MATHEWS
CONNECTING RESEARCH

2nd Edition of International Congress on

Materials Science & Nanotechnology

NOVEMBER 23-24, 2026

VIRTUAL

VIRTUAL

Greenwich Mean Time (GMT)

Book of Abstracts

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Welcome
Message

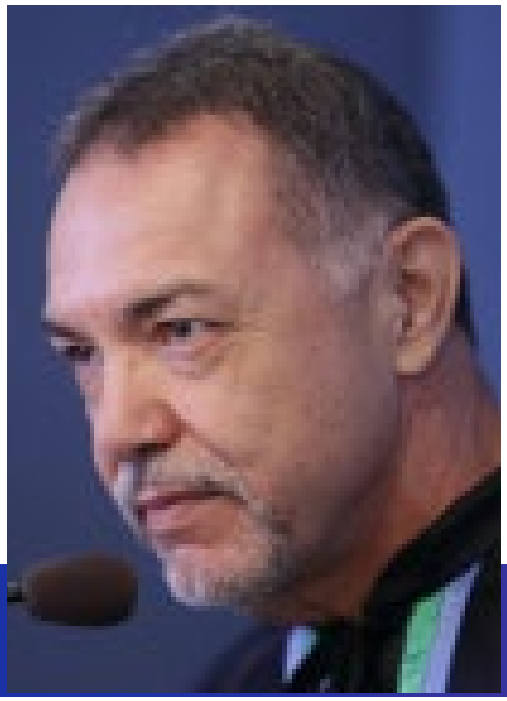


Prof. Dr. Habil. Bernd Blobel

Dear Colleagues and Friends,

It is an honor, to welcome you on behalf of the Scientific Committee to the 2nd Edition of the International Congress on Materials Science and Nanotechnology (M-Nano-2026), Which will be held from November 23-24, 2026 in Online. M-Nano-2026 will address nanoscale research and material innovation, considering nanomaterials, advanced composites, surface engineering, functional polymers, and energy-efficient technologies. The congress will focus on examining nanofabrication processes, material characterization tools, theoretical modeling, and performance evaluation techniques. For managing integration and interoperability of intelligent and ethical ecosystems, we have to integrate research, technology and practice, based on the latest advancements and inventive approaches. The challenges and solutions to be met can be excellently explained for transformed health ecosystems. The healthcare paradigm advanced from empiric and phenomenological through evidence-based and person-centered medicine to personalized, preventive, predictive, participative precision medicine (P5M). Thereby, we must consider and understand the individual health status, conditions and genetic and genomic dispositions in personal social, occupational, environmental and behavioral context at any level from elementary particles up to society and universe. This requires the inclusion of actors from multiple domains as well as the subject of care with their own methodologies, languages, ontologies, education and skills. I have developed the model and framework for managing integration and interoperability in such highly complex, dynamic, context-aware, multi-disciplinary transformed healthcare ecosystem, meanwhile standardized in ISO 23903. Because of its formal and foundational nature, the methodology is not restricted to health and social care, but has been successfully deployed already in many other domains, such as pharmaceutical research and development, nanotechnology, environmental sciences, education, etc. Welcoming you in M-nano-2026, I'm sure that this conference will provide an excellent platform to discuss nanofabrication processes, material characterization tools, theoretical modeling, and performance evaluation techniques, research and education. So enjoy a successful event.

Welcome Message



Professor Paulo De Morais

Dear Colleagues and Friends,

With great pleasure, I'm happy to welcome you to join us virtually, for the 2nd Edition of International Congress on Materials Science and Nanotechnology (M-Nano 2026). The conference will take place from 23 to 24 November 2026, in Online.

The International Congress on Materials Science and Nanotechnology, will provide stage to researchers, scientists and engineers from different disciplines to interact and exchange recent breakthroughs in materials science and nanotechnology with some of the best minds in the world. The conference will focus on discussing the current findings and networking opportunities for the advancement of materials science and nanotechnology. The program will highlight latest trends in materials research, with special emphasis on interdisciplinary research in both fundamental and applied areas to foster the development of innovative strategies. The conference will feature world renowned keynote speakers, oral and poster presentations to talk about existing research and upcoming challenges.

We cordially invite and encourage potential authors and co-authors to contribute by submitting their latest research findings in all areas of materials science and nanotechnology. With the presence of outstanding international experts, this conference promises a productive exchange of innovative ideas that can lead to new discoveries and applications. Authors are invited to submit their abstracts under one of the following topics, but not limited to: Materials Science and Engineering; Nanoscience and Nanotechnology; Advanced Materials and Nanomaterials; Biomaterials and Nanomedicine; Sensors, Actuators, and Nano-devices; Structural Materials and Nanomechanics; Polymers, Ceramics, and Composites; Magnetic and Spintronics Materials; Metamaterials; Metals, Metallurgy, and Mining; Graphene Technology – 3D & 2D Materials, Carbon Nanosctrutures; Bio-Nanotechnology and Synthetic Biology; Nanophysics and Nanoelectromechanical Systems; Nano Drug Delivery Systems; Computational Materials Science and Data-Driven Design; Materials and Nanotechnology for Energy and Sustainability; Laser, Optics, Photonics, and Electronics; Materials and Nanotechnology for Extreme Environments; Safety, Ethics, and Regulation in Materials Science and

Nanotechnology; Advanced Manufacturing and Materials Processing; 3D Printing and Additive Manufacturing; Materials Characterization Techniques; Nanofabrication and Nanolithography; Surface Engineering and Coatings; Emerging Frontiers in Materials and Nanotechnology; Artificial Intelligence and Emerging Digital Technologies; Interdisciplinary and Translational Nanotechnology; Applications in Different Fields

Cast the future with groundbreaking strides in Materials Science and Nanotechnology!

Welcome Message



Thomas J. Webster, Ph.D.

Dear Colleagues and Friends,

Welcome to the 2nd Edition of the International Congress on Materials Science and Nanotechnology !

Without a doubt, recent advances in materials and nanotechnology research have revolutionized numerous fields, including mine: medicine. But, how did this occur? Was your research part of these advancements? Have we innovated and commercialized such research enough? Are companies paying attention to this wonderful research? Are Universities helping you? What about your federal funding agencies? And, most importantly, are you in the right environment to innovate and commercialize your research? In my own experience, above all else, it takes a supportive environment. Find the right community. Find this conference.

I look forward to seeing everyone to further share my story and give you that “positive” boost!

Welcome
Message



Prof. Dr. Yarub Al-Douri

The M-Nano 2026 is one of the specialized and reputed institutes nationwide. It is giving the task of improving the scientific achievements in nanotechnology and nanoscience, and working hardly on several areas related to science and engineering. M-Nano 2026 is to improve networking and presenting a platform for scientific discussions. It is organized to donate the scientists, engineers, academicians, researchers, students and companies an opportunity for presenting their latest research finding, discoveries, ideas and products to focus on its wide applications. With renowned speakers, qualified participants and industrial experts, M-Nano 2026 offers a valuable chance to all delegates to share, learn and exchange views, opinions and thoughts for the future of their respective research areas. It may generate to create links and network amongst established scientist and students from all over the world for the betterment of science and engineering to solve common problems and improve the future.

Our Keynote Team



Bernd Blobel

University of Regensburg, Germany



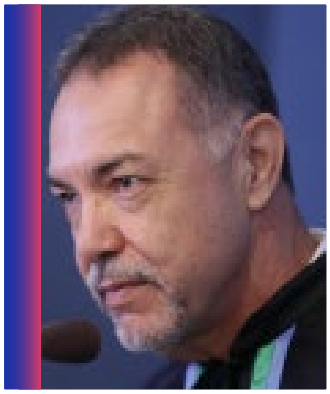
Brian Cantor

University of Oxford, United Kingdom



M.G.H. Zaidi

G.B. Pant University of Agriculture & Technology, India



Paulo C De Morais

Catholic University of Brasilia, Brazil



Thomas J. Webster

Hebei University of Technology, China



Yarub Al-Douri

European Academy of Sciences, Brussels, Belgium

ABOUT
Mathews International LLC

Founded in 2015, Mathews International LLC has rapidly established itself as a prominent publisher in the scientific community. With a strong focus on open access, Mathews International provides a platform for disseminating cutting-edge research across various scientific disciplines. The company has published numerous high-quality journals, fostering advancements in science and ensuring that knowledge is freely accessible to researchers, professionals, and the public alike.

Driven by a commitment to excellence, Mathews International prides itself on maintaining rigorous peer-review standards and collaborating with a diverse network of authors, reviewers, and editors from across the globe. Its open-access model not only promotes transparency and inclusivity but also accelerates the dissemination of vital scientific information. This approach has earned the company a reputation for publishing trustworthy, high-impact research that contributes to solving global challenges in fields such as medicine, environmental science, and technology.

As part of its ongoing commitment to advancing science and fostering collaboration, Mathews International LLC is now expanding into organizing conferences. These events aim to bring together experts, innovators, and thought leaders from around the world to share insights, exchange ideas, and explore the latest developments in their respective fields. The conferences will feature a diverse range of topics, from emerging technologies to groundbreaking healthcare innovations, fostering interdisciplinary dialogues that inspire new perspectives and solutions.

With years of experience in publishing, Mathews International's foray into conferences promises to deliver high-quality, impactful events that align with its mission of advancing scientific discovery and promoting global collaboration.

ABOUT
M-NANO 2026

The 2nd Edition of the International Congress on Materials Science and Nanotechnology (M-Nano-2026) is scheduled for November 23–24, 2026, bringing together researchers, scientists, academicians, engineers, and industry professionals from across the globe through a fully virtual platform.

Participants will engage in a rich agenda that includes expert keynote presentations, oral and poster sessions, and highlighting recent breakthroughs and future trends in Material Science and Nanotechnology. Topics will encompass advanced nanomaterials, quantum materials, two-dimensional (2D) materials, graphene technology, functional and smart materials, nanocomposites, biomaterials, nanomedicine, nanofabrication, nanoelectronics, photonics, magnetic and spintronic materials, and computational materials science. M-Nano 2026 aims to promote interdisciplinary collaboration, inspire scientific innovation, and provide a dynamic platform for sharing knowledge, presenting groundbreaking research, and exploring future opportunities in the field. The program also offers an opportunity for international participants to showcase their research, engage with leading experts, exchange ideas, and establish meaningful academic and professional collaborations.

Be part of a global scientific community dedicated to advancing next-generation materials, innovative nanotechnologies, and sustainable technological solutions. We eagerly anticipate your virtual participation in this international scientific gathering!



Experimental and Theoretical NANOTECHNOLOGY (ETN): Collaboration with M-Nano 2026

The Experimental and Theoretical NANOTECHNOLOGY (ETN) journal is proud to collaborate with M-Nano 2026 as its official supporting publication. As part of this partnership, authors of accepted conference papers are invited to submit their extended manuscripts to ETN for possible publication. This initiative ensures that the significant research presented at M-Nano 2026 is accessible worldwide, indexed, and citable within the global scientific community.

This collaboration offers an exceptional opportunity for researchers and professionals to publish their work in a peer-reviewed journal, gain academic recognition, and enhance the visibility of their contributions. All manuscripts submitted to ETN will undergo a comprehensive peer-review process conducted by the journal's editorial team to ensure the highest standards of quality and originality.

Journal Collaboration

About the Journal

Experimental and Theoretical NANOTECHNOLOGY (ETN), abbreviated as Exp. Theo. NANOTECHNOLOGY, is an international, multidisciplinary, open-access journal that publishes peer-reviewed research spanning the full spectrum of nanotechnology. The journal welcomes original research papers, reviews, short communications, and selected conference-related submissions that explore both experimental and theoretical advancements.

Special Publication Offer

In appreciation of this collaboration, M-Nano 2026 participants will receive a 50% discount on the Article Processing Charge (APC) for manuscripts accepted for publication.

Author Guidelines:

- Authors are requested to prepare their manuscripts strictly in accordance with the official guidelines of Experimental and Theoretical Nanotechnology (ETN). Submissions must follow the ETN manuscript template available on the journal's Instructions for Authors webpage.
- All manuscripts must be written in clear, polished English and must represent original, unpublished work. A similarity index of less than 20% is required, and all submissions will be screened for plagiarism prior to peer review.
- Authors are strongly encouraged to carefully review the formatting, structure, and reference style requirements before submission to ensure a smooth evaluation and publication process. For detailed author instructions, please refer to: https://etnano.com/index.php/journal/InstructionsforAuthors

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Keynote Sessions

NOVEMBER 23-24

2ND EDITION OF INTERNATIONAL CONGRESS ON

MATERIALS SCIENCE AND NANOTECHNOLOGY

KEYNOTE



Prof. Dr. habil. Bernd Blobel, FACMI, FACHI, FHL7, FEFMI, FIAHSI

[1]University of Regensburg, Medical Faculty, Regensburg, Germany

[2]Charles University Prague, First Medical Faculty, Prague, Czech Republic

[3]Faculty European Campus Rottal-Inn, Deggendorf Institute of Technology, Deggendorf, Germany

[4]University of Genoa, DIBRIS, Genoa, Italy

Designing and managing integration and interoperability of intelligent and ethical ecosystems, demonstrated for the health domain

For meeting the financial, quality and safety challenges as well as expectations of the patients, health and social care systems around the globe currently undergo a transformation towards personalized, preventive, predictive, participative precision medicine (5PM), supported by technology. It considers individual health status, conditions, genetic and genomic dispositions in personal social, occupational, environmental and behavioral context, understanding the pathology of diseases and turning health and social care from reactive to proactive. The aforementioned transformation is strongly supported by technologies such as micro- and nanotechnologies, advanced computing, artificial intelligence, autonomous systems and robotics, knowledge representation and management, etc. Besides their opportunities, those advanced technologies also bear risks to be managed, requiring the detailed consideration from a humanistic, moral and ethical perspective. For enabling communication and cooperation between all actors from different disciplines involved, using different methodologies, perspectives, intentions, languages, we shall understand and formally and consistently represent the multidisciplinary, highly complex and dynamic 5PM ecosystem. The outcome is a system-theoretical, architecture-centric, ontology-based, policy-driven approach for designing and managing intelligent and ethical 5PM ecosystems, applicable for any domain's ecosystem. The necessary model and framework has been developed by the author and meanwhile standardized as ISO 23903 Interoperability and Integration Reference Architecture. The formal representation of any ecosystem and its development process including examples of practical deployment of the approach are presented in detail. This includes correct systems and standards integration and interoperability solutions. The presented solutions have been deployed in many different domains already, such as medicine, environmental technology, astrophysics, nanotechnology, education, etc.

