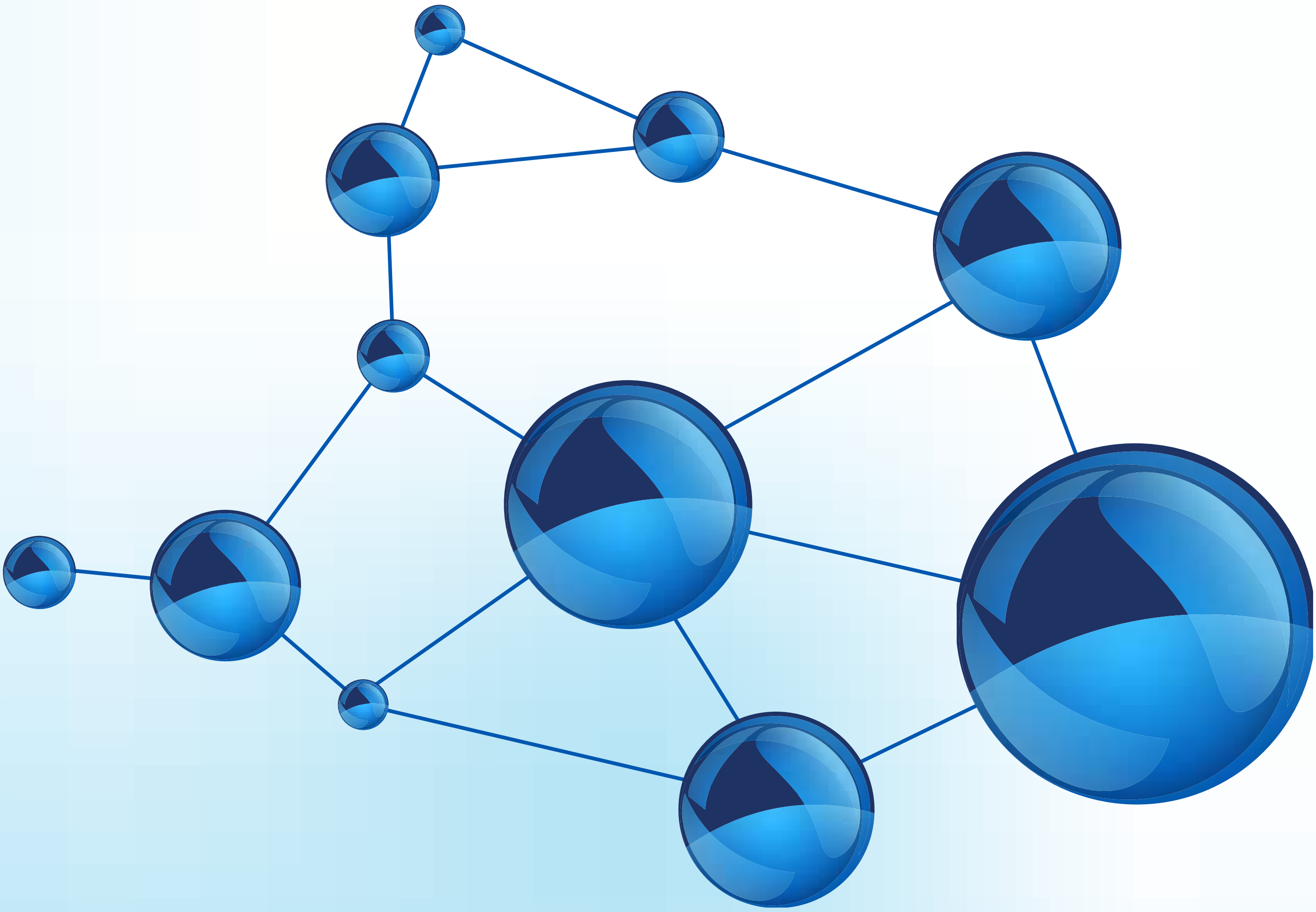
4th International Conference on

Advanced Nanomaterials and Nanotechnology

June 12-13, 2025 | Rome, Italy



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Floor Map

Conference Hall - Prathi

Wifi Details

Username: H10PLUS
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Speaker Representations

Conference Programme

Day 1

12th June

Session Chairs

Ali Al-Samydai, Al-Ahliyya Amman University, Jordan
Mohammed Saad Al-Ghamdi, King Abduaziz University, Saudi Arabia

Conference Programme

Day 1, June 12, 2025	
Meeting hall: Prathi	
08.00 - 08.45	**Registrations**
08.45 - 09.00	**Introduction**
Keynote Presentations	
09.00 - 09.40	**Ali Al-Samydai, Al-Ahliyya Amman University, Jordan**
Title: Meta-Analysis of Nano-Phytosomes: Unleashing the Potential of Plant-Derived Compounds for Advancing Cancer Therapy	
09.40 - 10.20	**Mohammed Saad Al-Ghamdi, King Abduaziz University, Saudi Arabia**
Title: Electrical Investigation of GaInAsP Under the Change of Quantum Well Number in Semiconductor Laser Diodes Structures	
Networking and Refreshments : 10.20 - 10.40 @ Lobby Bar	
Oral Presentations	
Session Chair	**Ali Al-Samydai, Al-Ahliyya Amman University, Jordan**
Session Chair	**Mohammed Saad Al-Ghamdi, King Abduaziz University, Saudi Arabia**
Sessions: Nanomaterials and Nanotechnology | Nanoscience and Technology | Advanced Materials and Functional Devices | Material Science and Engineering | Nanoparticles & Molecular Nanotechnology | Nanomedicine & Drug Delivery | Smart Materials and Technologies | Nano Physics & Nano Chemistry | Nanomechanics | Industrial Nanotechnology | Nanocellulose	
10.40 - 11.10	**Mark Hoffmann, University of North Dakota, USA**
Title: Low-lying Electronic States of the Nickel Dimer	
11.10 - 11.40	**Penghao Qi, Cardiff University, UK**
Title: Bending Stiffness of Nacre-like Hierarchical Graphene Nanofilms: A Voronoi-Based Modeling Approach	
11.40 - 12.10	**Laura Larue, ICMPE, France**
Title: Enhanced Targeting of Pancreatic Cancer Using N6L-Functionalized Lipid Nanocarriers Encapsulating Paclitaxel	

12.10 - 12.40	**Alaa Jassem MohammedAl-Erchelee, Al-Karikh University for Science, Iraq**
Title: Adsorption of Lead from Industrial Waste Water Using Nano Adsorbent: Optimization Study	
Group Photo: 12.40 - 12.50	
Lunch: 12.50 - 14.00 @ Ristorante	
14.00 - 14.30	**Piyushaa Emrith-Jankee, University of Mauritius, Mauritius**
Title: Democratisation of Production of Micro/Nano Cellulose	
14.30 - 15.00	**Orchidea Maria Lecian, Sapienza University of Rome, Italy**
Title: Abzymes Mimickers in Catalytic Reactions at Nanoscales	
Poster Presentations (15.00 - 15.30)	
Poster Judge	**Ali Al-Samydai, Al-Ahliyya Amman University, Jordan**
PP- 01	**Min Chang Shin, Dongguk University, South Korea**
Title: Endothermic Decomposition Characteristics of Various Initiators for Improving the Endothermic Performance of Aviation Fuel	
PP- 02	**Jung Hoon Park, Dongguk University, South Korea**
Title: Comparison of Endothermic Decomposition Characteristics of ZSM-5 and Activated Charcoal Catalysts for Improving Cooling Performance of Hypersonic Vehicles	
PP- 03	**Laura Larue, ICMPE, France**
Title: Design of a Platform for Hydrophobic Drug Delivery in Biomedical Applications	
PP- 04	**Edoardo Magnone, Dongguk University, South Korea**
Title: Design and Testing of a Hemodialysis Device Featuring Ceramic Hollow Fiber Membranes	
PP- 05	**Anatoly Kovalev, I. P. Bardin Central Research Institute for Ferrous Metallurgy, Russia**
Title: Influence of Relaxation Time of Energy Dissipation on Structural Instability of Coatings on Cutting Tools under Extreme Loads	
Oral Presentations	
15.30-16.00	**Pierfrancesco Morganti, Nanotechnology Unit at Academy of History of Healthcare Art, Italy**
Title: Nanobiotechnology in Cosmetic Dermatology	

Networking & Refreshments: 16:00 - 16:30 @ Lobby Bar	
16.30 - 17.00	**Jasim Mohammed Salman, Iraq University College, Iraq**
Title: Efficient Removing Technique of Heavy Metals from Industrial Wastewater	
Keynote Presentations	
17.00 - 17.40	**Valeri Ligatchev, Independent Researcher, Singapore**
Title: Mellin–Integral–Transform–Based Approach to Analysis on Features of Temperature-dependent Lattice Thermal Capacity of Nano-structured and Low-Dimensional Solids	
Day 1 Concludes	

