her work integrates both theoretical and experimental approaches to advance nanoscale science with relevance to healthcare and material innovation.



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Computer 3D models of isobaric Phase Diagrams (PD): Novel tool of materials science

Computer models of T-x-y diagrams Ag-Au{Sn}-Sb, Ag-Cu-Ni{Pb}, Al{In}-Sn-Zn, Au-Ge-Ag{Sb, Sn}, Li, K, La{Nd, Pr}| |Cl are duscused. To verify the model, a coherence analysis (cross validation) of the horizontal (on a polythermal section at a fixed temperature) and vertical (for some compositions of this isopleth) material balances may be carried out. Space models of PD (both for real systems and their prototypes) will be helpful to recognize the graphic errors in erroneous interpretation of experimental and computational (thermodynamic or ab initio) data. The publication of the graphics for the PD of many ternary systems makes it urgent to accelerate the training of students and more experienced specialists for the perception and understanding of such information. Development of technical specifications for the prototyping of the so-called exploded T-x-y diagrams will be very useful for this purpose. Two variants of disassemblable PD of the ternary systems will be shown: all phase regions of PD or their compressed variant–a puzzle with a complex element of the known origin. The use of ML approaches is proposed to modernize and expand the capabilities of the DESIGNER and EDITOR software (increasing the component nature of the physico-chemical system, converting concentration coordinates (weight, molar, equivalent, system-subsystem), generating X-ray phase analysis spectra, visualizing the dynamics of microstructure formation during cooling, automating processes (forming a Sheil scheme, assembling spatial models of phase diagrams, ...), creation of digital twins for all variants of phase diagram and their verification (validation), creation of digital passports for the most demanded materials). Digitization of space phase diagram by the creation of commercial product is fulfilled by 3D computer model of verified PD with the patent support. Completed 3D model of each PD will be made in the form of an independent object (including a commercial product protected by a patent), which can be offered to users in the form of a complete description of all possible

phase transformations in a ternary system equipped with extensive capabilities for visualizing all fragments of the PD and the results of calculations of crystallization processes occurring in the system.

Biography

Vasily Lutsyk is a Materials CAD Lab head, IPMS SB RAS. Professor, Bazarov Buryat State University. Session Organizer “Phase Diagram-Tool of Materials Science”, Conferences on Competitive Materials and Technology Processes IC-CMTP, (Hungary, 2012, 2014, 2016, 2018). Presentation: India-Russia Scientific Webinar on Additive Manufacturing Technologies, 2022; Conf. on Materials Science and Engineering, Singapore, 2022; 18th International Conf. on Catalysis, Chemical Engineering and Technology, Paris, 2024; Webinar on 3D Printing & Additive Manufacturing, Dubai, 2024; 5th Global Virtual Summit on Pharmaceutical and Novel Drug Delivery Systems, 2024. Committee member: Conf. on Thermal Science and Engineering (TSE 2024), Ningbo, China.

Venkat Potamsetti*, Thanishq Konda
Nousen Biotics, United Kingdom

Nanotechnology for nutritional equity: Liposomal delivery systems at the frontier of food and health

We at Nousen Biotics believe Liposomal nanotechnology offers a transformative opportunity to reimagine how nutrients are delivered, absorbed, and experienced in daily life. At Nousen Biotics, we are exploring how nanoencapsulation can enhance the stability and bioavailability of essential nutrients while supporting more personalised and equitable nutrition solutions.

This presentation bridges nanoscience and community nutrition, highlighting pathways to integrate liposomal systems into functional foods, supplements, and public health interventions. Beyond the laboratory, we will discuss the ethical, accessibility and sustainability dimensions of "nano-nutrition" ensuring these technologies serve diverse populations rather than niche markets.

By aligning innovation with inclusion, we envision a future where precision nutrition and nanotechnology converge to create smarter, safer, and more sustainable nutrition solutions for all.