Biography

Dr. Bernd Blobel received a multi-disciplinary education, covering mathematics, physics, systems engineering, electronics, medicine, informatics and medical informatics, including habilitations in medicine and informatics. He was Head of the Institute for Biometrics and Medical Informatics at the University of Magdeburg, and thereafter Head of the Health Telematics Project Group at the Fraunhofer IIS in Erlangen. Thereafter, he acted until his retirement as Head of the German National eHealth Competence Center at the University of Regensburg as well as Head of the globally unique International Interdisciplinary PhD and PostDoc College. Dr. Blobel was and is still leadingly involved in many countries' health digitalization as well as electronic health record strategy. He published more than 600 papers, published/edited many books and supervised a big number of PhD students from all around the world. Bernd Blobel was German Representative to

many SDOs such as HL7, ISO, CEN, OMG, IEEE, ASTM, SNOMED, etc., also chairing the national mirror groups. Furthermore, he is still engaged in international higher education. He was leadingly engaged in many countries' national digital health programs. Dr. Blobel is a Fellow of several international academies and played specific roles in global organizations such as WHO, European Commission, UNESCO, etc. His extended publication list is available at https://epub.uni-regensburg.de/view/people/Blobel=3ABernd=3A=3A.html.

KEYNOTE



Brian Cantor

Department of Materials, University of Oxford, Brunel Centre for Advanced Solidification Technology (BCAST), Brunel University London

Complexity in multicomponent high-entropy Cantor alloys

All human advances have depended on making new materials, and all materials are alloys, i.e. mixtures of several different starting materials or components. So the history of the human race has been the continued invention of new materials by discovering new alloys. Recently a new way of doing this, by manufacturing multicomponent high-entropy alloys, has shown that the total number of possible materials is enormous, so we have lots of wonderful new materials yet to find. And multicomponent phase space contains a surprisingly large number of single-phase extended solid solutions and compounds. The first of these that was discovered are called Cantor alloys, an enormous composition range with a single-phase fcc structure, based on the original equiatomic five-component Cantor alloy CrMnFeCoNi. This talk discusses briefly the history of alloying, the discovery of multicomponent alloys, the structure of multicomponent phase space, and the thermodynamics of multicomponent solid solutions such as the Cantor alloys. It concentrates on the complexity of local atomic configurations in such materials, their effect on properties such as atomic diffusion, dislocation slip, recrystallisation, surface catalysis and electron transport, and the resulting outstanding mechanical properties and potential applications, including for corrosion and radiation resistance, and to enhance recycling and re-use.

Biography

Brian Cantor is an Emeritus Professor in the Department of Materials at the University of Oxford, a Research Professor in the Brunel Centre for Advanced Solidification Technology at Brunel University London, and a Chief Editor of the Springer-Nature research journal High Entropy Alloys and Materials. He was previously Vice-Chancellor (President) of the University of York and the University of Bradford, Head of Mathematical and Physical Sciences at the University of Oxford, and a research scientist and engineer at General Electric Research Labs in the USA; he also worked briefly at Banaras Hindu University, Washington State, Northeastern University, IISc Bangalore and the Kobe Institute. Professor Cantor founded and built up the World Technology Universities Network, the UK National Science Learning Centre, the Hull-York Medical School, Oxford's Begbroke Science Park, the York Heslington East campus, the Wolfson Centre for Applied Health Studies, and the UN-backed International Centre of Excellence (ICE) in Circular Materials. He was a long-standing consultant for Alcan, NASA and Rolls-Royce; editor of Progress in Materials Science; Vice-President of the Royal Academy of Engineering; and Trustee of the UK National Science Museum Group, Marshall Scholarship Commission, and Leeds, York and Bradford Chambers of Commerce and Economic Development Boards. Brian Cantor invented the field of multicomponent high-entropy alloys and discovered the so-called Cantor alloys. He has won honours and prizes from many countries around the world. Professor Cantor is a Commander of the British Empire (CBE), Fellow of the Royal Society (FRS) and Fellow of the Royal Academy of Engineering (FREng).

KEYNOTE



Dr. M.G.H. Zaidi

Professor, Department of Chemistry, College of Basic Sciences & Humanities and Chief Executive Officer, Intellectual Property Management Center, G.B.Pant University of Agriculture & Technology, Pantnagar, Uttarakhand-253145, India

Processing of polymer nanomaterials in supercritical fluids: Bright commercial avenues, entrepreneurial opportunities, and only success

Supercritical fluids (SCFs) present the transient state of liquefiable gases and polar liquids above their critical point wherein the phases separating boundaries are unified into a single phase called SCFs. This state demonstrates unique diffusivity like gases combined with liquid like density. Applications of SCFs as an alternative media in food processing, chromatography, energy production and drug development was recognized till beginning of 19th century, has now well accepted in processing of nanomaterials. The most preferred SCFs are the supercritical carbon dioxide (SCC) and supercritical water (SCW). SCFs offers a series of unique opportunities synthesis of nanomaterials, development of nanostructured polymer blends, functional nanostructures and polymer nanocomposites. Size, shape and aspect ratios, infusion, deposition, dispersion of nano fillers are well controlled through tuning of physical variables of SCFs. Present keynote shall address the salient features of SCC and SCW in nanoparticle fabrication, synthesis and processing of nanocomposites, nanohybrids and functional nanostructures for antimicrobial, biomedical, anticorrosive, nano-electronic, structural, and energy storage applications. Concluding remarks will be presented on simplicity, diversity, economics, market potential, entrepreneurship avenues and commercial viability of SCFs assisted processing of nanomaterials.

Biography

Dr. M.G.H. Zaidi is a full professor in the Department of Chemistry, & C.E.O of Intellectual Property Management Center, G.B.Pant University of Agriculture & Technology, Pantnagar, 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. He has visited Germany, South Africa, Malaysia, and Singapore for various academic assignments. Professor Zaidi has mentored over 70 master's and doctorate, has around 200 publications and several patents.

KEYNOTE



Paulo C. De Morais
Catholic University of Brasilia, Brasilia, DF, Brazil

Manipulating graphene quantum dots for oncological application

Halogen-decorated graphene quantum dots (X@GQDs) will be herein explored as a material platform for application in photodynamic therapy (PDT). GQDs have been extensively studied in biomedical areas such as bioimaging, bio-sensing and photothermal therapy due to their superior optical and physiochemical properties. Application of GQDs in PDT has been explored lately, but currently the main challenges are inadequate singlet oxygen ($^1O_2$) quantum yield (QY), poor solubility, and biocompatibility. In this talk, the synthesis of a new class of halogen (fluorine) containing GQDs (F@GQDs) will be described. The as-synthesized F@GQD sample demonstrates an average particle size below 3 nm with a fluorine doping content of around 2%. The synthesized F@GQDs show improved water solubility and biocompatibility, while emitting strong green fluorescence and QY slightly above 13%. Moreover, the photodynamic activity was successfully tested in bioassays (*in vitro*).

Biography

Professor Paulo César De Morais (H60), PhD, was full Professor of Physics at the University of Brasilia (UnB) – Brazil up to 2013. Appointed as UnB's (Brazil) Emeritus Professor (2014); Visiting Professor at the Huazhong University of Science and Technology (HUST) – China (2012-2015); Distinguished Professor at the Anhui University (AHU) – China (2016-2019); Full Professor at the Catholic University of Brasília (CUB) – Brazil (2018); CNPq-1A Research Fellow since 2010; 2007 Master Research Prize from UnB. He held two-year (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 (UFMG) – Brazil. With more than 14,500 citations, Professor De Morais has published more than 500 papers (Web of Science), delivered more than 250 international invited talks (35 countries), and filed more 16 patents.

KEYNOTE



Thomas J. Webster, Ph.D.
Hebei University of Technology, China

Improving mobility and health in over 45,000 humans

Implant infection is rising with the U.S. Centers for Disease Control predicting one person every three seconds will die from a bacteria infection by 2050. 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 provide an over 25 year journey of commercializing nano orthopedic implants now in over 45,000 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, Artificial Intelligence (AI) has revolutionized numerous industries to date. However, its use in nanomedicine has remained few and far between. One area that AI has significantly improved nanomedicine is through implantable sensors. This talk will present research in which implantable sensors, using AI, can learn from patient's response to implants and predict future outcomes. Such implantable sensors not only incorporate AI, but also communicate to a handheld device, and can reverse AI predicted adverse events. Examples will be given in which AI implantable sensors have been used in orthopedics to inhibit implant infection and promote prolonged bone growth. In vitro and in vivo experiments will be provided that demonstrate how AI can be used towards our advantage in nanomedicine, especially implantable sensors. Lastly, this talk will summarize recent advances in nanomedicine to both help human health and save the environment.

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 that have numerous FDA approved medical products currently improving human health in over 30,000 patients. He currently serves as CSO of Novaurum, which 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.

KEYNOTE



Yarub Al-Douri
European Academy of Sciences, Brussels, Belgium

Analytical study of quaternary alloy

Ceramic-based quaternary II–VI materials have attracted much interest because their constituent elements have important characteristics, high characteristics of structure and optic applicable for digital recording heads, telecommunications, transformers, computers, sensors, photovoltaics, antibacterial and others. The $MgZnFe_2O_3$, $CoZnFe_2O_3$ and $NiZnFe_2O_3$ quaternary alloys nanoparticles are tetrahedral materials of chalcopyrite structure. They have been prepared by green technique; their structural properties are varied as atomic number varies. Due to limited or unavailability resources of the mentioned quaternary alloys nanoparticles, the cost is a challenge. However, green synthesis has reduced their cost.

Biography

Prof. Dr. Yarub Al-Douri is a Fellow of European Academy of Sciences, IETI Distinguished Fellow, Fellow of the Islamic World Academy of Sciences and Fellow of the Arab Thought Forum, winner of the NCPD International Prize 2025, winner of the prestigious Khalifa International Award for Date Palm and Agricultural Innovation 2024, recognized as one of World's Top 2% Scientists by Stanford University for six years consecutively since 2020, OeAD Award, Austria 2020, Japan Society for Promotion of Science (JSPS) Award 2019, Asian Universities Alliance (AUA) Award 2019, the total is 86 awards. Al-Douri is Associate Editor of Nano-Micro Letters (Q1, IF=36.3, Springer), Editor-in-Chief of Experimental and Theoretical NANOTECHNOLOGY (Scopus-indexed Q3). His prolific publication record, high h-index, and significant contributions to the scientific field further demonstrate his exceptional expertise. Additionally, he is a prominent public figure, frequently featured in international media for his scientific achievements.

BOOK OF ABSTRACTS

Special Talk

NOVEMBER 23-24

2ND EDITION OF INTERNATIONAL CONGRESS ON

MATERIALS SCIENCE AND NANOTECHNOLOGY

SPECIAL TALK



Michael Spry
Michael Spry Consulting, Traverse City, Michigan, USA

Innovative techniques for computer modeling of thermoelectric property interdependencies

Discussion of thermoelectric (TE) material performance has long been clouded by over-simplifications. Many are based on assumptions of no temperature dependency, exclusion of some properties from consideration, or reducing varying coefficients to singular effective values. In the early decades of scientific analysis for material properties, it was virtually impossible to mathematically integrate the Seebeck, Peltier, and Thomson Effects along with thermal conduction and electrical resistance. It was also an insurmountable challenge to resolve the co-dependencies of properties and thermal gradients. The emergence of widespread computer availability, however, finally offered the necessary capability for high volumes of serial calculations and automatic data manipulation. Legacy methods of analysis have nonetheless continued to predominate well into the 21st Century.

In forging new computer models to support the book Reframing Thermoelectric Effects For Better Understanding, finite element analysis was used to replace the effective levels commonly employed in the past. The intention was to detail the changing flow of energy throughout the length of operational samples. Toward that end, samples were conceptually divided into 1000 or 2000 segments along the axis of current flow. The desired ΔT was then divided among the segments. To establish a thermal gradient across the series, the length of each segment had to be determined. This was accomplished through deriving equations which summed up the interaction of material effects in each segment. This led to the derivation of quadratic formulas which could determine the length of each segment based on the cross-sectional area, junction temperatures, and the segmental energy levels for each of the properties.

It was also necessary to employ a computer algorithm called successive approximation (SA); this made it possible to estimate key variables within nested SA processing loops. The innermost loop established an estimate for source heat, then calculated the lengths of segments and compared the total length with that specified for the sample. Based on the direction of error, a new estimate for source heat was determined by incrementing or decrementing the previous value. After 20 estimates of this heat with decreasing margins of change, the closest sum of the segment lengths would approximate the specified length. Other loops of SA algorithms resolved specifications against calculated values for variables such as current level (for power generation) or peak gradient temperature (for cooling/heating). This led to convergence on a solution which determined the thermal gradient and balanced the varying energy levels from segment to segment. The changing energy levels along the length

were then automatically displayed on an area graph; these included phenomena related to Seebeck, Peltier, and Thomson effects, along with Joule heat and thermal conduction. The computer models for TE power generation and cooling/heating were ultimately able to successfully generate a thermal gradient and balance energy levels for every set of operating specifications attempted over hundreds of trials.

Thus, the innovative use of computer algorithms has led to analysis of material performance with greater potential for accuracy than has been seen with legacy approaches, and which better reveals the actual nature of operation.

Biography

Michael Spry is a retired electrical engineering technologist, computer programmer, and writer. He earned a BS in psychology from Michigan State University, and an AAS in electronics technology from Northwestern Michigan College. After stints in social work and electronics education, Spry spent 24 years as an EET and computer programmer at Tellurex Corporation. There, he designed testing and temperature control systems, and also created computer programs for designing and modeling thermoelectric (TE) systems. He also served on teams designing and testing advanced TE devices. After retiring in 2011, Spry began writing books on TE fundamentals.