Day 2

13th June

Session Chairs

Ali Al-Samydai, Al-Ahliyya Amman University, Jordan
Mohammed Saad Al-Ghamdi, King Abduaziz University, Saudi Arabia

Day 2, June 13, 2025

Meeting hall: Prathi

Keynote Presentations

10.00 - 10.40	**Hany Akeel Al-hussaniy, Al-Nisour University College, Iraq**
Title: Levofloxacin-Functionalized Gold Nanoparticles Enhanced by Resveratrol: A Synergistic Nanoplatform Targeting Resistant Ocular Infections	
10.40 - 11.20	**Jasim Mohammed Salman, Iraq University College, Iraq**
Title: Optimization Study of Preparation Activated Carbon for Removal Pollutants Using Response Surface Methodology	

Networking and Refreshments : 11.20 - 11.50 @ Lobby Bar

Oral Presentations

Session Chair	**Ali Al-Samydai, Al-Ahliyya Amman University, Jordan**
Session Chair	**Mohammed Saad Al-Ghamdi, King Abduaziz University, Saudi Arabia**

Sessions: Nanophotonics | Green Nanotechnology | Lipid Nanotechnology | Applications of Nanotechnology | Nanodevices and Nanosensors | Biomedical Engineering and Nanobiotechnology | Nanorobotics | Nanocomposite | Nanoelectronics and Nanophotonics | Nanotoxicology | Quantum Nanotechnology | Nano Surgery

11.50 - 12.20	**Mohammed Saad Al-Ghamdi, King Abduaziz University, Saudi Arabia**
Title: Electrical Properties Investigation in InAsP Quantum Dot Laser Diode Structures by the Change of Barriers Thickness	

Keynote Presentation

12.20 - 13.00	**Newaz Mohammed Bahadur, Noakhali Science and Technology University, Bangladesh**
Title: Novel Synthesis of Pure and Doped-Hydroxyapatite Nanocomposite for the Photo-Catalytic Degradation of Amoxicillin and Ciprofloxacin: Crystallographic Characterization Using XRD	

Lunch : 13.00- 14.00 @ Ristorante

Video Presentations

VP01	**Miltiadis Karazoupis, Independent Researcher, Greece**
Title: Electric Arc-Induced Pyrolysis of Transformer Oil: A Pathway to Combustible Gas Generation, Fireball Formation, and the Challenge of Visual Scale Perception in Night-Time Incidents	

VP02	**Sina Matalqah, Al-Ahliyya Amman University, Jordan**
Title: Biosynthesis of Silver Nanoparticles Using Aqueous Extract of Pomegranate Peels: Characterization and Evaluation of their Antimicrobial and Cytotoxic Activity	
VP03	**A V Vasanthi, Sarojini Naidu Vanita Pharmacy Maha Vidyalaya, India**
Title: Organ-On-Chip as Smart Biomedical Interfaces: Replacing Animal Models, Transforming Drug Development And Personalized Medicine	
VP04	**Zeinab Sanaee, University of Tehran, Iran**
Title: Synthesis of N-Doped SnO_2 Nanowire@Void@N-Doped Carbon as a High-Performance Anode for Lithium-Ion Batteries	
VP05	**B. Medha Gayatri, Sarojini Naidu Vanita Pharmacy Maha Vidyalaya, India**
Title: Nano Suspensions as a Promising Drug Delivery System	
VP06	**Tamás Tarjányi,University of Szeged, SEMILAB Co. Ltd, Hungary**
Title: Hardness And Creep Evaluation of Nanoindentation Measurements	
VP07	**Tamás Tarjányi,University of Szeged, SEMILAB Co. Ltd, Hungary**
Title: Dancing Biomolecules on Titanium Surface: Unraveling Peptide Binding with Molecular Dynamics	
Day 2 Concludes followed by Awards & Closing Ceremony	

Day 1

Advanced Nanomaterials and Nanotechnology

Keynote presentations

META-ANALYSIS OF NANO-PHYTOSOMES: UNLEASHING THE POTENTIAL OF PLANT-DERIVED COMPOUNDS FOR ADVANCING CANCER THERAPY

Ali Al-Samydai
Al-Ahliyya Amman University, Jordan

Abstract:

Nano-phytosomes represent an advanced drug delivery system for phytochemicals, enhancing their stability, bioavailability, and therapeutic efficacy. This meta-analysis, based on 93 studies, investigates the impact of phytochemical type on nano-phytosome characteristics, including size, charge, polydispersity index (PDI), and IC50 values. Multivariate Analysis of Covariance (MANCOVA) revealed significant effects of phytochemical type, even when accounting for cancer cell type and phospholipid composition as covariates. Least Significant Difference (LSD) post hoc tests highlighted distinct variations among phytosomes. Flavonoid-based phytosomes exhibited larger particle sizes, while terpenoid-based phytosomes had significantly lower surface charges. Flavonoids demonstrated higher PDI values compared to alkaloids and polyphenols, with alkaloids showing greater variability. Polyphenols had lower PDI values than terpenoids. Additionally, flavonoid-loaded phytosomes exhibited higher IC50 values compared to terpenoid-based formulations. These findings underscore the potential of nano-phytosomes in revolutionizing drug delivery systems and advancing innovative therapeutic approaches in cancer treatment..

Biography

Dr Ali Mahmoud Al-Samydai PhD Nanophytosome (Nano-based drug delivery systems) Associate Professor at Al-Ahliyya Amman University, Faculty of Pharmacy, Department of pharmaceutical and pharmaceutical technology, interested in developing novel Nanoliposmes and Nanophytosome models, resulting in a formulation having higher activities by promoted pharmacokinetic and pharmacodynamic properties compared to the conventional drugs and herbal extracts, Currently, Dr Al-Samydai investigating anti-cancer, anti-inflammatory and wound healing activities of a novel model of encapsulated phytoconstituents in Lipid-based nanoparticles.
He published 60 articles in the field of pharmaceutical sciences and pharmaceutical technology, and 51 articles indexed in SCOPUS from 2019-2024.

ELECTRICAL INVESTIGATION OF GAINASP UNDER THE CHANGE OF QUANTUM WELL NUMBER IN SEMICONDUCTOR LASER DIODES STRUCTURES

Mohammed Saad Al-Ghamdi and EE Alghamdi
King Abduaziz University, Saudi Arabia

Abstract:

The development of GaInAsP material was pioneered in the early 1970s by researchers at Bell Laboratories and NTT for use in long-wavelength optical communication systems. GaInAsP is a quaternary III-V semiconductor alloy that can be precisely engineered by adjusting the arsenic and phosphorus composition, allowing for tunable bandgaps suitable for emission in the 1.3 to 1.55 μm range. The GaInAsP material system continues to attract attention due to its compatibility with GaAs substrates, well-established fabrication processes, and superior performance in long-wavelength applications. Its strong electron and hole confinement and reduced sensitivity to temperature fluctuations make it a cornerstone of modern optoelectronics. These attributes, combined with its bandgap engineering flexibility, ensure its ongoing relevance in telecommunications and other advanced photonic systems. This makes it an ideal material for photonic devices on GaAs substrates.

This study investigates GaInAsP-based laser diodes emitting at 1.26 μm, focusing on threshold current density and zero-pies barrier height per well critical parameters for assessing thermal and electrical performance.

GaInAsP quantum well structures grown by Metal-Organic Vapor Phase Epitaxy (MOVPE) have demonstrated excellent optical and electrical properties, enabling the fabrication of high-performance laser diodes. These devices are particularly effective for fiber-optic communication due to their low threshold current, high efficiency, and temperature stability.

Experimental results indicate that threshold current density increases with temperature across all quantum well structures. The single quantum well configuration exhibits the steepest rise, suggesting higher thermal sensitivity. In contrast, the triple quantum well structure demonstrates superior thermal stability, marked by the lowest rate of increase in threshold current density.

Zero-pies barrier height decreases with temperature in all samples, but the single quantum well device shows the most rapid drop, reflecting greater susceptibility to thermal excitation and carrier leakage. The triple quantum well structure maintains a higher barrier height throughout the temperature range, supporting better carrier confinement and reduced leakage.

Biography

Prof. Al-Ghamdi completed his Ph.D degrees at Cardiff University UK in 2010. Afterword he got position at King Abdulaziz University in Saudi Arabia. Then he established the optoelectronic laboratory at King Abdulaziz University. He supervised more than 10 postgraduate students and received more than 8 funded projects form outside and inside the university. Prof. Al-Ghamdi research interest includes the design and fabrication of semiconductor devices laser diode and studies the optoelectronic and electrical properties of these devices by measuring their absorption, spontaneous, stimulated emission spectra, ideality factor, barrier height and series resistance. The current research topics include red emitters quantum dot laser diode which used in photodynamic therapy for cancer treatment and also used in the manufacture of dual wavelength sources for data storage. Prof. Al-Ghamdi has over 65 publications that have been cited over 600 times, and his publication h-index is 14. He is a member of IEEE and OSA societies.