Biography

Venkata Giridhar Reddy Potamsetti, is a clinical lead specialist in neurological conditions and a healthcare business data analyst passionate about bridging data, innovation, and community health. With a background in business analytics and experience translating data into strategic insights, he applies precision thinking to nutrition technology. As the founder of Nousen Biotics, he is pioneering next-generation liposomal delivery systems that make nutrients smarter by enhancing precision, bioavailability, and real-world nutritional impact.

His mission is to connect biotechnology with sustainable and equitable food systems, and he is keen to collaborate with experts in nanotechnology to advance the future of personalised and community nutrition.

Vladimir G. Chigrinov[1,2,3,4]

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Liquid crystal photolaignment on azodye nanolayers for new liquid crystal devices: Physics and applications

Photoalignment and photopatterning has been proposed and studied for a long time. Light is responsible for the delivery of energy as well as phase and polarization information to materials systems. It was shown that photoalignment liquid crystals by azodye nanolayers could provide high quality alignment of molecules in a Liquid Crystal (LC) cell. Over the past years, a lot of improvements and variations of the photoalignment and photopatterning technology has been made for photonics applications. In particular, the application of this technology to active optical elements in optical signal processing and communications is currently a hot topic in photonics research. Sensors of external electric field, pressure and water and air velocity based on liquid crystal photonics devices can be very helpful for the indicators of the climate change.

We will demonstrate a physical model of photoalignment and photopatterning based on rotational diffusion in solid azodye nanolayers. We will also highlight the new applications of photoalignment and photopatterning in display and photonics such as: (i) Fast high resolution LC display devices, such as field sequential color ferroelectric LCD; (ii) LC sensors; (iii) LC lenses; (iv) LC E-paper devices, including electrically and optically rewritable LC E-paper; (v) Photo induced semiconductor quantum rods alignment for new LC display applications; (vi)100% polarizers based on photoalignment; (vii) LC smart windows based on photopatterned diffraction structures; (vii) LC antenna elements with a voltage controllable frequency.

Biography

Professor Vladimir G. Chigrinov is Professor of Hong Kong University of Science and Technology since 1999. He is an Expert in Flat Panel Technology in Russia, recognized by the World Technology Evaluation Centre, 1994, and SID Fellow since 2008. He is an author of 6

books, 31 reviews and book chapters, about 335 journal papers, more than 757 Conference presentations, and 121 patents and patent applications including 50 US patents in the field of liquid crystals since 1974. He got Excellent Research Award of HKUST School of Engineering in 2012. He obtained Gold Medal and The Best Award in the Invention & Innovation Awards 2014 held at the, which was hosted in Kuala Lumpur, Malaysia, on 20-22 Feb 2014. He is a Member of EU Academy of Sciences (EUAS) since July 2017. He got A Slottow Owaki Prize of SID in 2018. Since 2018 until 2020 he works as Professor in the School of Physics and Optoelectronics Engineering in Foshan University, Foshan, China. 2020-2024 Vice President of Fellow of Institute of Data Science and Artificial Intelligence (IDSAI) Since 2021 distinguished Fellow of Institute of Data Science and Artificial Intelligence. He is IETI Fellow since 2019. He is a Editor in Chief of Liquid Crystal section in Crystals journal since 2023.

Wajid Ali Shah
Hiroshima University, Japan

Thermodynamics of AB_2 type hydrogen storage alloys with different composition

Hydrogen is increasingly recognized as one of the most promising substitutes for fossil fuels because of its clean combustion, negligible greenhouse gas emissions, and high energy output per unit mass. However, a major barrier to widespread adoption of hydrogen technology is safe and efficient storage. Conventional techniques, such as cryogenic tanks and high-pressure cylinders, are hindered by cost, safety, and energy efficiency concerns. In contrast, metal hydrides offer a compact, secure, and reversible storage approach by absorbing hydrogen into solid materials. Among them, Ti-based AB_2 alloys are particularly attractive due to their large volumetric capacity, moderate plateau pressures, and ability to form stable hydrides.