BOOK OF ABSTRACTS

Oral Sessions

NOVEMBER 23-24

2ND EDITION OF INTERNATIONAL CONGRESS ON

MATERIALS SCIENCE AND NANOTECHNOLOGY

ORAL PRESENTATION



A.S. Kamzin

Ioffe Institute, St. Petersburg, Russia 194021

New magnetic nanoparticles for theranostics: Diagnostics, drug delivery, and therapy

The first stable colloidal ferrofluid was created in 1938. The heating ability of nanoparticles in an alternating magnetic field was first used for therapeutic purposes in 1957. Ferrofluids have been included in a number of industrial applications such as encapsulation, transformer cooling, loudspeaker damping and cooling, and hazardous waste treatment. Over the past few decades, nanomaterials with sizes less than 100 nm possess unique properties in terms of high surface–volume ratios, tunable properties, enhanced thermal conductivity, which have made these nanomaterials highly useful in a wide range of applications in various fields including large-scale biomedical applications, such as targeted drug delivery, magnetic hyperthermia (MHT) treatment, MRT contrast agents, etc. In 2000, a new method of visualizing human organs was proposed, called magnetic powder imaging (MPI). Magnetic nanoparticles (MNP) are used in the listed methods of diagnostics and treatment of humans. If at the beginning of the stages of applying the MRI and MHT methods, MNP of hematite and magnetite were used, which are the most biologically compatible with a living organism. At present, medicine, especially MPI method, requires MNP with high magnetic characteristics.

Currently, MNP intended for use in the above-mentioned methods of diagnostics and treatment are being studied. MNPs such as core/shell: consisting of hard magnetic and soft magnetic materials, graphene oxide and ferrites, are very promising for biomedicine. The core has high magnetic characteristics, but is often toxic, so the core is coated with a biocompatible material. Combining components with completely different properties and characteristics allows us to obtain materials with new unique properties, which opens up new broad opportunities for their diverse applications.

The report presents the work on the creation of MNP with high magnetic and structural characteristics that satisfy both the well-known MRI method and the new method of visualization and diagnostics of MPI, as well as the treatment (MHT) of human diseases.

Biography

Prof. Dr. of Sci. Aleksandr Kamzin studied Physics at the Kazan State University, Russia and graduated as MS in 1970. In 1969, he was hired by the Laboratory of Magnetism of the Physico-Technical Institute of the Russian Academy of Sciences, where he still works. Professor Kamzin received at the same institution his PhD degree in 1978 and Dr. of Sci. in 1994. From 1969 in the same Institute he was in the position of junior, senior, leading research fellow and at present he is chief research fellow. He has published more than 180 research articles in SCI(E) journals extensively on zoonotic diseases.

ORAL PRESENTATION



Amr Ahmed Mostafa Mohamed

Materials Science Department, Institute of Graduate Studies & Research, Alexandria University, Alexandria, Egypt

A systematic study on the heterojunction effect of Cu_2O on TiO_2 for the photocatalytic degradation of organic compounds under UV irradiation

Semiconductors have been used for the degradation and treatment of a variety of pollutants found in wastewater and textile wastewater, including organic and toxic compounds, resulting in these by using UV irradiation in combination with catalysts such as TiO_2. In this study, TiO_2-Cu_2O nanocomposites of different ratios will be prepared and characterized, and their use in the photocatalytic degradation of Acid Red 8 dye in aqueous solution under UV irradiation as a model pollutant will be examined. TiO_2-Cu_2O nanocomposites were prepared and characterized using XRD, HR-SEM, EDX, and FTIR by using a batch photoreactor. The photocatalytic degradation was investigated utilizing several advanced oxidation processes with Cu_2O contents (0–50) wt%. We found from this study that UV/TiO_2-SnO_2 (90:10) had high activity and efficiency for the degradation of Acid Red 8 dye compared to other ratios.

Biography

Dr. Amr Ahmed Mostafa is a prominent researcher and academic expert in the field of Materials Science and Nanotechnology, with a specialized focus on Heterogeneous Photocatalysis and Nanostructured Semiconductors. He holds a PhD in Materials Science, and his research is at the forefront of developing high-efficiency nanocomposites, particularly TiO_2-SnO_2 and TiO_2-Cu_2O heterojunction systems, for advanced environmental applications and wastewater treatment. Dr. Mostafa has a distinguished track record of publishing high-impact research in prestigious international journals, including Springer Nature and MDPI. His work is widely cited for its contributions to understanding charge carrier dynamics and the optimization of metal oxide catalysts. In addition to his academic achievements, he is a recognized International Invited Speaker and a peer reviewer for several top-tier scientific journals. He is frequently invited to share his expertise at major global congresses across Europe and Asia, where he consults on the integration of nanotechnology in sustainable industrial solutions.

ORAL PRESENTATION



Ankit Kumar[1*], Drishti Pannu[2]

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[2]University Institute of Engineering, Chandigarh University, Mohali, Punjab, India

Advances in nanotechnology-enabled carbon capture: Materials, mechanisms, and applications

The increasing concentration of greenhouse gases and the need for sustainable energy and environmental technologies have accelerated the development of advanced carbon capture strategies. Nanotechnology offers new opportunities to improve the efficiency, selectivity, kinetics, and energy performance of carbon capture through the design of functional nanostructured materials. This talk focuses on recent advances in nanotechnology-enabled carbon capture, with particular emphasis on materials, capture mechanisms, and emerging applications. Different approaches, including absorption, adsorption, and membrane separation, are discussed from the perspective of nanomaterial integration. In absorption-based systems, nanofluids, nanocatalysts, and porous liquids can enhance mass transfer and facilitate solvent regeneration. Advanced adsorbents such as metal–organic frameworks, zeolites, carbon-based nanomaterials, and amine-functionalized materials provide high surface area, tunable pore structures, and tailored surface chemistry for selective gas capture. Nanotechnology also enables the development of mixed-matrix membranes by combining the processability of polymeric materials with the selective separation properties of inorganic nanostructures. Emerging approaches, including direct air capture and electrochemically mediated capture, further demonstrate the potential of nanostructured materials for next-generation carbon capture systems. Despite these advances, challenges related to energy consumption, material cost, moisture sensitivity, regeneration, long-term stability, and large-scale implementation remain. The talk concludes by highlighting current research directions toward the rational design of multifunctional nanomaterials and their integration into efficient, stable, and scalable carbon capture technologies.

Biography

Dr. Ankit Kumar Mittal is an Assistant Professor in the Department of Physics at Chandigarh University, India. He completed his Integrated M.Sc. in Physics from IIT Roorkee, India and received his Ph.D. in Physics from SLIET, India with research focused on ion beam–induced phase stabilization and modification of zirconia-based materials. His research interests include functional materials, energy materials, and radiation-induced modification of materials. Dr. Mittal has published research articles and book chapters and has presented his work at international scientific conferences. His current research focuses on the development and modification of advanced functional materials for energy and other emerging applications.

ORAL PRESENTATION



Dr. Archi Ghosh[1*], Prof. (Dr.) Mahua Ghosh Chaudhuri[2], Dr. Satadal Das[3]

[1]Department of Microbiology, Jagannath Gupta Institute of Medical Sciences & Hospital – North Kolkata, West Bengal, India

[2]School of Materials Science and Nanotechnology, Jadavpur University, Kolkata, West Bengal, India

[3]Senior Consultant Microbiologist, Peerless Hospital & B.K. Roy Research Centre, Kolkata, West Bengal, India

Bio-stabilized silver nanoparticles for antimicrobial applications in oral healthcare

Dental caries and oral microbial infections remain major global health concerns, necessitating the development of effective and biocompatible antimicrobial agents. Silver nanoparticles (AgNPs) have emerged as promising candidates owing to their broad-spectrum antimicrobial activity, high surface-area-to-volume ratio, and ability to disrupt microbial biofilms. However, conventional synthesis methods often involve toxic chemicals that limit biomedical applicability.

This study focuses on the development of bio-stabilized silver nanoparticles using eco-friendly and sustainable capping agents derived from natural biomaterials, including vegetable and fruit waste extracts as well as biocompatible polymers such as carboxymethyl cellulose. The synthesized nanoparticles were characterized using physicochemical techniques to evaluate particle size distribution, morphology, stability, and zeta potential.

The antimicrobial efficacy of the synthesized AgNPs was investigated against major oral pathogens including Streptococcus mutans, Lactobacillus casei, and Actinomyces israelii, which are strongly associated with dental plaque formation and caries progression. The nanoparticles demonstrated significant inhibitory activity against these organisms, suggesting enhanced antimicrobial performance and biofilm disruption potential. Furthermore, the incorporation of AgNPs into a prototype mouthwash formulation highlighted their applicability in preventive oral healthcare.

The findings indicate that bio-stabilized AgNPs provide a sustainable and effective nanotherapeutic strategy for combating oral microbial infections while minimizing environmental toxicity. This work contributes toward the advancement of nanotechnology-based oral healthcare products with improved antimicrobial efficacy and biocompatibility.

Biography

Dr. Archi Ghosh is currently serving as a Senior Resident in the Department of Microbiology at Jagannath Gupta Institute of Medical Sciences & Hospital – North Kolkata. She holds a Ph.D. in Nanomedicine from the University of Calcutta and has also completed postdoctoral research at the School of Materials Science and Nanotechnology, Jadavpur University. Her research expertise includes nanomedicine, microbiology, molecular biology, and antimicrobial therapeutics. Dr. Ghosh has collaborated with the Max Planck Institute for Polymer Research, Germany and has published several research articles in various reputed journals.

ORAL PRESENTATION



Elvira Memetovna Ibragimova*, Inabat N Temirbaeva

Institute of Nuclear Physics Academy of Sciences of Uzbekistan, Tashkent, Uzbekistan

Nanocrystal stripes grown by 5 MeV electron beam on As-Se-S film

Background: Interest in selenides increased in 2000 because of a new phenomenon discovery - structure phase transition induced by irradiation of metal-chalcogenide glass with focused 10-15 keV electron beam in SEM. Kinetic Monte Carlo simulations of fcc clusters showed that particles with six neighbours move faster below the roughening temperature. Recently As_2Se_3 and other metal chalcogenides have been attributed to a new class of photonic semiconductors due to their unique set of properties, such as low electrical conductivity, strong optical nonlinearity, high photosensitivity. Anion isovalent doping (S,Se,Te) generates shallow hole centers thereby combining high optical absorption, exciton luminescence and hole conductivity.

Methods: Our research is aimed at growing nanocrystal arrays under scanning fast electron beam and studying how the induced nanostructures influence the optical extinction (absorption and reflection). Material: $As_2(Se,S)_3$ film deposited on the poly(ethylene terephthalate) has the width 3 cm and thickness 55 μm. The U-003 linear electron accelerator with the parameters: 5 MeV electron beam at current density - 400 nA/cm^2, current pulse – 4 μs, beam width – 3 cm, beam scan 30 cm. Samples were irradiated in air at 160 and 290 K within fluency range 10^{14}-10^{15} cm^{-2} (6 dose steps). The following methods were implemented: SPM for surface roughness and morphology, SEM-EDS for quantitative local chemical element composition, XRD for crystal structure and phase composition analysis, FTIR and UV-vis spectroscopy.

Results: The estimated fast electron energy transfer is 10^4-10^5 J/cm^2. Since the maximal shell electron energy of As and Se is 12 keV, the scattering mechanisms are ineffective. The dominating mechanisms are ionization and radiation losses on the way of 5 MeV electron to the As and Se nuclei followed by nuclear reactions: As(33,42) + e- = Ge(32, 42)* seconds-living radionuclide; Se(34,46) + e- = As(33, 46)* minutes-living radionuclide. Both radionuclides emit beta and gamma producing structure damages. SPM revealed nanoscale grating (1-3 nm stripe height, 10-20 nm step) in the pristine sample. The electron fluency 10^{14} cm^{-2} at 165 K results in smoothening of sharp peaks of the grating and transforming it into larger cones. The dose dependence of optical density at E_g looks like periodic charging-discharging. And at 290 K one can see the distance between the neighboring fast electrons ~ 80 nm for the given electron beam density 400 nA/cm^2. The beam is inhomogeneous and makes stripes of conical and rod-like nanocrystals along the beam scanning direction. It happens with the significant contribution from the thermal diffusion at 290 K, as compared to that at 160 K. Semimetal

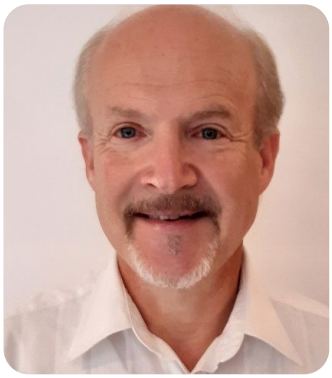
Arsenic cations are driven by the strong electric field towards the electron tracks as suggested by [Yoshida-1997].

Conclusions: The scanning 5 MeV electron beam at moderate fluencies and low temperatures resulted in the fast growth of As_n and As_2Se_3 rod-like (up to 100 nm height) faceted nanocrystal stripes arranged along the beam scanning direction on the exposed film surface. Such an ordered morphology intensified the fine structure of the optical oscillations. The process of self-assembling nanoparticles in faceted nanocrystals is driven by the known law of minimizing entropy.

Biography

Prof. Ibragimova Elvira Memetovna is a material scientist specializing in research of nuclear radiation impact on chemical element composition and crystal structure transformations in solids at macro-micro-nano-scales, and also physical functional response of various dielectric, semiconducting and superconducting materials on the irradiation. She holds Diploma of PhD, DrSci, Senior Scientist, Professor in physics of condensed state from the Institute of Nuclear Physics, Uzbekistan Academy of Sciences and has published ~100 research articles in international journals. Prof. Ibragimova is currently a Principal Researcher in this Institute and the chair of Expert Council in Physics in Uzbekistan.

ORAL PRESENTATION



Ernst Wagner

Pharmaceutical Biotechnology, University of Munich (LMU), Germany

Chemical evolution of nanomaterials for RNA delivery and genome editing

RNA drugs require targeted, efficient, and safe delivery. A bio-inspired chemical evolution strategy identified small sequence-defined lipopeptides with outstanding RNA transfer efficacy, easily available by simple (4-5 step) synthesis using natural or artificial amino acids, and lipo amino fatty acids (LAFs). LAF-peptides are dynamic in their response to endosomal pH, resulting superior endosomal escape. Refinement of carriers in sequence and topologies generated U-shape topologies with polar domain between LAF lipids, and Bundle topologies with the polar domain at the end. Bundle carriers transfect in full serum at very low mRNA dose (only ~2 nanoparticles/cell). Upon systemic administration of mRNA complexes, expression is found in the majority of organs of mice, with the highest levels in the spleen. Formulation of siRNA into LAF-LNPs results in in vivo gene silencing in liver endothelial cells or, upon coating with suitable ligands, gene silencing targeted into tumor endothelial cells. Carriers for CRISPR Cas9/sgRNA trigger genome editing in cell culture at ultra-low dose and upon i.v. application in skeletal muscle, heart muscle or brain of mice. Molecular mechanisms of carriers are enlightened by biophysical (LogD), ultrastructural (TEM, SAXS) characterization and MD calculations. Carrier topologies drastically differ in their interaction with lipid membranes, as revealed by SAXS in cholesterol bulk phases. U-shapes form standard lamellar phases, the more rigid dendritic Bundles fusogenic form inverted phases, with immediate impact on transfection mechanism and kinetics.