MELLIN–INTEGRAL–TRANSFORM–BASED APPROACH TO ANALYSIS ON FEATURES OF TEMPERATURE-DEPENDENT LATTICE THERMAL CAPACITY OF NANO-STRUCTURED AND LOW-DIMENSIONAL SOLIDS

Valeri Ligatchev
Independent Researcher, Singapore

Abstract:
Experimental and theoretical investigations on features of lattice thermal capacities of nano-structured and low-dimensional solid materials become attractive topics of material science couple decades ago. Distinctive feature of such materials is well-articulated spatial confinement of 'in-plane' acoustic, optical and 'out-plane' atomic vibrations (phonons). Due to inevitable discreetness of the vibrational spectra, imposed by the spatial confinement of those phonons, significant alterations in the sizes (spatial extents) and crystalline orientation of the morphological units (e.g., grains, columns, cones, etc.) of nano-structured materials are generally expected to affect considerably their thermal, electronic and optical properties. The interrelations among the morphological, vibrational and thermal characteristics of the nano-structured and low-dimensional solids are often evaluated using numerical integration procedures. In this work, the one-dimensional Mellin Integral Transform (MIT) is implemented instead at analysis of affect(s) of alteration in the (quasi-continuous and/or discretized) vibrational spectra of aforementioned solids and features of their measurable temperature-dependent lattice thermal capacity. Particularities of the MIT 'image functions' related to morphology of the nano-structured and low dimensional solid as well as to their lattice thermal capacity are discussed in this presentation. Implementation of MIT technique also allows one to analyze unambiguously profound characteristics of the harmonic and anharmonic vibrational states of spatially confined phonons. Key features of analytical expressions obtained based on the MIT technique are also discussed in comparison with their well-known counterparts obtained based on the Fourier and/or Laplace integral transform techniques and those of the experimental temperature dependencies of the lattice thermal capacities of the low-dimensional semiconductors and polymers. Some alternative semi-analytical approaches to interpretation on key features of the temperature-dependent lattice thermal capacity of low-dimensional and polymeric solids are discussed as well in the presentation.

Biography
Valeri Ligatchev's areas of scientific interest and expertise comprise of experimental and computational studies on electronic, optical, vibrational, relaxation time and defect states spectra as well as thermal properties of various (predominantly spatially non-homogeneous) semiconductors insulators and even superconductors, including nominally undoped and heavily doped polycrystalline and nano-crystalline diamond(s), flakes of two-dimensional semiconductors, silicon-germanium 'quantum dots', 'molecular wires', silicon micro- and nano-wires, hydrogenated amorphous silicon-based films, porous 'low-k' organic and inorganic insulating layers, as well as ceramic insulators with 'gigantic dielectric response' (GDR).
His so-called 'Generalized Skettrup Model' becomes expedient in several important areas: from realistic simulations on optical and electronic properties of polycrystalline and spatially non-homogeneous amorphous semiconductors and insulators as well as of their low-dimensional counterparts to convincing estimations on the harmonic and anharmonic fractions of lattice thermal capacity of such materials; this model could be useful as well at quantitative evaluations on lifetimes of Fröhlich Polarons. Valeri Ligatchev is a member of The Electrochemical Society since 2007. His name had been included in 2011 Edition of Marquis Who's Who in the World.

Advanced Nanomaterials and Nanotechnology

Day 1

Oral Presentations

LOW-LYING ELECTRONIC STATES OF THE NICKEL DIMER

Mark R Hoffmann and Patrick K Tamukong
University of North Dakota, USA

Abstract:

The generalized Van Vleck second order multireference perturbation theory (GVVPT2) method was used to investigate the low-lying electronic states of Ni_2. Because the nickel atom has an excitation energy of only 0.025 eV to its first excited state (the least in the first row of transition elements), Ni2 has a particularly large number of low-lying states. Full potential energy curves (PECs) of more than a dozen low-lying electronic states of Ni_2, resulting from the atomic combinations 3 F + 3 F and 3 D + 3 D, were computed. In agreement with previous theoretical studies, we found the lowest lying states of Ni to correlate with the 3 D + 3 D dissociation limit, and the holes in the d-subshells were in the subspace of delta orbitals i.e., the so-dubbed δδ states). In particular, the ground state was determined as X1Γ and had spectroscopic constants: bond length (Re) = 2.26 Å, harmonic frequency (ωe) = 276.0 cm^{-1}, and binding energy (De) = 1.75 eV; whereas the 11 Σ excited state (with spectroscopic constants: Re =2.26 Å, ωe = 276.8 cm^{-1}, and De = 1.75) of the dissociation channel lay at only 16.4 cm^{-1} (0.002 eV) above the ground state at the equilibrium geometry. Inclusion of scalar relativistic effects through the spin-free exact two component (sf-X2C) method reduced the bond lengths of both of these two states to 2.20 Å, and increased their binding energies to 1.95 eV and harmonic frequencies to 296.0 cm^{-1} for X1Γ and 297.0 cm-1 for 11 Σ. These values are in good agreement with experimental values of Re = 2.1545 ± 0.0004 Å, ωe = 280 ± 20 cm^{-1}, and o = 2.042 ± 0.002 eV for the ground state. All states considered within the 3 F + 3 F dissociation channel proved to 44 be energetically high-lying and van der Waals-like in nature. It contrast to most previous theoretical studies of Ni_2, full PECs of all considered electronic states of the molecule were produced.

Biography

Mark Hoffmann, Associate Dean for Research at UND's College of Arts & Sciences and Chester Fritz Distinguished Professor of Chemistry, has been named a Fellow of the American Association for the Advancement of Science (AAAS) for his contributions to chemistry. Hoffmann is a leading expert in quantum chemistry, known for his groundbreaking work in molecular interactions, including the discovery of a new type of chemical bonding published in Science in 2012. He holds degrees from Northwestern University and UC Berkeley and has taught at UND since 1988. Hoffmann has chaired UND's Chemistry Department and served as a visiting professor at prestigious institutions worldwide. His research has applications in diverse fields like catalysis, astrochemistry, and biological sciences. Hoffmann will be one of 564 AAAS Fellows announced in January 2022, a prestigious honor that dates back to 1874, recognizing significant advancements in science.

BENDING STIFFNESS OF NACRE-LIKE HIERARCHICAL GRAPHENE NANOFILMS: A VORONOI-BASED MODELING APPROACH

Penghao Qi[1], Xindong Chen[1,2] and Hanxing Zhu[1]

[1]*Cardiff University, Cardiff, UK*

[2] *Institute of Biomechanics and Medical Engineering, Tsinghua University, China*

Abstract:

Hierarchical "brick-and-mortar" structures, inspired by natural nacre, offer a powerful framework for developing advanced nanomaterials with exceptional mechanical properties. Among these, graphene nanosheets have emerged as a promising candidate due to their ultrathin geometry, high stiffness, and tenable interfacial interactions. However, despite having the same layered structure, the structural characteristics of flexible 2D membrane-like assemblies still differ significantly from those of natural nacre-like materials, such as larger thickness ratios of soft to hard phase materials and lower out-of-plane stiffness. This prevents the models developed in previous studies from accurately describing the mechanical properties of nacre-like flexible membrane materials, especially their bending properties. In this work, a finite element model based on Voronoi geometric structure was developed to investigate the bending stiffness of nacre-inspired hierarchical graphene films. The model interprets the film as a composite of ultrathin rigid graphene nanosheets (bricks) and interlayer van der Waals interactions (mortar). By systematically varying geometric and structural parameters, including nanosheet thickness and intralayer spacing, we reveal critical trends in bending performance. The results not only bridge a critical gap in understanding the bending mechanics of graphene-based composites but also offer practical guidance for optimizing their design for applications in flexible electronics, sensing membranes, and lightweight protective coatings. This study highlights the potential of graphene nanosheets as a building block for next-generation biomimetic materials, advancing their application in nanomaterials research and development.

Biography

Penghao Qi, who is a Ph.D. candidate at the School of Engineering, Cardiff University. His research focuses on the mechanical behavior and interfacial properties of graphene and other two-dimensional (2D) materials. He specializes in building multiscale modeling frameworks to investigate and optimize the structural design of complex film architectures assembled from nanosheets such as graphene and MXenes. His work aims to bridge atomistic mechanisms with macroscopic performance, providing insights into the mechanical robustness, bending stiffness, and interfacial failure modes of layered nanostructures.