The performance of Ti-Fe based AB_2 alloys can be tuned by incorporating alloying elements such as chromium (Cr) and manganese (Mn). Mn generally improves the kinetics of hydrogen absorption, while Cr stabilizes phases and adjusts plateau pressures. However, optimizing these substitutions remains challenging since each element alters the thermodynamic characteristics differently. The combined effects of Cr and Mn on cycling durability, hysteresis, and plateau pressure are not yet fully understood.

In this study, three alloys—$TiCr_{1.1}Mn_{0.3}Fe_{0.6}$, $TiCr_{1.3}Mn_{0.1}Fe_{0.6}$, and $TiCr_{1.5}Mn_{0.1}Fe_{0.4}$—were synthesized by arc melting followed by long-term annealing to promote a homogeneous C14 Laves phase structure. Hydrogen absorption–desorption behavior was evaluated using Pressure–Composition–Temperature (PCT) analysis, along with activation tests under controlled hydrogen pressures and temperatures. Stability was assessed over 25 hydrogenation–dehydrogenation cycles. Microstructural and phase changes were examined using X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM). Thermodynamic parameters, including enthalpy and entropy, were derived from Van't Hoff analysis.

The results revealed that $TiCr_{1.5}Mn_{0.1}Fe_{0.4}$ exhibited the highest hydrogen storage capacity (≈0.75–0.78 wt%) with stable plateau pressures, making it the most balanced composition thermodynamically. $TiCr_{1.3}Mn_{0.1}Fe_{0.6}$ showed slightly reduced capacity due to higher Cr and Fe content, but all alloys demonstrated good activation and rapid hydrogen uptake. Notably, none of the alloys displayed significant phase separation or particle coarsening after 25 cycles, indicating strong structural integrity and retention of storage capacity. Compression cycling experiments further confirmed their resilience: $TiCr_{1.5}Mn_{0.1}Fe_{0.4}$ required 245°C to reach 12 MPa hydrogen pressure, while $TiCr_{1.1}Mn_{0.3}Fe_{0.6}$ and $TiCr_{1.3}Mn_{0.1}Fe_{0.6}$ required 260°C and 305°C, respectively.

Overall, these findings highlight that careful adjustment of Cr, Mn, and Fe contents in Ti-Fe based AB_2 alloys can significantly enhance hydrogen absorption capacity, activation, and cycling stability. The studied alloys, particularly $TiCr_{1.5}Mn_{0.1}Fe_{0.4}$, show strong potential for application in future solid-state hydrogen storage and thermochemical compression systems, advancing the practical use of hydrogen as a clean energy carrier.

Biography

Wajid Ali Shah is currently pursuing a PHd degree in Mechanical Engineering at Hiroshima University, Japan, under the Japanese Government (MEXT) Scholarship. His research focuses on hydrogen energy materials, specifically the thermodynamic properties and cycling stability of Ti-based AB_2-type alloys for solid-state hydrogen storage and compression applications. Conducted detailed investigations into Pressure–Composition–Temperature (PCT) behavior, Van't Hoff thermodynamic analysis, and microstructural stability of multi-component Ti-Cr-Mn-Fe alloys, contributing to the understanding of alloy optimization for improved hydrogen absorption, activation, and cycling durability. In addition to his academic work, he has participated in several international academic and leadership initiatives, having served as a facilitator for the Organization for Educational Change and collaborated with global education teams in Japan and abroad. His long-term research vision is to advance sustainable hydrogen storage systems that can support the global transition to carbon-neutral energy.