Biography

Prof. Ernst Wagner is Chair of Pharmaceutical Biotechnology, Department Pharmacy, LMU Munich (since 2001). He was Director Cancer Vaccines, Boehringer Ingelheim 1992-2001 (world-wide first polymer-based gene therapy in 1994), 1987-1995 Group Leader at IMP Vienna and Vienna University Biocenter, 1985-1987 postdoc at ETH Zurich, 1985 PhD (TU Vienna). Professor Wagner is Academician of European Academy of Sciences, Controlled Release Society (CRS) College of Fellows, Honorary Professor at U of Sichuan. He authored ≥533 publications, with ≥56 700 citations, h-index 120 (GS).

ORAL PRESENTATION



Ghazal Tuhmaz*, Hoda Sharouf

Department of Textile Engineering, College of Petroleum and Chemical Engineering, Homs University, Homs, Syria

The effect of incorporating copper oxide nanoparticles on the properties of recycled acrylic fibers made by electrospinning technology

Electrospinning is a simple and effective method to obtain nanofibers with distinctive properties such as large surface area to weight and high porosity, which make them attractive for many applications. In this research, electrospinning technology was used to obtain nano non-woven mats using acrylic nanofibers (PAN) with copper oxide nanoparticles to improve the moisture absorption of the acrylonitrile polymer. CuO NPs were prepared and characterized. It was found that the average diameter of the particles is 28.5 nm. 6% polyacrylonitrile solution was prepared in a 50/50 mixture of acetone and dimethylformamide to produce nano non-woven mats. The nanoparticles were added to the polymer solution at several concentrations (0.25, 0.5, 1%). Samples were then prepared using an electrospinning device. In the end, 4 nano mats were obtained. They were characterized using a scanning electron microscope. It was shown that the diameters of nanofibers increased with increasing copper oxide concentration in the polymeric solution. Then, several tests were carried out to measure the ability of the prepared non-woven mats to absorb moisture, including measuring drop contact angle and absorption capacity test. After recording the results and comparing the samples, it was concluded that by increasing the concentration of CuO NPs, the absorbance improves significantly compared to the reference sample. Resulted non-woven mats can be used in applications that benefit the field of textiles and nonwovens by investing in acrylic exhaust, thus achieving an impact in the field of environmental protection with sustainable nanofibers as well as supporting the industry at the same time.

GHAZAL TUHMAZ, HODA SHAROUF, (2026). THE EFFECT OF INCORPORATING COPPER OXIDE NANOPARTICLES ON THE PROPERTIES OF RECYCLED ACRYLIC FIBERS MADE BY ELECTROSPINNING TECHNOLOGY. Journal of Textiles and Engineer, Tekstil ve Mühendis 33 (142), 42-48
DOI:10.7216/teksmuh.1771602

Biography

Current Roles: Head of the Textile Engineering Department at Homs University in Syria. Supervisor of the Nanofibers Lab at Homs University and Nanotechnology Laboratory at the National Center for the Distinguished (NCD) in Homs.
Academic Rank: Assistant Professor / PhD holder.
Primary Institution: Faculty of Chemical and Petroleum Engineering, Homs University.

Dr. Tuhmaz works at the intersection of:

Nanotechnology & Nanofibers: Advanced development of electrospun fibers and green electrospinning methods designed to preserve the environment.

Smart Textiles & Biomedical Applications: Engineering conductive technical fabrics, flexible strain sensors for smart applications, and biomaterials.

Artificial Intelligence: Utilizing artificial neural networks and fuzzy logic systems to model and predict the properties of nanomaterials.

ORAL PRESENTATION

Dr Harishchandra Singh, ANRF Ramanujan Faculty Fellow
AIAS, Amity University, India

Advanced nanomaterials for green hydrogen production: From catalyst design to real-time understanding

The development of efficient and durable nanomaterials is crucial for advancing green hydrogen technologies. This presentation will highlight recent progress in designing nanostructured transition-metal-based materials for electrocatalytic water splitting, with emphasis on interface engineering, defect modulation, and electronic structure optimization.

The role of nanoscale architecture in improving catalytic activity, charge transfer, and long-term stability will be discussed, along with approaches for developing scalable materials suitable for practical hydrogen production systems. Furthermore, advanced characterization strategies, including in-situ/operando techniques, will be highlighted to understand dynamic structural evolution of catalysts under working conditions.

This work demonstrates how rational nanomaterial engineering combined with real-time insights can accelerate the development of next-generation materials for sustainable hydrogen energy applications.

ORAL PRESENTATION



Irfan Nurhakim Hilmi*, Velin Intani Animesa, Raditya Anggara N. Santoso, Akhmadi Surawijaya

Institut Teknologi Bandung, Bandung, Indonesia

Simulation-driven design of a passive-basis BB84 QKD receiver on silicon photonics using Tidy3D and PhotonForge

Silicon photonics promises compact and stable quantum key distribution (QKD) receivers, but every decibel of loss and every degree of polarization error directly reduces the secret key rate. We present the simulation-driven design of a passive-basis BB84 receiver at 1550 nm, in which fixed on-chip splitters, rather than an active modulator, choose the measurement basis. The design targets the SiEPIC EBeam PDK on the Applied Nanotools 220 nm SOI electron-beam process. Each component is optimized in Tidy3D, whose open-source Python interface drives FDTD, eigenmode-expansion and heat solvers. The layout, extracted from the simulated geometry, is assembled in PhotonForge and verified with LVS and the open-source SiEPIC design-rule deck in KLayout.

Light from the fiber enters through a perfectly vertical two-dimensional polarization-splitting grating coupler (2D PSGC). It separates the two fiber polarizations into two waveguides with −3.14 dB efficiency and below 0.05 dB polarization-dependent loss, without a bottom mirror. TiW thermo-optic phase shifters and a tunable Mach–Zehnder interferometer (P_π=23.4 mW, 18 µs response) then undo the polarization rotation of the fiber. In each arm, a biased 1×2 multimode interference (MMI) coupler, designed on a stable 84:16 self-imaging plateau with 0.105 dB loss, sends most photons to the Z-basis detectors. The remaining light from both arms interferes in a 2×2 MMI (0.025 dB imbalance) to measure the X basis. Four inverse-taper edge couplers (0.38 dB loss) carry the outputs to off-chip single-photon detectors. Under fabrication variations, the MMI split ratios move by less than 0.5%. The grating resonance shifts by 1.65 nm per nm of silicon thickness while its peak efficiency stays between −2.3 and −3.2 dB.

The complete 1.79 × 0.80 mm receiver has 3.8 dB fiber-to-detector loss and an intrinsic QBER below 1.3×10^{-4}. We combine time-domain circuit simulation at 1 GHz, a gradient-descent tracking controller fed by reference pulses, and finite-key decoy-state analysis with superconducting detectors. Under slow fiber drift, the receiver delivers 10.1 Mbps secret key rate at 25 km and reaches 185 km. Under moderate drift it delivers 8.9 Mbps, and the range drops to 90 km because tracking speed becomes the limit. By linking nanoscale device optimization, verified layout, and quantum-link simulation in a single scriptable flow, this work shows that a fabrication-ready QKD receiver can be designed and its secure key rate predicted before any chip is made, giving a reusable path for future quantum photonic circuits.

Biography

Irfan Nurhakim Hilmi is a fresh graduate student from Institut Teknologi Bandung, Indonesia. He majors in Electrical Engineering and specializes in IC Design and Semiconductor Technology. Irfan has worked on multiple projects related to silicon photonics, from components to circuits. His biggest projects are on the implementation of quantum photonic circuits, specifically quantum key distribution.

ORAL PRESENTATION



Jaqueline da Silva Soares

Bioproseg Institute of Nanotechnology and Biotechnology, Novo Hamburgo, Rio Grande do Sul, Brazil

Surface area-driven functionalization of graphene oxide: A review on interfacial challenges, charge transfer, and enthalpy shifts in polymeric epoxy blends

This study reviews the critical challenges in integrating graphene oxide (GO) into polymeric epoxy blends, focusing on leveraging its high theoretical specific surface area through strategic chemical functionalization. Despite its exceptional properties, pristine GO often suffers from severe agglomeration driven by π–π stacking, which hinders interfacial efficiency. Surface functionalization addresses this barrier by tailoring the interface, drastically decreasing charge transfer resistance (R_{ct}) and enhancing local electron mobility across the polymer-GO boundary. Furthermore, the engineered interface induces significant thermodynamic shifts within the epoxy matrix; the high specific surface area restricts the segmental mobility of polymer chains, altering the heat capacity (C_p) step and optimizing the total cure enthalpy (ΔH_{cure}). This structural immobilization effectively suppresses enthalpy relaxation, enhancing long-term thermal stability. Ultimately, tuning the GO surface area via functionalization represents a vital pathway to overcome interfacial limitations, translating nanoscale properties into high-performance advanced materials for technological applications.

Biography

Jaqueline S. Soares is a chemical engineer and researcher specializing in nanostructured membranes and films for environmental solutions and biomaterials. A specialist in Recovery of Degraded Areas from Feevale University and a Master's candidate in Materials Engineering at UFRGS, she leads innovative research in Rio Grande do Sul, Brazil. Her studies focus on developing nanostructured frameworks for gas and pollutant sequestration, as well as ion-exchange membranes. Currently, Soares serves as CEO of the BIOPROSEG Institute of Nanotechnology and Biotechnology, where she coordinates the development of high-performance advanced materials for sustainability.

ORAL PRESENTATION



Jing-Yang You
Beihang University (BUAA), Beijing, China

Moiré excitons in generalized Wigner crystals: A first-principles GW-BSE study

Generalized Wigner crystals (GWCs) emerge in transition-metal dichalcogenide (TMD) moiré superlattices at fractional carrier fillings due to strong electron correlations in flat bands. When such correlated insulating ground states are photoexcited, they give rise to unusual excitonic phases, Wigner crystalline excitons (WCEs), where the interplay between electronic and excitonic correlations fundamentally reshapes the exciton internal structure. However, a microscopic understanding of WCEs has remained elusive. Here, by enabling large-scale first-principles many-body GW-Bethe-Salpeter equation (GW-BSE) calculations on systems with nearly 10,000 atoms per supercell, we directly reveal the internal structure of WCEs in an angle-aligned $MoSe_2/MoS_2$ moiré heterostructure at hole fillings ν_h=1/3 and 2/3. We find that the symmetry-breaking charge order of the GWC ground state propagates into the excited states: the excited electron density of the lowest-energy exciton does not follow the conduction band wavefunctions but instead closely tracks the excited hole density, which itself is pinned by the Wigner crystal. The electron-hole interaction dominates over the kinetic energy of free electron-hole pairs by more than an order of magnitude (exciton binding energies ~98–118 meV vs. bandwidth ~2–3 meV), making WCEs intrinsically correlation-driven. We further propose a photocurrent tunneling microscopy (PTM) experiment that can directly visualize the strongly correlated electron-hole pair distribution, providing an unambiguous experimental signature. Our work establishes a general computational framework for studying correlated excited-state phenomena in moiré quantum matter and highlights WCEs as a highly tunable mixed boson-fermion platform for exploring many-body interactions.

Biography

Dr. Jingyang You is an Associate Professor at the International Frontier Interdisciplinary Science Institute, Beihang University (BUAA). He received his Ph.D. in Condensed Matter Physics from the University of Chinese Academy of Sciences in 2020. Dr. You then conducted postdoctoral research at National University of Singapore and University of Southern California before joining BUAA in 2025. His research focuses on first-principles calculations of correlated quantum materials, including moiré excitonics, electron-phonon coupling in kagome superconductors, and topological quantum states. Dr. You has published over 40 papers as first/corresponding author in journals such as PNAS, Phys. Rev. Lett., JACS, and Natl. Sci. Rev.

ORAL PRESENTATION



Dr. Kumaraswamy Adepu

Professor, Mechanical Engineering, Defence Institute of Advanced Technology,
Pune - 411025, Maharashtra, India
(An autonomous institution under the Ministry of Defence, Govt. of India)

Relevance of indentation (nano/micro/macro) in current materials research

The increasing application of advanced materials in aerospace systems demands reliable characteris -ation of mechanical properties across multiple length scales, particularly when conventional destructive testing is impractical for miniature components, thin sections, coatings, and limited-volume materials. Instrumented indentation provides a powerful alternative for evaluating mechanical properties from macro- to nano-scale loads with minimal material consumption and damage. However, the influence of indentation size, strain rate, and temperature on the extracted mechanical properties remains an important consideration in establishing reliable material-property databases.

The present investigation focuses on the mechanical characterisation of two technologically important aerospace alloys: Ti-6Al-4V (Ti64), widely employed in low-pressure compressor components, and the precipitation-hardenable Ni-base superalloy Haynes 242 (H242), used in high-temperature aerospace applications. A systematic study was undertaken to examine indentation size effects (ISE) and the influence of strain rate and temperature over a broad range of loading conditions.

Macro-indentation experiments were performed using spherical indenters of different radii, while instrumented micro- and nanoindentation tests were conducted using a Berkovich indenter. The experimentally obtained indentation responses were analysed using established Tabor and Johnson approaches for determining elastoplastic properties. Dao's reverse-analysis methodology was employed to extract key plasticity parameters, including yield stress and strain-hardening exponent. In addition, finite-element (FE) simulations were carried out to investigate the temperature dependence of the mechanical response over the range of 300–673 K.

The results demonstrate that indentation size, strain rate, and temperature significantly influence key indentation-derived parameters, including Meyer hardness, constraint factor, pile-up/lip height, load–displacement response, yield stress, and strain-hardening exponent. The observed indentation size effects highlight the importance of accounting for length-scale dependence when interpreting nanoindentation data and correlating local mechanical properties with bulk material behaviour.

A qualitative correlation between the macro-, micro-, and nano-scale length regimes is established for Ti64 and H242, providing an integrated framework for understanding their mechanical response across multiple scales. The resulting characterisation methodology and material-property database

can support improved interpretation of nanoindentation measurements and contribute to more reliable design and performance assessment of aerospace components operating under demanding mechanical and thermal environments.