ENHANCED TARGETING OF PANCREATIC CANCER USING 6L- UNCTIONALIZED LIPID NANOCARRIERS ENCAPSULATING PACLITAXEL

Laura Larue and Sabrina Belbekhouche
East Paris Institute of Chemistry and Materials science/ University, France

Abstract:

Pancreatic cancer remains one of the most aggressive malignancies, characterized by poor survival rates and limited therapeutic options. Despite advances in chemotherapy, treatments show limited efficacy due to systemic toxicity, poor tumor specificity, and the emergence of drug resistance. Nanostructured lipid carriers (NLCs) have emerged as a promising strategy, offering improved drug delivery, controlled release and enhanced therapeutic efficacy, while enabling active targeting. These particles possess a solid matrix which allows them to encapsulate and protect bioactive compounds. The unique properties of NLCs facilitate their bioavailability and stability, which is particularly advantageous in cases where molecules exhibit low absorption or rapid degradation. The present study explores the development of NLCs by solvent diffusion method with natural lipid compounds, such as cholesterol and oleic acid, for pancreatic cancer treatment. NLCs were loaded with Paclitaxel (PTX), a chemotherapeutic and hydrophobic agent, and coated via electrostatic interaction with N6L, a synthetic hydrophilic ligand that specifically targets nucleolin, which is overexpressed on pancreatic cancer cells. The developed particles demonstrated stability under physiological conditions with diameters ranging from 150-170 nm. They were characterized in terms of morphology, zeta potential and suitability for storage under varying temperature, ionic strength, and pH condition. Additionally, the development of physically stable topical formulations was successfully achieved by freeze-drying with the addition of a cryoprotectant. The formulated NLC demonstrated promising anti-cancer efficacy in vitro against PANC-1 cells. The preliminary findings suggest that this dual-encapsulation system has potential to serve as an alternative treatment for pancreatic ductal adenocarcinoma (PDAC), addressing the limitations of conventional chemotherapy..

Biography

Laura Larue is a PhD student at the East Paris Institute of Chemistry and Materials Science, University of Paris, France. Her research focuses on the modification of polymers to develop innovative fibrous and particulate nanomaterials for advanced drug delivery systems. Aimed at improving the therapeutic efficacy of chemotherapeutic agents, her work involves tailoring poly mer surfaces and optimizing nanomaterial properties to enhance drug stability, bioavailability, and tumor-targeting capabilities.

A key focus of her thesis is the design of delivery platforms for pancreatic cancer therapy, ad dressing one of the most aggressive and treatment-resistant cancers. Using techniques such as electrospinning and nanoparticle formulation, she develops systems capable of controlled drug release and active targeting. Her interdisciplinary approach bridges chemistry, materials science, and medicine, contributing to the advancement of effective nanomedical solutions for critical challenges in oncology

ADSORPTION OF LEAD FROM INDUSTRIAL WASTE WATER USING AZOLLA PINNATA NANO ADSORBENT: OPTIMIZATION STUDY

Abdul Hadi Al-Hassani[1], Alaa Jassem Mohammed[2], Jasim Mohammed Salman[1]
[1]Iraq University College, Iraq
[2]Al-Karikh University for Science, College of Energy & Environmental Science, Iraq

Abstract:

Using response surface methodology (RSM) software, Iraqi date seeds and iron chloride were com- bined under ideal circumstances to create date seeds-iron oxide nanoparticles (DS-IONPs). This study examined the impact of several input parameters on the removal of specific heavy metals, in- cluding lead (Pb). These parameters included the mixing ratio of iron chloride to date seed extract (by volume), solution pH, and mixing temperature. Two-factor interaction (2FI) and quadratic mod- els were utilized, respectively, based on the central composite design (CCD) to correlate the impact of variable parameters on the synthesis of nano adsorbents used for the removal of Pb ion from aqueous solutions. The most significant component in each ex- perimental design response was de- termined by the analysis of variance (ANOVA).

The optimum conditions for synthesis DS-IONPs from Iraqi date seeds and ferrous chloride were found as follows: mixing ratio of 2.5:1, solution pH of 4.0, and mixing temperature of 65°C. The theory and experimental percentage removal of Pb were found to be (99.8 and 98.2%), while the percentage error between predicted and experimental results for the removal of Pb was 0.2%.

Biography

Alaa Jassem Mohammed Al-Erchele, currently lectuerar Al-Karikh University ,for Science, College of Energy & Environmental Science, Iraq, at the same time she is part time lecturer at Iraq university college. In addition to her job she is currently Ph.D. student in faculty os ecology, University Putra Malaysia (UPM), Malaysia, She was holds a M.Sc. in science of biology – Ecology from faculty of science, (UPM), Malaysia, in addition to numerous international certifications in the field of Environmental Management. Mrs Erchelee published more than 20 manuscripts in international journals and international conference in the fields of ecology, adsorption and phytoremediation process, preparation of activated carbons, chars and nano adsorbrnts, environmental applications, water, soil, air monitoring and analysis (laboratories & fields).

DEMOCRATISATION OF PRODUCTION OF MICRO/NANO CELLULOSE

Piyushaa Emrith-Jankee, Hareenanden Ramasawmy, Dinesh Surroop and Diganta Bhusan Das
University of Mauritius, Mauritius

Abstract:

Climate change poses a risk of 70% for global agriculture. African-SIDS countries whose economic pillar is the agricultural sector, are among the most affected by this phenomenon. Since all the African SIDS countries have close proximity to seawater, desalination is a promising alternative freshwater source, especially for irrigation. All desalination membranes are plastic-based. Hence, in the light of the concept of circular economy, there is a need to develop a green desalination membrane.

One pioneering green material is micro/nano cellulose. Research studies have shown that the cellulosic material confers numerous benefits when used for making desalination membranes. However, one main research gap with this material is that its extraction uses high-power consuming equipment and highly concentrated chemicals – this poses economic and ecological burdens to developing economies such as African SIDS countries. Hence, in this study, a cost-effective and eco- friendly pathway has been devised to extract micro/nano cellulose from waste banana trunks. The pathway consists of four stages: wet grinding, mild chemical (alkaline) wood ash pulping, one-pot biological bleaching followed by acid hydrolysis, and ball milling.

The cost-effectiveness and ecofriendliness of the developed pathway have been demonstrated through Multi-Criteria Decision Analysis (MCDA). Furthermore, the optimised experimental conditions for each stage of extraction have been provided. It has also been shown how these conditions affect the size group of the cellulose fibers obtained. Lastly, guidance has been given to show how a functional desalination membrane can be made from micro and nanocellulose. The effectiveness of such a membrane has been depicted through the characterization and performance of the resulting fabricated desalination membrane.

Overall, it is expected that this study will interest investors, industrialists, entrepreneurs and policy makers especially in African SIDS countries - as they will appreciate the promising eco-friendly and cost-effective developed pathway to alleviate their water scarcity issue (through the manufacturing of desalination membranes) and to promote self-sufficiency.

Biography

Piyushaa Emrith-Jankee is a Commonwealth PhD research scholar in the field of Cellulose fibers. Her research underscores the concept of sustainability and circular economy, whereby she focuses on the green extraction and processing of cellulose fibers. Her research explores the fundamental chemical and mechanical properties of cellulose fibers. Moreover, her research falls under the area of Sustainable Material Development since she works on developing novel cellulose-based membranes for water purification. She has contributed to scientific knowledge through her four publications in peer-reviewed journals Piyushaa Emrith-Jankee is a Commonwealth PhD research scholar in the field of Cellulose fibers. Her research underscores the concept of sustainability and circular economy, whereby she focuses on the green extraction and processing of cellulose fibers. Her research explores the fundamental chemical and mechanical properties of cellulose fibers. Moreover, her research falls under the area of Sustainable Material Development since she works on developing novel cellulose-based membranes for water purification. She has contributed to scientific knowledge through her four publications in peer-reviewed journals

ABZYMES MIMICKERS IN CATALYTIC REACTIONS AT NANOSCALES

Orchidea Maria Lecian and Sergey Suchkov
Sapienza University of Rome, Italy

Abstract:

The Markov chain formalisms are newly applied to abzymes mimickers at nanoscales in catalytic reactions. Crown Ethers can be used as Catalysts and Enzyme Mimics They use as scaffold was outlined in the Markov chain of Supramolecular scaffold for aminoester thiolysis is newly written. The Markov chain of enzyme-catalysed reaction following Michaelis–Menten ki- netics is newly established for the enzyme-substrate complex. From, the Mechanism of RNase A action is studied, and the Markov chain is newly stated. The Synthetic route for 6-diSeCD id recalled from, and the Markov chain is newly provided with the enamine mechanism of the proline-catalysed asymmetric aldol reaction is appreciated from and the Markov chain is newly written. Strategies for designing enzyme-activated scaffold-like probes. The Markov chain and the tow-state Markov State Models newly defined for the action sce- narios of β-Lactamase, and of β-Galactosidase. The Markov chain and the three-states Markov state Model of Mechanism are newly spelled for covalent labeling of cysteine proteases by acyloxymethyl ke- tone type probes. Pre-quenched β-lactam probe releases the DABCYL quencher upon hydrolysis by β-Lactamase and a β-lactamase mutant allows this compound to function as an activity-based probe: the Markov chains and the Markov State Models are newly determined. The activation of 2-cyanobenzothiazole proceeds by removal of capping groups on the terminal cysteine residue which undergoes polymerization and the Acti- vation of 2-cyano-6-hydroxyquinoline (CHQ)-based macrocyclization probe are newly analytically studied with their Markov chains and with their Markov State Models. Oxidation of Luciferin derivatives (see, i.e., is also newly studied. The structures of 5-hydroxytryptamine–Gd3+–DTPA, bis-5-hydroxytryptamine–Gd3+–DTPA, bis-o-dianisidine–Gd3+–DTPA and the mechanism of MPO catalyzed polymer- ization of phenols are newly described.