Wei Shao[1*], Witold Chrominski[1], Mark Fedorov[1], Michał Kanios[1], Chenying Shi[2], Javier LLorca[2,3], Jan S. Wróbel[1]

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Effect of Ag on the precipitation stability in Al-Mg-Si-Ag alloy: First-principles calculations, Calphad modeling and experimental validation

Al-Mg-Si-Ag alloys offer a desirable balance between formability and bake-hardening potential, making them attractive for advanced engineering applications. However, complete crystal structure information of precipitate phases is not always available or unambiguous. Thus, the Gibbs free energy of different phases in the Al-Mg-Si-Ag alloy system was determined by combining first-principles calculations, cluster expansion method and Monte Carlo simulations. This information was used to develop a thermodynamic database of the Al-Mg-Si-Ag system, enabling accurate determination of phase stability and phase distribution. The results revealed that the addition of Ag significantly modifies solute clustering behavior and promotes the formation of Guinier-Preston zones at the early stages of the precipitation in Al-Mg-Si-Ag alloys. In contrast, the crystal structure of the β'' strengthening phase was not influenced by the presence of Ag. The developed TDB for this quaternary alloy will facilitate the prediction of thermodynamic properties in binary and ternary systems involving Al, Mg, Si and Ag atoms. It also provides a robust foundation for extrapolating more complex Al-Mg-Si-based alloy systems.

Biography

Wei Shao is a Postdoctoral Researcher at Warsaw University of Technology. She received her PhD in Materials Science from the Polytechnic University of Madrid and IMDEA Materials Institute, as well as holds a PhD from Yanshan University, China. Her research interests include first-principles calculations, phase diagram prediction, and thermodynamic modeling of alloys. Her recent work focuses on the effect of Ag on the precipitation stability of Al-Mg-Si-Ag alloys, combining first- principles and CALPHAD approaches.

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Enhancement of defects on nitrogen-doped carbon nanomaterials via chlorination: Experimental and theoretical studies

The role of chlorine in enhancing defects in nitrogen-doped Carbon Nanomaterials (CNMs) was investigated via pyrolysis Chemical Vapour Deposition (CVD) method. Tetrachloroethane (TTCE) and acetonitrile (CH3CN) were used as sources of chlorine and nitrogen, respectively. Nanomaterials with variable morphologies were obtained when the amount of TTCE was varied in the feed. Carbon nano-onions were found to be the dominating nanomaterials for CNMs generated from room temperature feed mixtures, which confirms functionalization and doping of CNMs with chlorine and nitrogen. The degree of defects was enhanced in CNMs generated from heated feed mixtures, which was evidenced by the formation of mixtures if irregular branched bamboo-compartmented nanotubes and nano-necklaces, coiled Carbon Nanotubes (CNTs), and broken bamboo-compartmented CNTs. The amount of defects in CNMs was enhanced in CNMs generated from heated mixtures, evidenced by increased ID/IG intensity peak ratio obtained from Raman spectroscopy analysis. Types of defects were also identified from XPS and Raman spectroscopy analysis ranging from boundary-like, vacancy-like, hoping and on-site defects. Theoretical calculations via DFT of CNMs generated from all room temperature feed mixtures revealed the emanation of a C–Cl peak at the conduction band TDOS which emanated due to the generation of an unoccupied mid-gap state which originates from the sp^3-hybridized defect brought by neutral chlorine adducts.

Keywords: Defects, Chlorine, Carbon Nanomaterials, Theoretical Calculations.

Biography

Dr. Winny K Maboya completed her PhD degree in 2018 from University of the Witwatersrand. She was employed by Vaal University of Technology from April 2009 to December 2023 where she was appointed as a Senior Lecture from 2019. She currently holds a Senior Lecture position at University of South Africa since January 2024 to date. Her research is in fabrication of carbon nanomaterials, their use as electrocatalysts and photocatalysts supports, their characterization and application in water splitting.

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Augmented quantum dot-enhanced IGZO-Te heterogeneous photodiode enabling synaptic in-sensor image processing

This study presents a quantum-dot–enhanced heterogeneous photodiode based on an IGZO-Telluirum (Te) junction, engineered to function as an optoelectronic synapse for neuromorphic vision applications. By incorporating CdSe-ZnS core-shell Quantum Dots (QDs) onto the IGZO-Te interface, the device simultaneously performs light sensing and synaptic learning, enabling in-sensor computing without the need for external data transfer between sensing and processing units.