Keywords: Nanoindentation, Instrumented indentation, Indentation size effect, Ti-6Al-4V, Haynes 242, Strain rate, Temperature, Aerospace materials, Finite-Element analysis

Biography

Dr. Kumaraswamy Adepu is Professor of Mechanical Engineering at DIAT (DRDO), with 31 years of experience in teaching, research and academic leadership. His research interests include mechanical characterisation through Nano/Micro/Macro indentation, high strain rate deformation behaviour, tribology, and allied areas. He has served as Principal Investigator for sponsored R&D projects funded by DRDO and has contributed significantly to research and innovation through 4 patents, 75 peer-reviewed journal publications, 6 eBook chapters and 45 conference proceedings. Dr. Adepu has supervised 10 PhD scholars and 75 plus M.Tech./MS(R) scholars, with 8 doctoral scholars currently pursuing research under his guidance. He has also adjudicated 30 plus PhD theses.

ORAL PRESENTATION



Lívia Vieira Depieri*, Maria Vitória Lopes Badra Bentley

School of Pharmaceutical Sciences of Ribeirão Preto, University of São Paulo, Ribeirão Preto, São Paulo, Brazil

Microfluidics for nanoparticle production: Advances, challenges, and opportunities

Microfluidics has emerged as a powerful technology for nanoparticle production, offering precise control over fluid mixing and process conditions, improved reproducibility, and opportunities for continuous and scalable manufacturing. The physicochemical properties of nanoparticles produced by microfluidics are strongly influenced by the interplay between formulation composition, device design, and processing parameters. However, moving from controlled nanoparticle formation to robust drug delivery systems still involves important challenges, including process optimization, scale-up, and downstream processing.

This presentation will discuss key advances and remaining challenges in microfluidic nanoparticle production, using nanostructured lipid carriers (NLCs) as a case study to illustrate the relationship between formulation composition, processing conditions, and nanoparticle properties. NLCs composed of solid and liquid lipids were produced using a herringbone microfluidic device, and critical parameters, including lipid concentration, flow rate ratio (FRR), and total flow rate (TFR), were investigated. The resulting NLCs showed particle sizes below 150 nm and low polydispersity, demonstrating the ability of microfluidic processing to generate nanoparticles with controlled physicochemical properties.

Beyond nanoparticle formation, downstream processing was investigated as a critical step toward obtaining stable formulations. Different strategies for residual solvent removal and freeze-drying were evaluated, demonstrating that post-production conditions can substantially influence nanoparticle recovery and redispersion. Optimization of these steps enabled preservation of the colloidal properties of the NLCs after reconstitution.

Overall, these findings illustrate both the potential and the challenges of microfluidics for nanoparticle production. Integrating formulation design, microfluidic process parameters, scale-up strategies, and downstream processing is essential for translating the advantages of microfluidics into robust and scalable nanocarrier production. Together with examples from ongoing research, this case study will provide a broader perspective on the opportunities of microfluidic technologies for the development of advanced drug delivery systems.

Biography

Lívia Vieira Depieri, PhD, is a postdoctoral researcher at the NanoGeneSkin Laboratory, School of Pharmaceutical Sciences of Ribeirão Preto, University of São Paulo (FCFRP-USP), Brazil. Her research focuses on advanced drug delivery and nanotechnology for skin diseases, including lipid-based nanocarriers, topical delivery, siRNA-based therapies, microneedles, and microfluidics for controlled and scalable nanocarrier production. During her PhD, she conducted part of her research at the Massachusetts Institute of Technology (MIT) under the supervision of Prof. Robert Langer. Dr. Depieri's current research integrates nanocarrier development, process optimization, and advanced strategies for drug and nucleic acid delivery.

ORAL PRESENTATION



María José Lavorante

Faculty of Engineering, National Defense University, Ciudad Autónoma de Buenos Aires, Argentina

Institution of Scientific and Technological Research for Defense (CITEDEF), Buenos Aires Province, Argentina

Influence of surface condition and agitation on the performance of pickled-passivated stainless steel electrodes for water electrolysis

The performance of stainless steel electrodes in alkaline water electrolysis is strongly influenced by surface condition, interelectrode distance, and hydrodynamic regime. In particular, chemical surface treatments may alter the electrode/electrolyte interface and modify the global response of the cell. In this work, the influence of surface condition and agitation on the performance of pickled-passivated stainless steel electrodes was investigated in a two-electrode water electrolysis cell.

Four anode/cathode surface configurations were studied: TL-TL, TL-PP, PP-TL, and PP-PP, where TL denotes the electrode under a cleaning treatment and PP the pickled-passivated one. The system was evaluated at interelectrode distances of 6, 10, 14, 18, and 22 mm, both in the absence and presence of agitation. Cell voltage-current density (V-j) curves were obtained, and the response was further compared at representative voltages of 2.5, 3.0, and 3.5 V. In addition, the effect of agitation was quantified through the parameter $\Delta_{jagitation}=j_{with\ agitation} - j_{without\ agitation.}$

In the absence of agitation, interelectrode distance had a strong effect on performance, with current density decreasing systematically as the distance increased in all configurations. Under these conditions, the relative order of response was generally TL-TL>PP-TL>PP-PP>TL-PP, indicating that the pickled-passivated treatment did not improve the global cell response and that its effect depended on the electrode to which it was applied. In particular, treating only the cathode led to the least favorable behavior. To illustrate this trend with numerical values, at 3.0 V and 6 mm the above-mentioned configurations presented current densities of 164.02, 145.93, 143.29, and 122.83 [mA cm^{-2}] for TL-TL, PP-TL, PP-PP, and TL-PP, respectively.

Under agitation, a markedly different behavior was observed. Although the effect of interelectrode distance remained evident, the relative order between configurations changed substantially. In general, the response tended to follow the order PP-TL>PP-PP>TL-PP>TL-TL, indicating that TL-TL became the least favorable configuration, while the systems containing at least one pickled-passivated electrode exhibited higher current densities over the full distance range. To illustrate this behavior numerically, at 3.0 V and 6 mm the current density values were 251.52, 246.36, 233.77, and 151.39 [mA cm^{-2}] for PP-TL, PP-PP, TL-PP, and TL-TL, respectively.

When the net effect of agitation was evaluated for each individual configuration as s $\Delta j_{agitation} = j_{with\ agitation} - j_{without\ agitation}$, a strong configuration dependence was observed. At 3.0 V and 6 mm, $\Delta j_{agitation}$ was −12.63 [mA cm^{-2}] for TL-TL and +110.94, +105.58, and +103.07 [mA cm^{-2}] for TL-PP, PP-TL, and PP-PP, respectively. In the treated systems, the positive effect of agitation remained significant at all distances, although it tended to decrease as the interelectrode gap increased.

These results show that agitation not only changes the magnitude of the cell response but also modifies the hierarchy of performance among surface configurations. Agitation strongly favors systems containing at least one pickled-passivated electrode and attenuates the previously adverse effect associated with cathode treatment. Overall, the results highlight the importance of the interplay between surface condition, interelectrode distance, and agitation in determining the performance of stainless-steel-based water electrolysis systems.

Biography

María José Lavorante collaborates with the Research and Development Division of Renewable Energy at the Institution of Scientific and Technological Research for Defense (CITEDEF), Argentina. Her research interests include water electrolyzers, fuel cells, dark fermentation and conductometric titrations. She is Professor of Solids and Colloidal Chemistry at the Faculty of Engineering, National Defense University. From 2021 to 2024, she coordinated the CYTED H2Transel subnetwork "Electrolyzers for Industrial Use and Storage." Professor Lavorante has published numerous scientific articles in her areas of interest and has served as reviewer for international congresses and peer-reviewed journals.

ORAL PRESENTATION



Prof. Narasimha Golla

Professor and Dean (R&D), Sri Venkateswara University, Tirupati-517502, Andhra Pradesh, India

Biosynthesis of metallic nanoparticles (MNPs) and their applications in medical, agricultural, and environmental sectors

Nanotechnology is a novel interdisciplinary science that serves as a nexus between the basic sciences and the life sciences, and the life sciences are no exception. As multi-drug resistance in pathogens has rendered antibiotics ineffective, nanoparticles are the next frontier. Silver nanoparticles have been found to have applications in various fields, such as inter-chelating agents. Due to their enhanced responsiveness to environmentally friendly technology for quantifiable synthesis, several developed nations have seen significant growth in the biosynthesis of metallic nanoparticles. The biological method, however, is the most in-demand approach to preparation because it is quicker, safer, less expensive, and more environmentally friendly than other techniques. In addition, the importance of silver, copper, and cobalt has been extensively examined in light of their numerous applications, including antifungal, anti-inflammatory, antibacterial, antiviral, and biocatalytic activities, as well as their use in anticancer medicines. The significant texture of MNPs is their broad-spectrum antimicrobial property, which is attributed to their ability to inhibit microbial colonization associated with biomaterial-related infections. Recent reports indicate that fungi, viruses, and bacteria are susceptible to metal nanoparticles. In our lab, the biological synthesis of metal nanoparticles, silver, copper, and cobalt, occupying the top slot, uses an eco-friendly approach. Metallic silver nanoparticles are synthesized by the cell-free filtrate of various microbial sources. Viz fungi (Aspergillus niger, Aspergillus flavus, and Agaricus bisporus), Actinobacteria (Actinomycetes), and copper and cobalt from the plant parts (leaves, flowers, stems, etc.). Using plant sources as reducing agents in the formation of MNPs is particularly attractive due to the process's cost-effectiveness and time-saving nature for MNPs synthesis. In our studies, various plants, including Piper betle, Ocimum leaves, Azadirachta indica, Ficus religiosa, and Ziziphus, are used to synthesize AgNPs. CuNPs & CoNPs) from Senna alata. The synthesized AgNPs were characterized by UV-visible spectroscopy, FTIR, SEM, and DLS to further examine their biosynthesized efficacy and morphological properties, including size, shape, and stability. The probable mechanism for the extracellular biosynthesis of MNPs (silver) nanoparticles was explained. The synthesized metallic nanoparticles exhibited excellent antimicrobial activity against bacterial pathogens (E. coli, Staphylococcus, Pseudomonas, Bacillus spp., etc.), including drug-resistant bacteria, plant fungal pathogens (Sclerotium rolfsii, Rhizoctonia bataticola, etc.), and antiviral activity against Sesbania mosaic virus, a causative agent of mosaic disease in Sesbania plants in the agricultural sector. The biocatalytic nature of MNPs has been tested on textile dyes, such as Methylene Blue (MB) and Bromothymol Blue (BTB). The AgNPs exhibited good decolorization of dyes, which is useful for environmental cleanup.

Biography

Professor Narasimha Golla is presently working as Professor and Dean (R&D) at Sri Venkateswara University, India. He focuses on Applied Microbiology and Nanotechnology, specifically bioactive compounds and the characterization of metallic and non-metallic nanoparticles. His work explores their biological applications as antimicrobial, anticancer, antiviral, and biocatalytic agents in modern medicine and bioremediation. He has published over 180 papers in reputable national and international journals, as well as several books and book chapters. His research has been supported by major projects from the Department of Biotechnology, the University Grants Commission, and the Board of Nuclear Sciences, India. Additionally, he serves as an editor and advisory board member for various peer-reviewed journals and maintain active memberships in organizations such as the American Nano Society (AMN) and the Asian Council of Science Editors (ACSE). Professor Golla also currently serves as the President of the Microbiology Society of India, Andhra Pradesh (MBSI). Narasimha was honored with several recognitions, including being named a Highly Cited Researcher by Elsevier and receiving the World Research Fellow (London, 2025) and the Research Excellence Award. Dr. Narasimha looks forward to the possibility of collaboration and further development of eminence in modern science and technology.

Publications and Citations: I and h index

Google Scholar Citations: 6643; Scopus publications: 118

Google Scholar I index: 113; Web of Science: 86

Google Scholar h-index: 39

Research Gate: https://www.researchgate.net/profile/Gnarasimha?ev=hdr_xprf

Google Scholar: http://scholar.google.com/citations?hl=en&user=M1-UMc8AAAAJ

Scopus: http://www.scopus.com/authid/detail.url?authorId=6603251119

ORAL PRESENTATION



Oleg Dimitriev[1*], Alexander Fedoryak[1], Petro Smertenko[1], Shih-Wei Huang[2], Fu-Chuan Fan[2], Chih-Hao Chang[2], Dovydas Blazevicius[3], Gintare Krucaite[3], Saulius Grigalevicius[3]

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Thermal energy upconversion using thermally-activated delayed fluorescence materials

Heat and thermal radiation are large components of energy provided by direct sun radiation (where infrared constitutes a significant portion), terrestrial radiation, byproducts of industrial and agricultural activity, physical, chemical and biological processes in nature as well. However, a subsequent conversion of thermal energy into other useful forms such as electricity or mechanical work is associated with significant irreversible losses and generally low efficiencies if operating at modest temperature differences. Therefore, novel principles of thermal energy conversion into convenient forms, which are less dependent on high temperatures and temperature gradients as well as on spontaneous discharge, are still of great demand. Thermally activated delayed fluorescence (TADF) is an interesting option for thermal energy upconversion into the visible light, where the latter can be further used for solar cell operation to produce electricity or for direct lighting. In TADF process, the thermal activation step is needed to fulfill an electronic transition from the triplet to singlet energy level of the TADF emitter, from which radiative relaxation of the excited electron occurs, where heat might be exploited as a side energy assisting luminescence. In this work, the potential of heat upconversion to visible light through thermal management of the TADF-based OLEDs is demonstrated. We show that the performance of OLEDs based on the yellow (Y) and green (G) TADF emitters can be effectively tuned by temperature. In particular, enhancement of the OLED's electroluminescence by 5–6 times was achieved when operating near the turn-on voltage and heating the device to 50°C, while enhancement decreases at higher applied biases. Upon heating, enhancement of the external quantum efficiency and power efficiency of the devices was achieved by factors of up to 7.4 and 1.13 for the Y device and by 3.8 and 1.16 for the G device, respectively. From the practical point of view, exploiting OLEDs at high temperatures may still be a challenging task due to the potentially negative long-term impact of heat on device performance, which should be prevented as well. By overcoming the related problems, the thermal management of emissions and the energy upconversion of TADF-based OLEDs promise potential application of this phenomenon for heat harvesting and energy-saving applications.