The role of carboxypeptidase and that of β-galactosidase are newly investigated. The action of caspase-3 is newly comprehended.

Biography

Prof. Orchidea Maria Lecian graduated in Theoretical Physics at Sapienza University of Rome and ICRA-in 2005 and completed her PhD at Sapienza University and ICRA. She was post-doctoral Fellow at IHES (Bures-sur-Yvette, France), MPI (Potsdam-Golm, Germany) and Sapienza University of Rome. She took part in intensive research prorammes at MPI (Potsdam-Golm, Germany) and The Fields Institute for Research in Mathematical Sciences (Toronto, Canada) and IHES (Bures-sur-Yvette, France). She has been researcher for SAIA- NS'P (The National Scholarship

Programme of the Slovak Republic- National Stipendium Program) as Research grantee and Erasmus Lecturer

at Comenius University in Bratislava (Bratislava, Slovakia), Faculty of Mathematics, Physics and Informatics, Department of Theoretical Physics and Physics Education- KTFDF in 2017-2018. She was Visiting Professor at Kursk State University, Faculty of Algebra, Geometry and Didactics of Mathematics Theory (Kursk, Russia) within the Programme Education in Russia for Foreign Nationals of the Ministry of Science and Higher Education of the Russian Federation in 2022-2023.

She was Assistant Professor at Sapienza University of Rome and has been Professor at Sapienza University of Rome, she is member of several Research Consortia. She is author of research papers, conference papers, review papers, invited papers, five books and one book-chapter. She Editor-in-chief, Editorial-board member and reviewer of several international Journals.

EFFICIENT REMOVING TECHNIQUE OF HEAVY METALS FROM INDUSTRIAL WASTEWATER

Alaa Jassem Mohammed[1], Abdul Hadi Al-Hassani[2] and Jasim Mohammed Salman[*3]
[1]*Al-Karikh University, College of Energy & Environmental Science, Iraq*
[2]*University Putra Malaysia (UPM), Faculty of Forestry and Environment, Malaysia*
[3]*Iraq University College, Basra, Iraq*

Abstract:

Heavy metal-containing industrial wastewater treatment procedures often include toxicity reduction technologies to meet technology-based treatment standards. The physio-chemical removal methods discussed included reverse osmosis, ultrafiltration, membrane filtration, electrodialysis, ion exchange, bio adsorption on new adsorbents, and phytoremediation.

Adsorption and bio adsorption uses a variety of inexpensive bio adsorbents, such as activated carbon, char, nano materials, algae, industrial waste, forest waste, and agricultural waste, to remove as much heavy metal as possible from wastewater. Instead of using physical-chemical methods to remove heavy metals from wastewater, Adsorption and bio adsorption techniques are the most environmentally beneficial option. For harmful inorganic compounds created by a variety of industries that cannot be eliminated by biological or physical processes, however, chemical procedures are the most effective therapies. One potential technique for eliminating contaminants from industrial wastewater is phytoremediation, which is acknowledged as a superior green remediation technology. These days, the emphasis is on finding a sustainable method for increasing wastewater treatment capacity. The phytoremediation technology has made use of a variety of aquatic plant species.

Biography

Prof. Jasim Mohammed Salman is the current Dean of Iraq University College and has previously held senior academic positions, including Dean of Petroleum Engineering at Al-Ayen University, Dean at Al-Kunooze University College, Scientific Deputy Dean at Al-Nisour University College, and Professor at Madinat Al Ilim University College.

He holds a Ph.D. in Chemical Engineering from the University of Sciences Malaysia and has over 30 years of experience in environmental management, water and wastewater treatment, adsorption processes, and laboratory analysis. Prof. Salman has collaborated extensively with international firms in Iraq on environmental and engineering projects.

A prolific researcher, he has published over 80 papers in international journals and conferences. His contributions have earned him numerous honors, including being ranked in the top 0.5% of scholars worldwide by ScholarGPS (2024) and being named a Fellow of the International Association of Advanced Materials (FIAAM) in Sweden (2020). He also received the Scientist's Medals in 2017 and 2019 from the same association.

NANOBIOTECHNOLOGY IN COSMETIC DERMATOLOGY

Pierfrancesco Morganti[1,2]
[1]*Nanotechnology Unit, Academy of History of Healthcare Art, Italy*
[2]*Dermatology China Medical University, Shenyang, China*

Abstract:

Cosmetic Dermatology is a brunch of Dermatology regarding the use of Cosmeceuticals and nutraceuticals, made by nanotechnological techniques. Due to the plastic waste that, invading lands and oceans, is creating environmental and health problems, our research group are proposing the use of novel tissue-carriers, as substitutes of the emulsion-vehicles, utilized to make the actual Cosmeceuticals. These original carriers, made by natural polymers and electrospinning technology, are used to make biodegradable tissue-carriers. These novel tissues may be embedded by selected biodegradable nano-ingredients, encapsulated into nano- chitin-Nano lignin (CN-NL) complexes. It is interesting to underline that both the polymers, CN and NL, act as carrier as well as active ingredients, useful for their antioxidants and skin-repairing effectiveness. Moreover, the activated tissue-carrier may be packed by paper or aluminum foils, so that the final cosmeceutical is biodegraded at 100%. In conclusion the proposed new nanobiotechnological carrier may be useful to create innovative, biodegradable, plastic-free cosmeceuticals to save our health and the Environment.

Biography

Pierfrancesco Morganti, Academic member of Directory Board and Director of R&D Center, Nanotechnology unit at Academy of History of Healthcare Art, Rome, Italy is Visiting professor of Skin Pharmacology and Applied Cosmetic Dermatology at Department of China Medical University, Shenyang, China from 1980 until today. In different years of his scientific life he was professor on contract of skin Pharmacology and Applied Cosmetic Dermatology at some prestigious Universities of Milano, Pavia,L' Aquila, Naple and Rome and chaired as invited lecturer many scientific seminars and sessions in different universities and international meetings in Europe, Russia, West-Asia, Asia-Pacific, North and South Americas. He had an industrial experience from 1980 to 2018 as CEO and R&D Manager of an Italian cosmetic industry, producing clinically correct cosmetics. Moreover in 1985 he was co-founder with other scientists of the International Society of Cosmetic Dermatology, being the founder and Editor in cheaf until 2021 of the Journal of Applied Cosmetology. Author of more than 500 scientific papers,8 books and various book' chapters and patents, he is working from more than ten years on the development of natural nanocomposites, innovative tissue-carriers and biodegradable packagings that, fundamentally made by chitin nanofibrils, nanochitin and other biopolymers, may be obtained from food and agro-forestry waste, by skin- and eco-friendly technologies. These novel, biodegradable carriers might find an interesting use to produce not only innovative and smart carriers for drugs, cosmeceuticals and nutraceuticals, but also biodegradable packagings and containers. For the last Scientific papers published he has been enclosed among the 2% of the more active and known scientists in the world during the years 2022,2023 and 2024

Advanced Nanomaterials and Nanotechnology

Day 2

Keynote Presentation

LEVOFLOXACIN-FUNCTIONALIZED GOLD NANOPARTICLES ENHANCED BY RESVERATROL: A SYNERGISTIC NANOPLATFORM TARGETING RESISTANT OCULAR INFECTIONS

Hany Akeel Al-Hussaniy

Al-Nisour University College, Iraq

Abstract:

Levofloxacin, a broad-spectrum fluoroquinolone antibiotic, is frequently used in the treatment of ocular infections. Levofloxacin-loaded gold nanoparticles (Levo-AuNPs) were synthesized through a one-step reduction method in which levofloxacin acted as both reducing and stabilizing agent. The synthesized nanoparticles were characterized using UV–Visible spectroscopy, transmission electron microscopy (TEM), dynamic light scattering (DLS), and Fourier-transform infrared spectroscopy (FTIR). The zeta potential was measured at −21.6 mV, indicating moderate stability of the colloidal system. Antibacterial efficacy was assessed against clinically relevant ocular pathogens, including Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella pneumoniae, and Escherichia coli. The minimum inhibitory concentration (MIC_{50}) values demonstrated a significant improvement when Levo-AuNPs were combined with resveratrol. Notably, the MIC_{50} of Levo-AuNPs against P. aeruginosa decreased from 24.1 ± 1.4 µg/mL (Levo alone) to 2.3 ± 0.2 µg/mL when used in combination with resveratrol, reflecting nearly a 10-fold enhancement. Combination index and isobologram analysis confirmed the synergistic interaction between levofloxacin and resveratrol. These findings suggest that the co-delivery of levofloxacin and resveratrol via gold nanoparticles holds strong potential as an advanced antimicrobial strategy for the treatment of drug-resistant ocular infections

Biography:

Dr. Hany Akeel Al-Hussaniy (Scopus H Index 16)

PhD in Pharmacology | Editor-in-Chief | Lecturer | Founder of Iraqi Medical Research Center

Dr. Hany Akeel Al-Hussaniy is a distinguished Iraqi academic and researcher specializing in pharmacology and biomedical sciences. He holds a PhD in Pharmacology and has published over 60 peer-reviewed articles in internationally indexed journals, with a growing impact in areas such as immunopharmacology, oncology, and computational drug discovery. His research contributions have earned him citations in Scopus, Clarivate, and Google Scholar, reflecting a strong academic footprint across the Middle East and beyond.