Optical and structural analyses confirm the multilayer configuration of the device. Approximately 45 nm IGZO, 11nm Te, and a 16nm thick QDs layer. The optical bandgaps of IGZO, Te, and QDs were measured to be 3.95eV, 0.65eV, and 1.92eV, respectively. The large bandgap of IGZO ensures low leakage current and high stability, whereas the narrow bandgap of Te extends detection into the Near-Infrared (NIR) region. QDs play a dual role by enhancing light absorption and acting as charge trapping sites that modulate the carrier transport within the heterojunction. As a result, the IGZO-Te-QD device exhibits a remarkable 9.78 times increase in photocurrent compared to IGZO-Te without QDs.

The device demonstrates robust synaptic performance under optical pulse stimuli (405nm, 80μWcm^{-2}). Excitatory Postsynaptic Current (EPSC), Paired-Pulse Facilitation (PPF), and pulse number and duration dependent plasticity are clearly observed. The photocurrent retention exceeds 300 seconds, confirming long-term memory functionality analogous to biological synapses. Furthermore, a 6×6 photodiode array was fabricated to evaluate pattern recognition capability. The array successfully distinguished an illuminated letter ‘O’, demonstrating both short-term and long-term synaptic weight modulation with uniform pixel response and

negligible crosstalk.

Overall, this IGZO-Te-QDs optoelectronic synaptic photodiode integrates sensing, memory, and learning within a single device. The demonstrated broadband optical response, long-term retention, and scalable array characteristics highlight its strong potential for future energy-efficient neuromorphic vision hardware.

Biography

Yongin Cho is a Ph.D. candidate in the Department of Advanced Materials Science and Engineering at Sungkyunkwan University, Republic of Korea. His research focuses on developing neuromorphic devices using emerging nanoscale materials. He specializes in designing FeFET and memristor based memory architectures and integrating them with sensing units to realize in-sensor memory systems, where data sensing and computation occur within a single device. His work aims to reduce data movement and power consumption, enabling energy-efficient next generation AI hardware.

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POSTER PRESENTATIONS

An-Ni Chen, Ting-Chih Tseng, Chun-Feng Lai*
Feng Chia University, Taiwan

Anisotropic In(Zn)P-based nanocrystals with high photoluminescence quantum yield and broadband for Near-Infrared LEDs

Near-Infrared (NIR) light exhibits distinct advantages, such as non-destructive interaction and deep tissue penetration, making it particularly suitable for real-time, non-invasive diagnostic applications. NIR Light-Emitting Diodes (LEDs) have increasingly become attractive candidates for integration into compact devices. In this study, In(Zn)P/CdSe/CdS/ZnS core/shell/multi-shell anisotropic heterostructured nanocrystals (AH-NCs) were synthesized with high photoluminescence quantum yield of 72%, broadband NIR-I to NIR-II emission spectrum (700nm to 1400nm), and emission bandwidth (full-width at half-maximum) of 210nm. Furthermore, the AH-NCs mixed silicone integrated with blue flip-chip LEDs to fabricate down-conversion NIR AH-NC-LEDs, yielding an NIR optical output power of 21mW under driving current of 100mA, and a photoelectric efficiency of 38.4%. These multicomponent AH-NCs show significant potential for advancing NIR optoelectronic device technologies.

Biography

Chun-Feng Lai received the Ph.D. degree in Department of Photonics and Institute of Electro-Optical Engineering at Chiao Tung University, Taiwan in 2010. He has joined the Department of Photonics, Feng Chia University as an assistant professor in August 2011. He has made significant academic achievements and breakthroughs in the field of full-dimensional photonic crystal nanostructures, as well as varying types of quantum dot materials for white-LED and display applications. He is proud to have published more than 60 papers in SCI journals, with an H-index of 24, an i10-index of 46, and a sum of the times cited of 1584.