Biography

Dr. Dimitriev is a physicist specializing in photophysics of organic dyes and conjugated polymers, also working in other related fields such as material science of organic and hybrid heterostructures, energy conversion, photoinduced charge transfer, ecology issues as well. He obtained his Ph.D. degree in solid state physics from Donetsk State University in 1992 and currently is a Senior Scientist at V. Lashkaryov Institute of Semiconductor Physics, National Academy of Science of Ukraine. Dr. Dimitriev also works as Assistant Professor at Igor Sikorsky Kyiv Polytechnic Institute. He has been a recipient of international awards obtained from Swedish Institute, Fulbright Visiting Scholar Program, German Academic Exchange

Service (DAAD), and Japan Society for the Promotion of Science (JSPS). Dr. Dimitriev is the author of over 100 publications and two popular science books.

ORAL PRESENTATION



Prof. Dr. Osman Adiguzel

Firat University, Department of Physics, Elazig, Turkey

Dual memory characteristics and lattice reaction governing reversibility in shape memory alloys

Shape memory alloys are adaptive structural materials and take place in a class of advanced smart materials by exhibiting dual memory characteristics, shape memory effect and superelasticity, with recoverability of two shapes in different conditions. 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. This is plastic deformation, due to soft character of material in low temperature condition, with which strain energy is stored in the material and releases on heating by recovering original shape. Shape memory effect is governed by thermomechanical transformations, 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. Moreover, twinned structures turn into detwinned martensite structures by means of stress induced martensitic transformations with deformation in the low temperature conditions. 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. It is important that thermoelasticity is result of thermoresponsive reaction, and superelasticity is result of mechanical responsive reaction. Twinning and detwinning reactions play important role in martensitic transformations and they are driven by internal and external forces by means of inhomogeneous lattice invariant shears.

Copper based alloys exhibit this property in metastable β-phase region, which has bcc-based structures. Lattice twinning is not uniform in these alloys, and the ordered parent phase structures undergo the non-conventional layered structures with martensitic transformation. These 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 ternary copper based CuZnAl and CuAlMn alloys. X-ray diffraction profiles and electron diffraction patterns exhibit super lattice reflections. Critical transformation temperatures of these alloys are over the room

temperature. 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 has studied at Surrey University, Guildford, UK, as a post-doctoral research scientist in 1986-1987, and studied on shape memory alloys. Dr. Adiguzel 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. Professor Adiguzel 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 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.

ORAL PRESENTATION



Priyanka Dobariya[1,2*], Vinay Thakur[3], Amrutha A[1,2], Karan Marvaniya[1,2], Raghavan Ranganathan[3], Shilpi Kushwaha[1,2], Ketan Patel[1,2]

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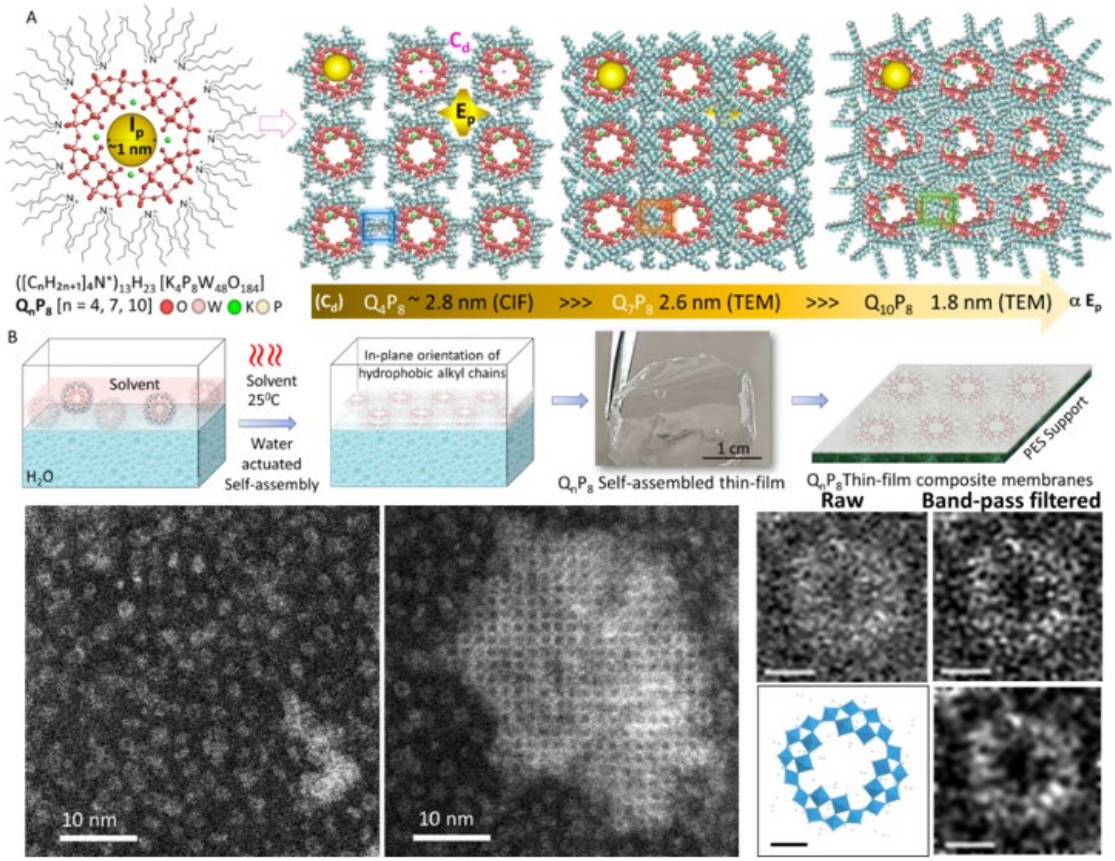
[3]Indian Institute of Technology Gandhinagar, Gandhinagar, Gujarat, India

Counterion-directed assembly of oriented 1 nm-intrinsic porous polyoxometalate thin films for precise molecular separation

Precise control of pore size at the angstrom scale is critical for advancing membrane technologies capable of high-resolution separations. Biological membranes, such as aquaporins, achieve exceptional selectivity through well-defined nanopores. In contrast, conventional polymer membranes possess disordered, dynamic pore networks due to inefficient chain packing, leading to a fundamental permeability–selectivity trade-off. While crystalline porous materials like MOFs, COFs, and zeolites offer fixed and uniform pores, their practical application is hindered by limited mechanical strength, processability challenges, and difficulty in fabricating large-area, defect-free films while preserving their structural order. Here, counterion-directed supramolecular assembly of polyoxometalates, a class of crystalline thin-film membranes assembled from crown-type polyoxometalate (POM) clusters, $[P_8W_{48}O_{184}]^{40-}$ (P_8). These P_8 clusters contain intrinsic ~1 nm pore defined with crystallographic precision, ideal for molecular sieving. By functionalizing P_8 with alkylammonium counterions ($[C_nH_{2n+1}]_4N^+$, n=4, 7, 10), we direct supramolecular self-assembly into continuous, defect-free thin films with ordered, permanent porosity. Tuning the alkyl chain length adjusts the extrinsic porosity (Ep) between clusters without disrupting the intrinsic pore network (Ip). Shorter chains (Q_4P_8) enable dual-path transport via Ip and Ep, whereas longer chains (Q_7P_8, $Q_{10}P_8$) restrict transport solely through Ip, enabling precise molecular sieving. These ultrathin selective layers (~30–500 nm) can be fabricated over large areas (~50 cm^2). POMbranes demonstrate single-digit pore selectivity and tenfold higher separation efficiency for molecules differing by only 100–200 Da compared to state-of-the-art membranes, offering a scalable strategy to translate molecular design into practical, high-performance separation technologies.



Reference: P. Dobariya et al., J. Am. Chem. Soc. 2026, 148, 3280–3290. DOI: 10.1021/jacs.5c17644

Biography

Dr. Priyanka Dobariya completed her Ph.D. in Chemistry at CSIR-Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar, India. She designs porous functional materials (polyoxometalates, hydrogen-bonded organic frameworks and microporous polymers) as thin-film membranes for molecular separation, resource recovery and electrocatalysis. Dr. Dobariya has published 14 peer-reviewed articles, including two first-author papers in the Journal of the American Chemical Society, and has filed four patent applications. Her 1-nm-pore "POMbrane" work was featured by EurekAlert (AAAS), The Hindu and Times of India. She received CSMCRI's Best Female Research Scholar Award 2026 and several best-poster awards.

ORAL PRESENTATION



Dr. Raheema Jahangir Khan

Higher Colleges of Technology, Fujairah, United Arab Emirates

Electrically controlled droplet formation in charged colloidal suspensions using microfluidics

Charged colloidal suspensions are promising soft materials for developing controllable microfluidic systems. In this work, we investigate how a DC electric field affects the formation of droplets from a negatively charged colloidal suspension in a microfluidic T-junction. The colloidal suspension was used as the dispersed phase with an immiscible oil as the continuous phase. The same microfluidic geometry, materials, flow conditions, and experimental setup used for the conventional electrolyte system were maintained, allowing a direct comparison of the two systems. Experiments were performed at different applied DC voltages, and the resulting changes in droplet shape, interface deformation, neck formation, and breakup were observed using microscopy. Increasing the applied voltage produced clear changes in the droplet formation and breakup behavior. These changes are attributed to the combined effects of electric-field-induced particle migration, interfacial polarization, and electrohydrodynamic stresses. The results provide new insight into how charged colloids interact with fluid interfaces under electric fields and demonstrate the potential of this approach for producing electrically tunable colloidal microcompartments. Such microcompartments may be useful for future cell-free biochemical reactions and artificial-cell systems.

Biography

Dr. Raheema is an experienced higher education faculty and researcher with around 12 years of international teaching and research experience in physics. She has PhD in complex systems and colloidal materials majoring in Physics. Dr. Raheema Jahangir Khan has worked on Colloidal Phase Transition Dynamics under external electric and magnetic fields at University of Navarra, Spain and experimental studies of melting colloidal crystals in suspension influenced by external fields at Johannes Gutenberg University Mainz, Germany. She is currently Engineering faculty member at Higher Colleges of Technology, United Arab Emirates.

ORAL PRESENTATION



Rukiye Öztekin*, Delia Teresa Sponza

Dokuz Eylül University, Department of Environmental Engineering, İzmir, Turkey

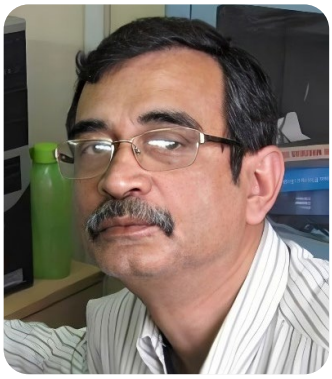
Sunlight-mediated removal of endocrine disruptors from wastewater using trimetallic core-shell Ag-TeO_2@ZnO nanocomposites

The current work emphasizes the preparation of trimetallic core-shell Ag–TeO_2@ZnO nanocomposites (NCs) by thermo-mechanical method for the efficient photocatalytic degradation of 2,4-dichlorophenol and β-naphthol pollutants. FE-SEM shows that Ag and TeO_2 nanoparticles are deposited on the surface of ZnO nanotubes. The band gap of pristine ZnO NPs and 5 wt% Ag–TeO_2@ZnO nanocomposites are found to be 3.16 and 2.96 eV, respectively. The calculated specific surface area (SBET) of pristine ZnO NPs and 5 wt% Ag–TeO_2@ZnO nanocomposites are 40.47 and 45.66 m2/g, respectively, confirming that Ag and TeO_2 nanoparticles contribute to increasing in surface area of pure ZnO. The synthesised nanocomposite showed excellent photocatalytic performance for the degradation of β-naphthol (95.6%) in 40 min at the concentration of (0.6 mg/ml) and 2,4-DCP (99.6%) in 180 min (0.4 mg/ml) under natural sunlight. Cyclic Voltammetry and Electrochemical Impedance Spectroscopy were carried out to study the electrochemical properties. The determination of reactive oxygen species (ROS) confirmed that the degradation of the pollutants by 5 wt% Ag–TeO_2@ZnO NCs was due to the formation of superoxide radicals. Electron paramagnetic resonance revealed the presence of sharp signals in pure ZnO nanoparticles at g ~1.95 and oxygen vacancy peak at g ~2.01 in 5 wt% Ag–TeO_2@ZnO NCs. To study the mechanism behind the degradation of pollutants, scavenger test using histidine and ascorbic acid (ROS scavengers) was performed. The synthesised nanocomposites are highly stable and showed enhanced efficiency up to three cycles, confirming their reusability as a photocatalyst.

Biography

Post-Dr. Rukiye Öztekin is currently working as a researcher at Dokuz Eylül University, Department of Environmental Engineering. She studied her master education at Dokuz Eylül University Department of Environmental Engineering on "Color removal from textile wastewater in sequencing batch reactor". Post-Dr. Öztekin completed her doctorate education at Dokuz Eylül University Department of Environmental Engineering on "Effect of sonication on the treatment of toxic and refractory industrial wastewaters". She completed her post-doctorate education at TÜBİTAK with a scholarship on "The production of methane gas from carbon dioxide". Post-Dr. Öztekin has many international publications.

ORAL PRESENTATION



S.K. Bandyopadhyay

Retired Professor, Variable Energy Cyclotron Centre, India

Role of d electrons in multifunctional materials

Multifunctional materials are of today's quest. A class of multifunctional materials display simultaneous ordering in different dimensions like magnetism, polarization etc. They are more known as multiferroics. Quite a significant number of them are based on perovskite structures having a transition metal ion in the body centre. The electronic configuration of this central transition element plays a key role in the behavior of those multiferroics. For example, those with d^0 configuration display ferroelectricity while those with d^n (where n is non zero) generally display magnetic behavior. The d^0 configuration leads to distortion of metal-oxygen bond in these perovskites and breaking of special inversion symmetry causing a local dipole moment and ferroelectricity. Often this distortion in metal-oxygen bond is caused by lone pair of electrons of non transitional cations in the corners of the perovskite structure. $BiFeO_3$ (BFO) is a shining example of this kind of distortion, where the central ion Fe(III) causes magnetism but Bi(III) ions in the corner cause the polarization leading to the multiferroicity in BFO displaying both ferroelectric and antiferromagnetic ordering. The symmetry breaking manifests in different kinds of ordering. Moreover, the variable valency of the central transition metal ion with d electrons manifests in redox behavior in these materials leading to various uses. We have observed such various functions in the multiferroic BFO like ferroelectric, magnetic and high specific capacitance rendering these materials useful in green energy storage materials. Moreover these redox behavior of these transition metal ion also leads to antimicrobial behavior in BFO.