Dr. Al-Hussaniy is the Editor-in-Chief of the Medical and Pharmaceutical Journal, a peer-reviewed, open-access journal that has achieved indexing in several platforms including Google Scholar, J-Gate, ROAD, BASE, and CAS (Chemical Abstracts Service).

He is also the founder of the Iraqi Medical Research Center, a platform dedicated to advancing medical and pharmaceutical education and research in the region. Through this center, he has organized scientific collaborations, supported early-career researchers, and promoted open-access knowledge dissemination.

OPTIMIZATION STUDY OF PREPARATION CERATOPHYLLUM DEMERSUM ACTIVATED CARBON FOR REMOVAL HEAVY METALS USING RESPONSE SURFACE METHODOLOGY

Abdul Hadi Al-Hassani[1], Alaa Jassem Mohammed[2] and Jasim Mohammed Salman[1]

[1]Iraq University College, Basrah, Iraq
[2]Al-Karikh University for Science, College of Energy & Environmental Science, Iraq

Abstract:

Generic term used to describe a family of carbonaceous adsorbents with a highly amorphous structure and a developed internal pore structure and high surface area. The large of surface area relative to the size of the actual carbon particle makes it easy to remove large amounts of impurities in a relatively small enclosed space. According to the International Union of Pure and Applied Chemistry (IUPAC) there are three types of AC:

Micropores type (pore size < 2 nm).

Mesopores type (pore size 2-50 nm).

Macropores type (pore size >50 nm).

Activated carbon has specific properties depending on the material source (precursor) and the mode of activation. The main goals of this research study are to optimize the operating parameters (activation temperature, activation time and chemical impregnation ratio IR) in the preparation of mesoporous activated carbon from one of the aquatic plants (Ceratophyllum demersum) for the removal of different types of heavy metals from aqueous solutions. Also to characterize the prepared Ceratophyllum demersum activated carbons (CDAC) for their physical and chemical properties (surface area, pore size distribution, surface morphology, proximate content, elemental analysis and surface chemistry). Finally, to study the effects of initial heavy metals concentrations, contacting time, on the removal of these materials onto prepared activated carbon in batch and fixed-bed process.

Biography:

Prof. Jasim Mohammed Salman is the current Dean of Iraq University College and has previously held senior academic positions, including Dean of Petroleum Engineering at Al-Ayen University, Dean at Al-Kunooze University College, Scientific Deputy Dean at Al-Nisour University College, and Professor at Madinat Al Ilim University College.

He holds a Ph.D. in Chemical Engineering from the University of Sciences Malaysia and has over 30 years of experience in environmental management, water and wastewater treatment, adsorption processes, and laboratory analysis. Prof. Salman has collaborated extensively with international firms in Iraq on environmental and engineering projects

NOVEL SYNTHESIS OF PURE AND DOPED-HYDROXYAPATITE NANOCOMPOSITE FOR THE PHOTO-CATALYTIC DEGRADATION OF AMOXICILLIN AND CIPROFLOXACIN: CRYSTALLOGRAPHIC CHARACTERIZATION USING XRD

Newaz Mohammed Bahadur
Noakhali Science and Technology University, Bangladesh

Abstract:

Nanosized hydroxyapatite (HAp) is considered an elementary material for artificial bone tissue engineering and the applications are expanding and one of them is the photocatalytic degradation of environmentally hazardous pollutants. In this research, HAp nanoparticles, in pure form and doped with cadmium (Cd), Flouride (F), Sodium (Na) were synthesized using a conventional wet-chemical precipitation method from natural source. Additionally, the synthesized samples such as pure and doped-HAp were characterized by X-ray diffraction (XRD), Fourier Transform Infrared spectroscopy (FT-IR), scanning electron microscopy (SEM), and UV–Vis spectroscopy. Moreover, the XRD analysis allowed for a detailed estimation of the crystallite size, assisting in their tailoring of increased photocatalytic activity. The crystallite sizes of the nano-crystallite HAp were evaluated using the Scherrer Method (SM), Williamson-Hall Method (WHM), Size-Strain Plot (SSP), Halder-Wagner Method (HWM), and Sahadat-Scherrer Method (SSM). The models confirmed the formation of nano crystallite hydroxyapatite in pure and doped form. Cadmium doping in HAp showed great photocatalytic activity for example at 150 min, 31 % amoxicillin and 52 % ciprofloxacin were degraded upon 1.5 wt % Cd doping in HAp crystal. In addition, F-HAp nano-photocatalyst effectively degraded Congo red in aqueous solution and process variables such as pH, reaction time, doses of catalyst, source of photons (sunlight degradation), temperature, and Congo red concentration were optimized. Compared to pure HAp, altering the percentages of dopant ions within the HAp structure resulted in an enhanced photocatalytic performance for the degradation of Congo red dye across all tested conditions. Moreover, under sunlight irradiation, the new Na-HAp photocatalyst was put to use in the process of degrading pharmaceutical pollutants such as antibiotics (amoxicillin and ciprofloxacin). It was found that using a 0.1 g dose of 1% Na_HAp under specified conditions, such as a pH of 7 and 120 minutes of sunlight irradiation, resulted in degradation percentages of 60% and 41.59% for amoxicillin and ciprofloxacin, respectively. Different radical scavengers were utilized to determine the reaction mechanism for the photochemical degradation of antibiotics. Additionally, the ability to be reused and the stability of 1% Na_HAp, a newly developed photocatalyst, were assessed. Therefore, this research adds to our understanding of how to optimize redox capacity for the rapid breakdown of a variety of antibiotics when exposed to sunlight.

Biography:

Dr. Newaz Mohammed Bahadur is a Professor of the Department of Chemistry, Noakhali Science and Technology University, Bangladesh. He did his PhD and Postdoc from Utsunomiya university, Japan. He has been working in Noakhali Science and Technology University since 2006. He was the Chairman of the Department of Applied Chemistry and Chemical Engineering for the periods of 05/03/2006 to 01/10/2007, 07/10/2013 to 06/10/2016 and 27/2/2020 to 26/02/2023. He was also the Chairman of the department of Chemistry from 27/02/2023 to 11/09/2024. He was the dean of faculty of Education Sciences from 26/09/2019 to 10/06/2023. His interest encompasses a number of areas spanning Physical, Inorganic, Analytical, Environmental Sciences, Bioinformatics, impact SERS-COV-2 on environment, Material Sciences, Surface Sciences, Semiconducting Interfaces, Quantum Dots, etc. He published more than 90 research articles in Q1 and Q2 journals. His google scholar citation is almost 2100.

Day 2

Advanced Nanomaterials and Nanotechnology

Oral Presentations

ELECTRICAL PROPERTIES INVESTIGATION IN INASP QUANTUM DOT LASER DIODE STRUCTURES BY THE CHANGE OF BARRIERS THICKNESS

MS Al-Ghamdi and RM Albugami
King Abdulaziz University, Saudi Arabia

Abstract:

In this study, the InAsP quantum dot laser diode devices grown on GaAs substrates were fabricated. It is important to select and design suitable materials at the nanoscale for the fabrication of quantum dot laser diode devices. These lasers are characterized by their unique electronic and optical properties, operating at wavelengths between 720 and 780 nm, spanning the red to the near infrared spectral range. Their characteristics include significantly low threshold currents, great frequency ranges, narrow spectral linewidths, and reduced temperature sensitivity. We prepared three samples of InAsP quantum dot lasers with different barrier lengths using AlGaInP as the barrier material.

Our investigation concentrates on characterizing the structural and physical properties of these lasers. These samples contain semiconductor materials GaAs, GaInP, AlInP, InAsP, and AlGaInP with different compositions X. We measured the relationship between the bandgap energy E_g and composition X theoretically at a constant temperature of 300 K, the aim being that electrons have sufficient thermal energy to move into the conduction band and thus enable current to flow within the compound. In addition, we investigated the relationship between the bandgap energy E_g and the lattice constants for all materials used. We observed that all materials had the same lattice constant, equal to 5.65 Å, These materials are lattice matched with GaAs, except for the lattice mismatch in InAsP, which has a value of 5.86Å, which was chosen to be different for the quantum dot formation. Moreover, all these materials have a direct bandgap, except for AlInP indirect bandgap, which represents a cladding layer that contributes to confining electron transport.