Jan Kruzelák*, Ivan Hudec
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Rubber composites with EMI absorption shielding performance

Contemporary societal developments demonstrate a pronounced orientation toward the advancement of sophisticated electrical and electronic technologies, which indubitably enhances the overall quality of human existence. However, the proliferation of electronic devices results in the concurrent accumulation of electromagnetic radiation within the surrounding environment. This phenomenon leads to electromagnetic radiation from one source creating interference with another, a condition termed Electromagnetic Interference (EMI). EMI can exert substantial detrimental effects on electronic equipment functionality, diminishing operational efficiency or precipitating complete system failure. Furthermore, the adverse impact of EMI on biological systems and human health has been well-documented. Contemporary research has identified EMI's influence on multiple health dimensions, encompassing reproductive, neurological, and developmental complications. Consequently, there exists an increasingly urgent need for the development of materials that provide effective shielding against unwanted electromagnetic interference.

In comparison to conventional solid metallic plate shielding solutions, rubber-matrix composites exhibit advantageous characteristics including reduced cost, lower density, enhanced processability and moldability, superior elastic properties, increased flexibility, and improved resistance to corrosive degradation.

In present work, composite materials were prepared by incorporation of manganese-zinc ferrite and combination of manganese-zinc ferrite with carbon black into acrylonitrile-butadiene rubber. The study was aimed at examination of fillers' influence on mechanical properties, electrical conductivity, and absorption shielding performance of the composites.

The findings showed a strong correlation between permittivity, conductivity, and absorption shielding. Enhanced conductivity corresponded with increased permittivity, which consequently diminished absorption shielding effectiveness. The results demonstrated that composites filled with manganese-zinc ferrite can be used as efficient EMI shields with absorption dominated shielding mechanism within the tested frequency range 1 MHz–3 GHz. In hybrid composites based on combination ferrite and carbon black, the inclusion of carbon black led to a more uniform distribution of ferrite throughout the rubber matrix and enhanced the composites' mechanical properties. Additionally, the conductive carbon black played a role in charge storage, various polarization processes, and associated relaxation effects within the rubber matrix, which resulted in increased permittivity. These changes subsequently influenced the absorption peaks and related EMI absorption characteristics of the hybrid composites.

Acknowledgements: This work was supported by the Slovak Research and Development Agency under the contract No. APVV-22-0011 and by grant agency VEGA under the contract No. 1/0056/24.

Biography

Ján Kruzelák is experienced from the study of preparation and characterization of rubber compounds based on various elastomers filled with traditional fillers used in rubber industry as well as with magnetic active fillers and biopolymer fillers. His area of expertise is also research and development of vulcanization systems used for cross-linking of rubber matrices. He has been a member of the IRCO, an international organization bringing together representatives of rubber industry research associations and production organizations of each member country.

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Flexible high specific capacitance supercapacitor based on Laser-Induced Graphene with an optimize design on interdigitated electrodes

Laser-Induced Graphene (LIG) has emerged as a prominent subject in materials science due to its streamlined fabrication and superior electrical conductivity. This study identifies the optimal laser parameters—specifically a power of 6 W and a scanning speed of 127 mm/s—for the synthesis of LIG Interdigitated Electrodes (IDEs). Following fabrication, a solid-state electrolyte composed of sulfuric acid (H2SO4), Polyvinyl Alcohol (PVA), and deionized water was applied to the optimize designed IDEs to construct the LIG supercapacitor. Electrochemical characterization via Cyclic Voltammetry (CV) revealed a high specific capacitance of 8.678mF/cm2, with 60.2% retention (5.225mF/cm2) after a 60-day aging period. Furthermore, Multistep Potentiometry (MP) analysis yielded an energy density of 4.82μWh/cm² and a power density of 0.289mW/cm². These results demonstrate a rapid, cost-effective manufacturing route for LIG-based energy storage devices. The interdigitated architecture effectively maximizes the electrochemically active surface area, thereby enhancing capacitive performance without expanding the physical footprint or material consumption.