Biography

Dr. Sujit Kumar Bandyopadhyay is a Materials Scientist specialising in Nanostructured Materials. He obtained Ph.D. in 1998 and was post doctoral fellow in Atomic Institute, Vienna in 2000. Dr. Bandyopadhyay has more than 150 publications in peer reviewed journals and national and international conferences. He has authored an e-book entitled "Charged Particle Irradiation Studies on Bismuth based High Temperature Superconductors & MgB_2"; A comparative Survey; S.K.Bandyopadhyay, Contributory article in "Superconductor", ISBN 978-953-307-107-7, edited by Adir Moyses Luiz and four contributory chapters in different books.

ORAL PRESENTATION



Sachin Sharma Ashok Kumar[1,2*], K. Ramesh[2], S. Ramesh[2]

[1]Mechanical Engineering Department, Faculty of Engineering, Taylor's University, Lakeside Campus, Selangor, Malaysia

[2]Centre for Ionics University of Malaya, Department of Physics, Faculty of Science, Universiti Malaya, 50603 Kuala Lumpur, Malaysia

Effects of TiO_2 nanoparticles on the adhesion and anticorrosion properties of the graphene-based composite coating on mild steel using electrochemical impedance spectroscopy approach

In this study, TiO_2 nanoparticles in varying concentrations of 0.5, 1, 2, and 3 wt.% were added into the acrylic-epoxy polymeric matrix with 90:10 wt.% (90A:10E) ratio incorporated with 1 wt.% graphene, to fabricate graphene/TiO_2 based nanocomposite coating systems. Furthermore, the properties of the graphene/TiO_2 composite coatings were investigated by water contact angle (WCA) measurements, cross-hatch test (CHT), field emission scanning electron microscope (FESEM) and the electrochemical impedance spectroscopy (EIS) studies respectively. The EIS was observed by determining the breakpoint frequencies over a period of 30 days. The results revealed that the TiO_2 nanoparticles were successfully decorated on the graphene surface by chemical bonds, which resulted the graphene/TiO_2 nanocomposite coatings to exhibit better dispersibility within the polymeric matrix. The WCA of the graphene/TiO_2 coating increased along with the ratio of TiO_2 to graphene, achieving the highest CA of 120.85° for 3 wt.% of TiO_2. Excellent dispersion and uniform distribution of the TiO_2 nanoparticles within the polymer matrix were shown up to 2 wt.% of TiO_2 inclusion. Among the coating systems, throughout the immersion time, the graphene/TiO_2 (1:1) coating system exhibited the best dispersibility and high impedance modulus values ($|Z|_{0.01}$ H_z), exceeding 10^{10} Ω cm^2.

Biography

Assoc. Prof. Ir. Ts. Dr. Sachin Sharma Ashok Kumar is a material scientist experienced in the development of graphene and graphene oxide nanomaterials incorporated with reinforced composites, supercapattery, batteries, solar cells, fuel cells, hydrogen storage, polymer nanocomposites, corrosion coatings and 3D composites for numerous engineering applications. He received both of his BSc. degree (Hons.) and MSc. (Hons.) in Mechanical Engineering minor in Materials Science from Wichita State University, USA in year 2011 and 2012, respectively. Dr. Sachin Sharma Ashok Kumar received his Ph.D. in Advanced Materials Science Engineering in University Malaya in 2023. His current research involves the synthesis of super-hydrophobic graphene-based polymer nanocomposite coatings for corrosion applications. He has published over 60 articles in various high-ranked ISI/WoS- and Scopus-listed journals, participated in 70+ international conferences as a keynote/distinguished/oral speaker and has received several excellence awards at international/national exhibitions pertaining to his research and inventions. He is currently a member and a licensed Professional Engineer registered with the Board of Engineers Malaysia (BEM) and Institution of Engineers Malaysia (IEM) and a Professional Technologist with Malaysia Board of Technologists (MBOT).

ORAL PRESENTATION



Saliou SECK*, Alioune SOW, Mamadou Salif MANE

Department of Physics, Cheikh Anta Diop University, Dakar, Senegal

Investigation and modeling of the photovoltaic properties of lead-free $CsSn_{0.50}Ge_{0.50}I_3$ perovskite solar cells

In this work, a modeling study of $CsSn_{0.50}Ge_{0.50}I_3$ perovskite-based photovoltaic devices has been carried out. The study highlights the influence of geometric parameters such as the diffusion length of minority carriers and the thickness of the absorber layer on the solar cell performance. A thin ZnO film is used as the transport window layer while a Cu_2O or NiO film plays the role of buffer layer. The $ZnO(n_+)/Cu_2O(n)/CsSn_{0.50}Ge_{0.50}I_3(P)$ and $ZnO(n^+)/NiO(n)/CsSn_{0.50}Ge_{0.50}I_3(P)$ photovoltaic structures modeled show internal quantum efficiencies of 51.3% and 72.6%, respectively. For the Cu_2O buffer layer, an increase in the internal quantum efficiency from 46.1% to 51.3% and from 45.7% to 52.3% has been observed when varying the $CsSn_{0.50}Ge_{0.50}I_3$ perovskite layer thickness and the minority carrier diffusion length, respectively. For the NiO buffer layer, on the other hand, the quantum efficiency increases from 58.9% to 72.6% for the perovskite layer thickness variation and from 56.2% to 75% for the minority carrier diffusion length variation.

Keywords: Perovskite, Thickness, Diffusion length, Internal quantum efficiency

Biography

Dr. Saliou SECK is a physicist specializing in lead-free hybrid perovskite materials research for photovoltaic applications. He holds a PhD in Physics from Cheikh Anta Diop University.

ORAL PRESENTATION



Sayani Bhattacharyya
Krupanidhi College of Pharmacy, Bengaluru, Karnataka, India

Mucoadhesive bigel for vaginal delivery of dolutegravir–lamivudine for HIV pre-exposure prophylaxis

Purpose: Despite advances in prevention and therapy, HIV continues to be a serious worldwide health problem, and women represent a disproportionately affected population. Vaginal microbicides offer a promising pre-exposure prophylactic strategy; however, conventional gels suffer from rapid clearance, leakage, and suboptimal retention. The present study aimed to develop and evaluate a novel mucoadhesive, vaginal bigel for the localized delivery of a fixed-dose combination of dolutegravir and lamivudine to enhance prophylactic efficacy and user compliance.

Methods: Bigels comprising a gelatin–HPMC–hyaluronic acid hydrogel and a glyceryl monostearate–olive oil organogel were prepared in varying ratios. Lamivudine was incorporated into the hydrogel phase, while dolutegravir was loaded into the organogel. Formulations were evaluated for rheology, pH, drug content, mucoadhesion, enzyme-responsive drug release in simulated vaginal and seminal fluids, cytotoxicity, apoptosis, genotoxicity, and in vivo pharmacokinetics in rabbits.

Results: The optimized formulations exhibited pseudoplastic viscoelastic behaviour, physiological pH (6.5–6.8), high drug content (>80%), and strong mucoadhesive retention for 24 h. Enzyme-responsive release demonstrated biphasic kinetics with rapid lamivudine release followed by sustained dolutegravir release over 24 h. In vitro cellular studies confirmed enhanced apoptosis in HeLa cells with minimal toxicity and no genotoxicity in normal 3T3-L1 fibroblasts. In vivo studies revealed sustained vaginal drug levels of both the drugs exceeding IC_{50} values with negligible systemic exposure and no mucosal irritation.

Conclusion: These findings demonstrate that enzyme-responsive mucoadhesive bigels represent a safe, effective, and patient-friendly platform for vaginal HIV pre-exposure prophylaxis.

Biography

Dr. Sayani Bhattacharyya is a Professor and Head of the Department of Pharmaceutics at Krupanidhi College of Pharmacy, Bengaluru. She is an accomplished academician, researcher, and Ph.D. research guide with extensive experience in pharmaceutical education and research. Her research interests include novel drug delivery systems, nanotechnology-based formulations, and advanced pharmaceutical formulations. Dr. Bhattacharyya has contributed to several research publications, scholarly activities, and postgraduate research initiatives. She is actively involved in mentoring M.Pharm and Ph.D. scholars, promoting interdisciplinary research, and fostering innovation in pharmaceutical sciences. Her academic contributions reflect a strong commitment to research excellence, quality education, and advancement of pharmaceutical technology.

ORAL PRESENTATION



Viorel Chihaia[1*], Andreea Neacsu[1], Simona Petrescu[1], Dan Pavunev[2], Elena Maria Anghel[1]

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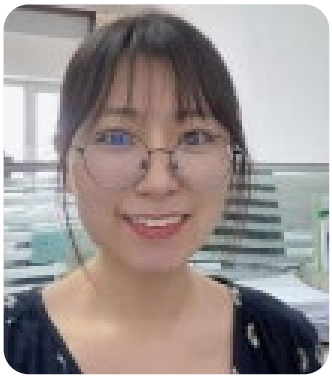
Phonon transport and thermal conductivity in polymer nanocomposites reinforced with Cu@SiO_2 core–shell nanoparticles: A kinetic Monte Carlo approach

Thermal conductivity enhancement in polymer nanocomposites reinforced with metal–ceramic core–shell nanoparticles depends on phonon transport within the constituent materials and across their interfaces. This report presents a spectral kinetic Monte Carlo (KMC) modelling framework for investigating heat transport in polymer matrices reinforced with copper-core/silica-shell (Cu@SiO_2) nanoparticles. Phonons are represented as energy-carrying walkers undergoing propagation, intrinsic scattering, and probabilistic transmission or reflection at polymer–SiO_2 and SiO_2–Cu interfaces. Interfacial transport is described using the Diffuse Mismatch Model (DMM), while Kapitza resistance characterizes thermal boundary effects. The effects of silica-shell thickness, nanoparticle volume fraction, and interfacial thermal resistance on effective thermal conductivity are examined using the parameters and results reported in the study. The reported conductivity increases from 0.50 W m^{-1} K^{-1} at a shell thickness of 2 nm to a maximum of 0.79 W m^{-1} K^{-1} at 10 nm, before decreasing for thicker shells. Increasing nanoparticle volume fraction from 0 to 30% raises conductivity from 0.18 to 0.63 W m^{-1} K^{-1}, whereas increasing Kapitza resistance from 10^{-8} to 10^{-6} m^2 K W^{-1} reduces it from 0.75 to 0.35 W m^{-1} K^{-1}. These trends illustrate the competing effects of nanoparticle geometry, thermal bridging, and interfacial resistance. The results highlight the importance of optimizing shell thickness and interface quality to improve heat transport while retaining the protective and stabilizing functions of the silica shell.

Biography

Dr. Viorel Chihaia is a senior researcher at the "Ilie Murgulescu" Institute of Physical Chemistry of the Romanian Academy in Bucharest, Romania. He graduated in Physics from the University of Bucharest in 1989 and obtained his PhD in Chemistry in 1999. His research focuses on surface science, catalysis, and energy materials, using computational chemistry, quantum chemical calculations, and molecular dynamics simulations. Dr. Chihaia has also collaborated with renowned international research institutions in Germany, South Korea, and Taiwan, contributing to advances in computational materials science.

ORAL PRESENTATION



Xue Liu

Institute of Tobacco Research, Chinese Academy of Agricultural Sciences, Qingdao, P.R.China

Research on catalytic degradation technology of emerging contaminants based on functionalized nanomaterials

With the rapid development of industrial and agricultural production, the detection frequency and concentration levels of emerging contaminants represented by pesticides, antibiotics, and heavy metals in the environment have continued to rise, posing significant threats to ecological security and human health. To address these challenges, this study focuses on the efficient catalytic degradation of emerging contaminants and constructs two types of functionalized nanomaterial systems—photocatalysis and persulfate activation—targeting two typical scenarios: aquatic environments and soil–water coexisting/agricultural product surfaces.

For the aquatic photocatalysis scenario: Polymerized graphitic carbon nitride (g-C_3N_4) was prepared via a thermal polycondensation method, and its morphology and band structure were optimized by adjusting the precursor ratio. Platinum single-atom modified carbon nitride (Pt-SA/C_3N_4) was synthesized using an impregnation–thermal reduction strategy. Ti_3C_2/In_4SnS_8 and Ti_3C_2 MXene/WO_3 composite photocatalysts were fabricated via in situ hydrothermal and solvothermal methods, respectively, to construct heterointerfaces that promote photogenerated charge carrier separation.

For the soil–water coexisting and agricultural product surface scenarios: Iron single-atom modified carbon nitride (Fe SA/C_3N_4) was synthesized using a pyrolysis–coordination strategy. S-CuMnO mixed oxide was prepared by in situ calcination polymerization. Three-dimensional molybdenum disulfide nanoflowers (3D MoS_2) were self-assembled via a hydrothermal method for persulfate activation.

Biography

Dr. Xue Liu currently works at the Institute of Tobacco Research, Chinese Academy of Agricultural Sciences as an associate researcher. She has been dedicated to seeking feasible applications of nano-materials in environmental pollutants analysis and remediation. Dr. Liu obtained her PhD degree from China Agricultural University in 2018.

BOOK OF ABSTRACTS

Poster Sessions

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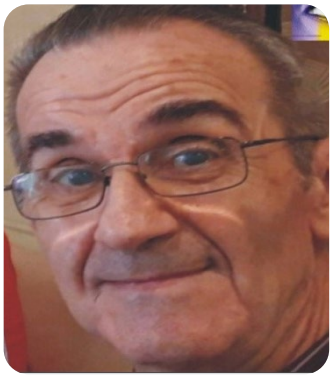
POSTER PRESENTATION



Dr. Dan Mihai Stefanescu
Romanian Measurement Society, Romania

Nanodevices – concepts, representations, rainbow scales and perspectives

1. Definitions: Nanoscience is a modern field embracing the sciences and engineering needed for designing, synthesizing and describing materials and devices. Nanodevices are critical enablers that will allow mankind to exploit the ultimate technological capabilities of electronic, magnetic, optical, and biological systems. Nanotechnology is the manipulation of matter with at least one dimension sized from 1 to 100 nanometers (nm), commonly known as the nanoscale. The paper aims to systematize knowledge in Nanoscience, with some suggestive examples: CNT (Carbon Nano-tube), skyrmion, and installations of nanoindentation and of digital photoelasticity.