The InAsP quantum dots are self-formed using the Stransky-Krastanov method. Finally, this results in the improvement and development of quantum dot laser diode devices, enhancing the electron transport process within the device, and achieving high efficiency.

Biography

Prof. Al-Ghamdi completed his Ph.D degrees at Cardiff University UK in 2010. Afterword he got position at King Abdulaziz University in Saudi Arabia. Then he established the optoelectronic laboratory at King Abdulaziz University. He supervised more than 10 postgraduate students and recived more than 8 funded projects form outside and inside the university. Prof. Al-Ghamdi research interest includes the design and fabrication of semiconductor devices laser diode and studies the optoelectronic and electrical properties of these devices by measuring their absorption, spontaneous, stimulated emission spectra, ideality factor, barrier height and series resistance. The current research topics include red emitters quantum dot laser diode which used in photodynamic therapy for cancer treatment and also used in the manufacture of dual wavelength sources for data storage. Prof. Al-Ghamdi has over 65 publications that have been cited over 600 times, and his publication h-index is 14. He is a member of IEEE and OSA societies.

Day 1

Advanced Nanomaterials and Nanotechnology

Poster

ENDOTHERMIC DECOMPOSITION CHARACTERISTICS OF VARIOUS INITIATORS FOR IMPROVING THE ENDOTHERMIC PERFORMANCE OF AVIATION FUEL

Min Chang Shin, Jung Hoon Park and Edoardo Magnone
Dongguk University, South Korea

Abstract:

For hypersonic vehicles using cooling systems with regenerative cooling channels, the endothermic performance of liquid fuel is crucial. To improve the endothermic performance of aviation fuel, research on various additives is actively being conducted. This study comparatively screened the effects of various initiators on the endothermic decomposition characteristics of aviation fuel to develop additives that will improve its performance in the future. The liquid products were analyzed by Gas Chromatograph Mass Selective Detector (GC-MSD), while gaseous products were examined using Gas Chromatography (GC) with Flame Ionization (FI) and Thermal Conductivity (TC) detectors. The endothermic amounts of aviation fuel decomposition in the presence of various initiators were experimentally determined based on the power input to the reactor.

Biography

Min Chang Shin, who majored in safety engineering during his undergraduate studies, continued his education in chemical engineering at the graduate level, focusing on research related to clean energy and membrane technology. His master's thesis centered on developing air purification systems using visible-light responsive TiO_2 to promote environmental sustainability. More recently, his research has branched into two significant areas: optimizing hollow fiber membranes for use in hemodialysis machines to enhance their efficiency and reliability and developing adsorbents for carbon dioxide capture directly from the air as part of a global initiative to combat climate change and promote environmental preservation

COMPARISON OF ENDOTHERMIC DECOMPOSITION CHARACTERISTICS OF ZSM-5 AND ACTIVATED CHARCOAL CATALYSTS FOR IMPROVING COOLING PERFORMANCE OF HYPERSONIC VEHICLES

Jung Hoon Park
Dongguk University, South Korea

Abstract:

Hypersonic vehicles may experience durability problems due to the rapid increase in surface temperature caused by air friction during operation. To address this issue, a cooling method utilizing a regenerative cooling channel is adopted, which cools through the endothermic reaction of liquid fuel. However, since the endothermic performance of the liquid fuel itself is relatively low, it is important to develop technology to improve it. In this study, the endothermic decomposition characteristics of fuel were analyzed using ZSM-5 zeolite and activated carbon catalysts to enhance the fuel's endothermic decomposition performance. The catalyst properties were investigated using Brunauer-Emmett-Teller (BET), X-ray Diffraction (XRD), and Temperature-Programmed Desorption (TPD) analysis. Catalyst coating characteristics were examined by Scanning Electron Microscopy (SEM) analysis. The liquid products were analyzed by Gas Chromatograph Mass Selective Detector (GC-MSD).

Biography

Dr. Park studied his bachelor (1988/1993), master's degree (1996/1994) and Ph.D. (1996/2000) at the Department of Chemical Engineering of the Korea University, Seoul (Korea). From 2000 to 2013 he was a researcher at the Korea Institute of Energy Research (KIER), Daejeon (Korea). Actually, Dr. Jung Hoon Park is an Assistant Professor at the College of Engineering of Dongguk University in Seoul (Korea) and team leader of a laboratory specialized on Carbon capture and storage (CCS). His activity focuses on oxygen separation using ion transport membrane as well as hydrogen separation using metal and ceramic composite membrane, fine ceramic synthesis using hydrothermal reaction, and supercritical water extraction.

DESIGN OF A PLATFORM FOR HYDROPHOBIC DRUG DELIVERY IN BIOMEDICAL APPLICATIONS

Laura Larue and Sabrina Belbekhouche

East Paris Institute of Chemistry and Materials science/ University, France

Abstract:

Antimicrobial resistance (AMR) is an increasingly global health concern, with infections caused by antibiotic-resistant bacteria projected to result in nearly 10 million deaths worldwide annually by 2050, as highlighted in the O'Neill report. This alarming trend underscores the urgent need for innovative antibacterial therapies, particularly for wound infections where resistance is notably prevalent. To address this challenge, gelatin-based fibers have been developed as a novel platform for antibiotic delivery through the electrospinning technique. This cutting-edge approach combines biocompatibility, efficient drug delivery and potent antibacterial activity, offering a potential solution to the global AMR crisis. Gelatin, a water-soluble protein derived from collagen and a prominent natural biomaterial, was selected due to its role as the predominant component of the extracellular matrix (ECM). Furthermore, gelatin is extensively used in the pharmaceutical and biomedical fields due to its unique properties, including biocompatibility, adhesion capacity and cost- effectiveness. The developed fibers provide the advantage of loading an antibiotic with poor water solubility, such as ciprofloxacin, which is a widely used antibiotic in the treatment of various bacterial infections. The resulting electrospun antibacterial fibers exhibit uniform morphologies with diameters ranging from 100 and 300 nm. The antibacterial efficacy of these fibers was assessed in vitro against a spectinomycin-resistant strain, revealing that the designed dressings could completely eliminate of Escherichia coli growth within 20 minutes, with sustained efficacy for up to 72 hours. These findings suggest that ciprofloxacin-loaded gelatin fibers represent a promising antimicrobial material for the prevention and treatment of wound infections, particularly those caused by antibiotic-resistant pathogens.

Biography

Laura Larue is a PhD student at the East Paris Institute of Chemistry and Materials Science, University of Paris, France. Her research focuses on the modification of polymers to develop innovative fibrous and particulate nanomaterials for advanced drug delivery systems. Aimed at improving the therapeutic efficacy of chemotherapeutic agents, her work involves tailoring poly mer surfaces and optimizing nanomaterial properties to enhance drug stability, bioavailability, and tumor-targeting capabilities. A key focus of her thesis is the design of delivery platforms for pancreatic cancer therapy, ad dressing one of the most aggressive and treatment-resistant cancers. Using techniques such as electrospinning and nanoparticle formulation, she develops systems capable of controlled drug release and active targeting. Her interdisciplinary approach bridges chemistry, materials science, and medicine, contributing to the advancement of effective nanomedical solutions for critical challenges in oncology

DESIGN AND TESTING OF A HEMODIALYSIS DEVICE FEATURING CERAMIC HOLLOW FIBER MEMBRANES

Edoardo Magnone
Dongguk University, South Korea

Abstract:

In this research, a hemodialysis module featuring ceramic hollow fiber membranes was developed and assessed. These membranes were produced using the phase inversion technique and were sintered under varying conditions. Critical attributes such as pore size average, hydraulic permeability, and protein retention were methodically examined to enhance the membrane's efficacy. An acrylic module, specifically designed, was assembled to incorporate the ceramic membranes for hemodialysis usage. Model blood solutions containing typical uremic toxins like urea, creatinine, and potassium phosphate were used to mimic clinical scenarios. The efficacy in removing these toxins was determined through TOC analysis and UV-Vis spectrometry. The findings indicated that spinning parameters and sintering temperatures profoundly affected the membranes structure and functionality, impacting their permeability and adsorptive properties. The ceramic hollow fiber membranes demonstrated substantial water flow and effective toxin elimination, underscoring their potential in hemodialysis. Their integration into the bespoke module ensured consistent operation and dependable performance. This study highlights the promise of ceramic hollow fiber membranes as a durable and efficient option for hemodialysis, setting the stage for further developments in medical filtration technology.