Fig. 1 Fabrication process of LIG interdigital electrode supercapacitors.

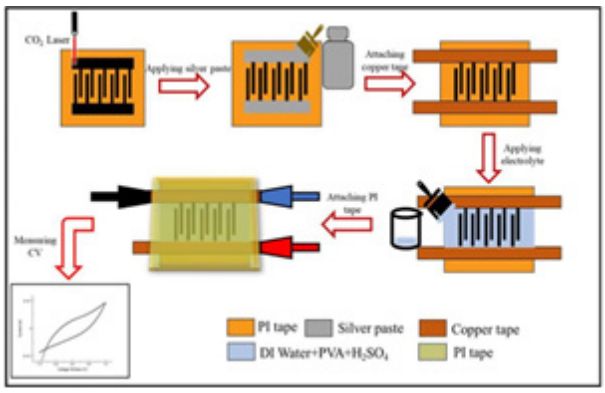
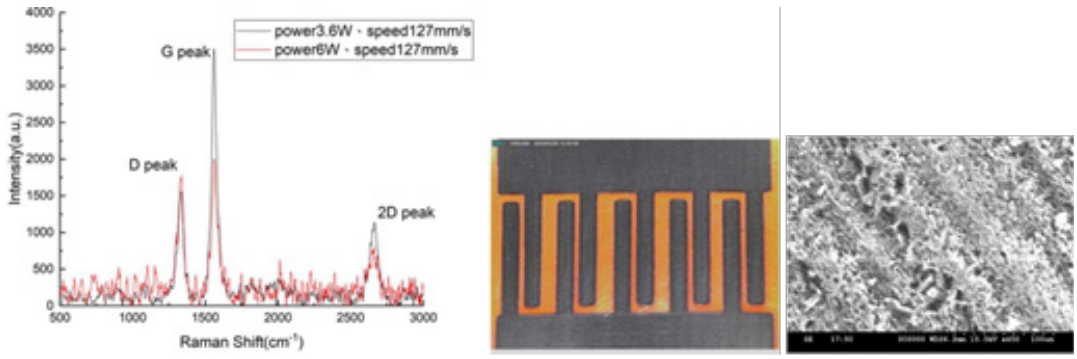


Fig. 2 (a) Raman intensity distribution diagram of our graphene film at laser power of 3.6W and 6W and the same scanning rate of 127mm/s. (b) Morphology of LIG sample under OM, and (c) Microstructure of LIG sample under SEM observation.



Biography

Jia-Chuan Lin holds a Ph.D. in Electrical Engineering from National Cheng Kung University. He is currently a Distinguished Professor at National Taipei University, where he previously served as Vice President, a role he also held at St. John's University. His research specializes in semiconductor and nanotechnology. Dr. Lin has received numerous accolades, including the IEDMA (International Electronics Devices and Materials Association, Taiwan) Excellent Research Award and the Ministry of Education's Outstanding Teaching Practice Award in Taiwan. He is also recognized in Who's Who in the World for his professional contributions.

Norio Inui

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Stabilizing levitation of a graphene flake in a magnetic field through the Casimir effect

To probe the fundamental quantum mechanical aspects of mesoscopic objects, the phenomenon of quantum decoherence must be effectively mitigated. A primary pathway for decoherence involves the object's physical contact with its environment; consequently, non-contact levitation offers a promising route to maintaining quantum coherence. While optical trapping has been successfully employed for levitating atomic and molecular species, its application is generally unavailable for nanoscale objects such as graphene flakes.

In this work, we propose and analyze a novel levitation scheme specifically designed for a graphene flake, integrating the effects of diamagnetism and the Casimir force. Graphene exhibits robust diamagnetism, enabling it to be levitated above a suitable magnetic field source. However, the strong anisotropy of its magnetic permeability poses a significant challenge to stable levitation. The permeability of a graphene sheet is substantially greater perpendicular to its surface than parallel to it. This anisotropy generates a magnetic torque that forces the flake to rotate until its surface is oriented parallel to the magnetic field lines. To achieve stable levitation where the flake's orientation can be maintained at a desired angle, a counteracting, stabilizing torque is required to oppose this rotational tendency.