2. Applications: Figure 1 shows the range for twelve (apostolic digits) methods of electrical measurement of non-electrical quantities, customized for force transducers, starting with the parametric ones (R and C) and continuing with more complex ones, mainly electromagnetic. Optical methods "resonate" with electromagnetic ones, Nanoscience being mainly in the visible range (in the rainbow colours) (c) and imposing intuitive and ingenious artistic representations. Referring to the electromagnetic spectrum, Frequency is the number of waves that pass a point each second, while Wavelength is the length of one wave. Optoelectronics (or optronics) is the study of electronic devices and systems that find, detect and control light. Common domain names appear in the Handbook of Force Transducers versions (a) and KRISS – the National Metrology Institute of South Korea (b).

3. Carbon Nanotubes (CNTs) are hollow cylinders of graphene composed of a single layer of carbon atoms, densely packed in a honeycomb crystal lattice.

4. The Electronic "Coexistence" of Optical and Electromagnetic Methods is explainable by the dual nature of light (particle and wave) and we find it in Figure 2, where they appear in a broad perspective: an 8.6 pN laser pointer, nanoindentation in rainbow colours (b), Atomic Force Microscopy (d) and optical interferometer (e).

5. On the scale of the universe, solar magnetic storms occur (Fig. 3, a), while in the laboratory, nanometric particles are produced, i.e. skyrmions, tiny magnetic vortices (in rainbow colours) found at the surface of magnetic materials manipulated by mechanical energy. Skyrmions, as magnetoelastic sensors (Fig. 3, b), have been widely touted as providing the basis for new high-density memory devices because of their small size (nanometers) and relative stability. The force to create and destroy skyrmions

was quite low, less than ten nanonewtons (10 nN, i.e. NanoNewton) per skyrmion, comparable to the pressure exerted by the tip of a conventional pencil writing in a notebook.

6. In Figure 4 two **Experimental Stress Analysis** (σ) installations are presented: a) classical and b) digital photoelasticity. Comparing the specific strain maps (ε), the second one has higher measurement sensitivity by three orders of magnitude (powers of 10, in this case: nano vs micro)! Retardation describes the phase shift between the polarization component projected along the fast axis and the component projected along the slow axis. Retardation is specified in units of degrees, waves, or nanometers.

7. A synoptic table with 16 rainbow scales of different shapes appears in Figure 5.
Such colour bars or disks are used in a wide range of applications, within various areas, as follows: F. Surface profile rugosity (in microns=μ); K. Visible light spectrum (with "components" expressed in nanometers: 400 nm for UV and 700 nm for IR); L. Stress map (von Mises) for an elastic element of a patented wheel weigher (with specific deformations expressed in microStrain).

8. Artistic creation also involves the science of proportions, exemplified in Figure 6 by several spiral vortexes (I also included the one in rainbow colors), and the Da Vincian 1:1.618 format continues to be adopted by publishing houses today. An artistic vision of Nanoscience appears in Figure 7. At the top of this composition, five spectacular inserts can be seen, the first one being made by IA – Britannica, and in the center a rainbow scale can be identified!

9. Call For An Editor Of The Rainbow Encyclopedia: And continuing like this, from rainbow to rainbow, the most comprehensive encyclopedia is borning, entitled "Rainbow Colours in Nature, Life, Science and Art" (Fig. 8).

Wow, Leonardo da Vinci's saying: Everything is connected! Gaudeamus igitur...

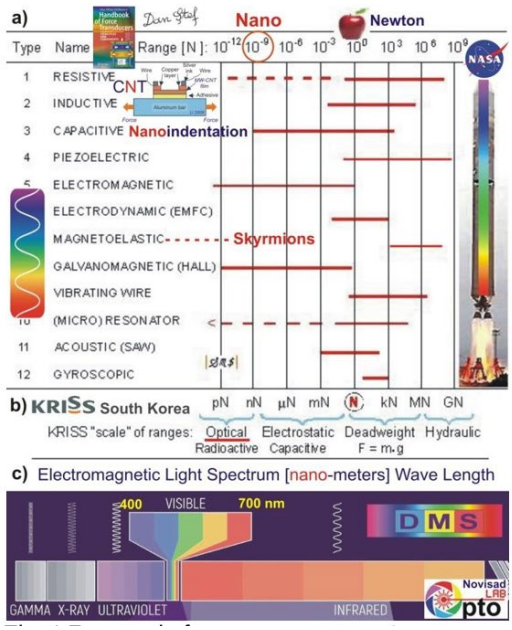


Fig. 1 Ranges in force measurements

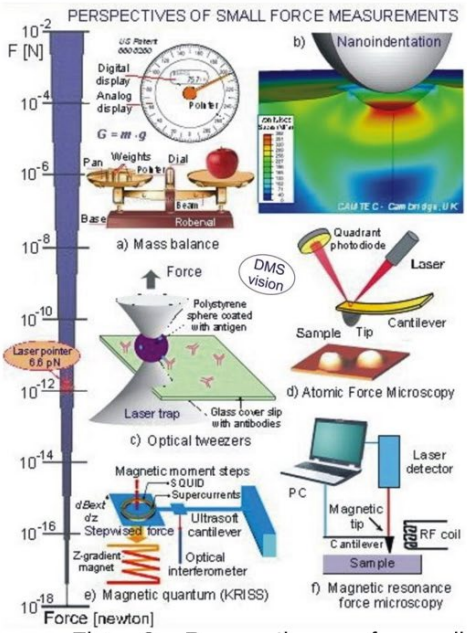


Fig. 2 Perspectives of small force measurements

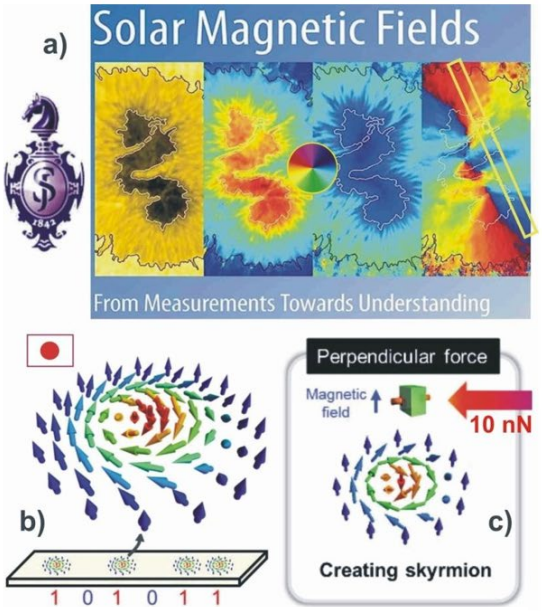


Fig. 3 Skyrmions – magnetoelastic sensors

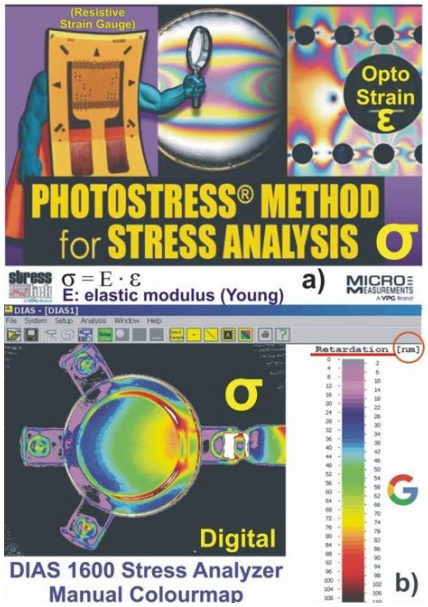


Fig. 4 Photostress analysis: a) classical, b) digital

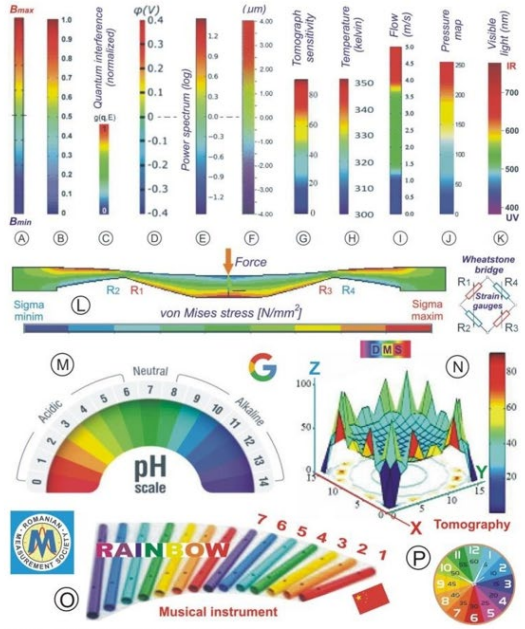


Fig. 5 Rainbow scales

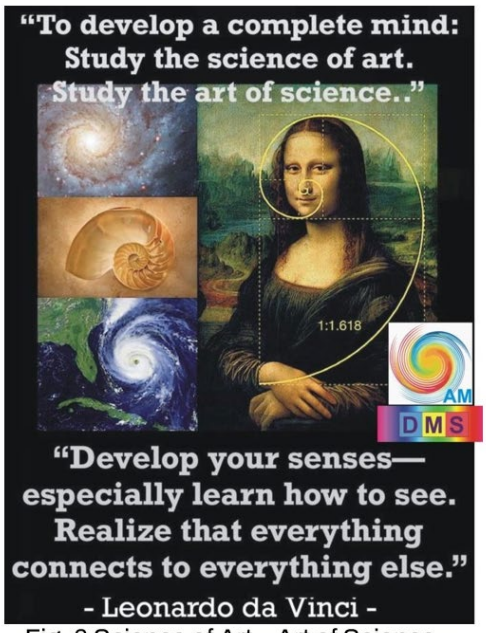
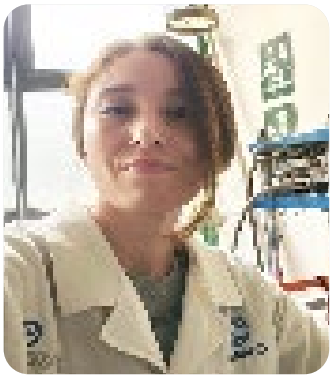


Fig. 6 Science of Art – Art of Science

Biography

Dan Mihai Ştefănescu, born in Bucharest on 6 April 1946, received BS (1969) in Applied Electronics, MS (1983) in Experimental Stress Analysis and PhD cum laude (1999) in Electrical Engineering, all from the "Politehnica" University of Bucharest. He worked as Senior Researcher in Measurement Techniques with the National Institute for Aerospace Research in Bucharest (1969 – 2003). He completed a Postdoctoral Fellowship (NATO grant) on Knowledge-based Intelligent Systems for Selecting Industrial Sensors at Twente University of Enschede, The Netherlands (2002). He was Visiting Scientist within Korean Research Institute of Standards and Science, conducting a project on Force Transducers Optimization by Numerical Methods (2004) and then within Center for Measurement Standards in Taiwan, R.O.C., leading a project on Improved Portable Truck Scales (2005). Now, he is Senior Consultant for the Romanian Measurement Society. His current research interests: electrical measurement of mechanical quantities, material testing installations and metrological procedures for multicomponent transducers. He has authored about 200 manuscripts in peer-reviewed journals and is the author or coauthor of seven technical books. He is member of the Verband Deutscher Electrotechniker (1987), IEEE (2023), Romanian representative (1988) and member of General Council of IMEKO (2014).

POSTER PRESENTATION



Julia Sarahi Soto Tovar[1*], Eugenia Lugo Cervantes[1], Montserrat Alcázar Valle[1], Enrique Jaime Herrera López[2], Juan Carlos Cuevas Bernardino[1], Rubén González Núñez[3]

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Development and characterization of PLA biocomposites reinforced with lignocellulosic fibers from avocado and cacao shell waste

Composites based on polylactic acid (PLA) reinforced with lignocellulosic fibers from avocado (Persea americana) shell waste (ASW) and cacao (Theobroma cacao) shell waste (CSW) were prepared. The effect of chemical functionalization of the fibers on the mechanical, thermal, and morphological properties of the composites was analyzed. ASW and CSW are underutilized agro-industrial residues with a high lignocellulosic content. The fibers were extracted and subsequently functionalized via oxalic acid esterification to improve compatibility with the PLA matrix. Biocomposite plates with 6 wt% of treated fibers were obtained using a thermocompression molding process (Carver press) to produce 3 mm thick plates. Subsequently, standardized test specimens for tensile and flexural testing were laser-cut in accordance with ASTM D638 and D790. A comprehensive characterization protocol was employed to evaluate the effect of fiber treatment on the biocomposite performance. Scanning electron microscopy (SEM) was used to assess fiber dispersion, interfacial adhesion, and fracture morphology. Chemical interactions between the functionalized fibers and the PLA matrix were investigated by Fourier-transform infrared spectroscopy (FTIR). Thermal properties were analyzed by differential scanning calorimetry (DSC) to determine glass transition temperature, melting behavior, and crystallinity. At the same time, thermogravimetric analysis (TGA) was employed to evaluate thermal stability and degradation profiles. Mechanical performance was quantified using tensile, flexural, and interlaminar shear tests in accordance with ASTM standards. This methodological approach aims to establish correlations between chemical functionalization, microstructure, and thermo-mechanical properties. By using reinforcements of natural and residual origin (avocado and cacao shells) and developing biocompatible filaments for additive manufacturing, this approach promotes the reuse of agro-industrial waste, thereby reducing environmental impact and supporting the transition toward a circular economy.

* At the time of submitting this abstract, experimental results and final conclusions are still being processed. However, the complete and original findings — including mechanical, thermal, morphological, and biodegradability characterization — will be presented for the first time at the conference. This work is expected to provide novel insights into the development of sustainable biocomposites from agro-industrial waste.

Biography

Julia Sarahi Soto Tovar is a Master's student in Biotechnological Innovation Sciences at CIATEJ, Mexico, researching PLA biocomposites reinforced with lignocellulosic fibers from avocado and cacao shell waste for thermoforming applications. She holds a degree in Fashion Design and has worked as a textile designer for international brands in China and Mexico, founded a sustainable fashion label, and lectured at university level. Her work bridges design, textile sustainability, and materials science to develop circular, bio-based manufacturing solutions.

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We sincerely thank all speakers, delegates, and partners for making this conference a great success. Your enthusiasm and contributions have strengthened our shared vision of advancing innovation in materials science and nanotechnology.

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