We demonstrate that the Casimir effect provides the necessary stabilizing torque. The quantum vacuum's electromagnetic field between the graphene flake and the magnet's surface is confinement-dependent, meaning it changes as a function of the flake's rotation angle. As a

result, the Casimir energy—the renormalized summation of the zero-point energy between the flake and the magnet's surface—varies with orientation. The minimum Casimir energy is achieved when the graphene flake is positioned parallel to the surface of the magnet. Thus, this interaction inherently generates a restoring torque that favours the parallel orientation.

The ultimate stability of the levitated graphene flake is therefore governed by the delicate balance and interplay between the destabilizing magnetic torque and the stabilizing Casimir torque. We present a detailed analysis of the Casimir torque's dependence on the levitation height. Our findings conclusively show that the Casimir effect provides a mechanism to stabilize the diamagnetic levitation of a graphene flake, offering a viable path toward utilizing such nano-objects for macroscopic quantum experiments.

Biography

Dr. Inui received his doctorate degrees in information science with the theoretical study on the universality of nonequilibrium phase transitions in interacting particle systems at Tohoku University in 1995. He has served as a Professor at the University of Hyogo. His primary research interest is the Casimir effect and its application to nanotechnology.

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Design and combinatorial synthesis of biomimetic multivariate metal-organic frameworks for efficient drug loading

Multivariate Metal-Organic Frameworks (MOFs) with iso-reticular architectures and spatially programmable functional groups represent an attractive platform for the development of sequence-dependent materials. By enabling precise control over the type, ratio, and spatial arrangement of functional groups, multivariate MOFs offer opportunities to encode complex structure–function relationships that resemble those found in biological macromolecules. However, the construction of extensive multivariate MOF libraries that allow function-targeted material selection, analogous to directed evolution in proteins, remains a significant challenge.

Here, we report a biomimetic strategy to design multivariate MOFs (bMTV-MOFs) by incorporating amino acid–derived functional linkers into the reticular framework. This approach introduces protein-like binding cavities, chemical diversity, and tunability into otherwise rigid MOF structures. By enumerating all possible combinations of nine functionalized organic linkers, a comprehensive library of 1089 MOFs was generated, encompassing both single-component and multivariate entries. These bMTV-MOFs were synthesized in a combinatorial manner and systematically evaluated for drug delivery performance.

Verteporfin (VP), a clinically approved photosensitizer for Photodynamic Therapy (PDT), was selected as a model therapeutic cargo to assess structure–function relationships within the MOF library. Among the constructed materials, tertiary bMTV-MOFs exhibited superior VP loading capacity and controlled release behavior compared with pristine MOFs. The enhanced performance is attributed to the cooperative effects of multivariate functional groups in forming biomimetic binding cavities that promote favorable host–guest interactions.

In vitro studies demonstrated that VP-loaded tertiary bMTV-MOFs induced strong photodynamic effects in multiple cancer cell lines, including B16F10, 4T1, and K7M2. Notably, the privileged A1F6H3 and A3D1H6 bMTV-MOFs achieved a 23–68-fold enhancement in PDT efficacy relative to VP delivered by pristine MOFs, primarily through apoptosis-mediated cell death.

Overall, this work demonstrates that biomimetic multivariate MOF libraries enable function-targeted material selection and provide a versatile platform for precision drug delivery and photodynamic therapeutic applications.

Biography

Qingqing Zuo is a Ph.D. candidate at Zhejiang University, China. Her research focuses on nanomaterials and nano-enabled drug delivery systems, with particular interests in nanomedicine and protein-based therapeutics. Her work integrates materials design with biomedical applications for therapeutic delivery.

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