Biography

Professor Magnone received his degree in Chemistry from the University of Genoa (IT) in 1995 and his PhD in Electrochemistry in 1999. In 2004 he moved to the University of Tokyo (JP), where he worked for about four years on nanomaterials for energy applications, developing a novel method for the synthesis of perovskite-type oxides. He received prestigious awards, including a fellowship from the Japan Society for the Promotion of Science (JSPS) to conduct research on Solid Oxide Fuel Cells (SOFC) at the Center for Collaborative Research (CCR) in Tokyo. He also spent a year as an invited researcher at the National Institute for Materials Science (NIMS) in Tsukuba (JP). Subsequently, he worked for three years at the Korea Institute of Energy Research (KIER) in Daejeon (KR) before joining Dongguk University (Seoul) as an associate professor in 2013. He has held this position since 2013 and has published over 100 papers in chemistry and materials science, focusing on advanced synthesis, membrane science, and catalytic properties of nanomaterials. His current research interests include Pd-based membranes for H2 separation, CO_2 capture through gas-liquid hollow fiber membrane contactors, and improving the cooling performance of hypersonic vehicles. His current research interests span Pd-based membranes for H2 separation, CO_2 capture utilizing gas-liquid hollow fiber membrane contactors, and advancements in cooling performance for hypersonic vehicles.

INFLUENCE OF RELAXATION TIME OF ENERGY DISSIPATION ON STRUCTURAL INSTABILITY OF COATINGS ON CUTTING TOOLS UNDER EXTREME LOADS

A Kovalev[1,2], D Wainstein[1,2], E Konovalov[1,2], V Vakhrushev[1,2] and S Dmitrievskii[1]
[1]I. P. Bardin Central Research Institute For Ferrous Metallurgy, Russia
[2]Surface Phenomena Researches Group, Russia

Abstract:

Within the framework of non-equilibrium thermodynamics, self-organization of a multicomponent coating under extreme dry cutting conditions was investigated. The aim of the work is to explain the established phenomenon of repeated microstructural transformation of amorphous and crystalline states during tribooxidation of PVD $Ti_{0.2}Al_{0.55}Cr_{0.2}Si_{0.03}Y_{0.02}N$ coating on Co-W carbide steel during dry high-speed cutting of AISI H13 steel with a hardness of HRC 53–55 at a speed of 600 m/min. The protective properties of this adaptive coating are basically related to their active transformation under the action of external physical and mechanical influence. The composition and structure are designed in such a way that tribooxides are formed on the surface of the cutting tool with the coating, reducing the coefficients of friction and thermal conductivity. Kinetic postulates in the thermodynamics of nonequilibrium processes are used for explanation. Energy conservation-dissipation is considered under the conditions of the existence of many interconnected and independent wave processes, taking into account their relaxation times. Self-organization of the coating is considered as a transformation of an open nonlinear system with a small number of physical fundamental objects and mathematical equations that determine the wave mechanisms of energy dissipation through various channels. Low coefficients of thermal conductivity and friction of such wear-resistant tribooxides contribute to the abrupt localization of wear in submicrovolumes. This is one of the signs of large-scale structural self-organization of a thermodynamic system. The energy dissipation during phase, structural transformations, heat transfer and plastic deformation occur on different time scales. And they are characterized by incomparable relaxation times. It is established that quantum coherence, the cross-section of energy exchange channels determines the transition of the system to a stationary state. The dissipation and accumulation of supplied energy occurs through various channels. This process is directly or indirectly regulated by feedback. The relaxation times of phonon and plasmon heat transfer were determined using electron spectroscopy methods. Cyclic nanoindentation made it possible to measure the relaxation time of energy dissipation on microplastic deformation. Self-organization of the coating devel-

ops as a chain of repeating processes of the appearance and disappearance of tribooxide films, amorphization and dynamic recrystallization of the coating. A generalized scheme of phase and structural transformations in the surface layers of the nitride ion-plasma coating during cutting is presented. It is shown that important factors of energy exchange are the channel cross-section, delay and relaxation times and the presence or absence of quantum coherence.

Day 2

Advanced Nanomaterials and Nanotechnology

Video Presentations

ELECTRIC ARC-INDUCED PYROLYSIS OF TRANSFORMER OIL: A PATHWAY TO COMBUSTIBLE GAS GENERATION, FIREBALL FORMATION, AND THE CHALLENGE OF VISUAL SCALE PERCEPTION IN NIGHT-TIME INCIDENTS

Miltiadis Karazoupis
Independent Researcher, Greece

Abstract:

Power transformers are critical components in electrical grids, and their operational integrity is paramount. The mineral oil used within these transformers serves as both an insulator and a coolant. However, internal electrical faults, particularly high-energy arcing, can subject this oil to extreme thermal stress. This article investigates the phenomenon of pyrolysis in transformer oil initiated by electric arcs, typically resulting from fault conditions with voltages such as 25,000 Volts or higher within the equipment's operational context. It explores the mechanisms by which arc-induced high temperatures lead to the decomposition of insulating oil into various combustible gases, primarily hydrogen, acetylene, methane, and ethylene. The rapid generation and accumulation of these gases can cause a significant pressure rise within the transformer tank, potentially leading to tank rupture. Upon rupture and the subsequent release of the flammable gas mixture and atomized oil into the atmosphere, ignition by the arc or hot components can result in a catastrophic fireball and sustained fire. This review synthesizes existing literature on arc characteristics, oil pyrolysis chemistry, gas generation dynamics, pressure vessel failure, and combustion phenomena to demonstrate the credible pathway from an internal electric arc to a transformer fireball. Furthermore, it addresses the common misperception of fireball size when viewed through low-resolution, low-frame-rate night-time cameras, considering factors such as blooming, lens flare, and atmospheric refraction due to humidity, which can lead to an overestimation of the actual event scale. Understanding this entire sequence, including the nuances of visual evidence interpretation, is crucial for enhancing transformer design, safety protocols, diagnostic techniques like Dissolved Gas Analysis (DGA), and accurate post-incident analysis.

Biography

Miltiadis Karazoupis is an independent researcher specializing in Quantum Gravity. He employs computational techniques to address theoretical problems, exploring the intersection of Theoretical Physics and Computational Mathematics. His research interests lie at the critical crossroads of fundamental physics, quantum information theory, and computation.

In addition to his research, Miltiadis Karazoupis is an author, a ScholarsColab Research Mentor, and a member of the Hellenic Physicists Society as well as the GFOSS/Open Technologies Alliance.

BIOSYNTHESIS OF SILVER NANOPARTICLES USING AQUEOUS EXTRACT OF POMEGRANATE PEELS: CHARACTERIZATION AND EVALUATION OF THEIR ANTIMICROBIAL AND CYTOTOXIC ACTIVITY

Sina Matalqah
Al-Ahliyya Amman University, Jordan

Abstract:

Background: Olive leaf extract (OLE) is a valuable source of phenolic compounds that have been found to possess antioxidant, anti-tumoral, antimicrobial, anti-inflammatory, anti-angiogenic, anti- atherosclerotic and platelet anti-aggregate activities but their clinical application is hindered by their poor pharmacokinetics and low stability. To overcome these limitations, this study aimed to enhance their biological activity and stability by loading them into silver nanoparticles.

Objectives: Green synthesis of silver nanoparticles using OLE as a reducing agent to enhance the antimicrobial and cytotoxic properties of OLE.

Methods: Silver nanoparticles (OLE-AgNPs) were synthesized using the OLE as a reducing agent and polyvinylpyrrolidone (PVP) as a stabilizer. UV visible absorbance spectroscopy was used to confirm the formation of OLE-AgNPs while dynamic light scattering (DLS) was used to characterize them in terms of hydrodynamic particle size distribution, polydispersity index (PDI) and surface charge. Cytotoxicity and antimicrobial effects of OLE and OLE-AgNPs were determined on lung cancer cell lines, and gram positive and gram-negative bacteria strains, using MTT assay and disc difusion method.

Results: The OLE-AgNPs were successfully synthesized through bio-green method which identified when the color was changed to brownish upon adding OLE into AgNO3 solution and their formation was confirmed by using UV visible spectrophotometry and DLS analysis.

Conclusion: Green nanoparticles have been successfully synthesized and loaded with a plant extract. The prepared OLE-AgNPs showed improved antibacterial and cytotoxic effects compared to OLE. The protocol adopted here for synthesis OLE-AgNPs can be applied to other metal NPs due to highly oxidization in nature of OLE. Moreover, the abundance and biomedical applications such as antibacterial and anticancer nature of OLE mediated AgNO3 potentially attracts for the up scaling of metallic nanomaterial to explore various catalytic as well as biomedical applications

Biography

Dr. Sina Matalqah (Nanotechnology Drug Delivery Systems). Assistance professor at Al-Ahliyya Amman University, Faculty of Pharmacy, Department of Pharmaceutical and Pharmaceutical Technology. Dr. Matalqah has her expertise in preparation and evaluation of Chitosan Nanoparticles (NPs) and Metal NPs especially Silver NPs (AgNO3), loaded with either drugs or plant extract resulting a novel formulations having higher activities compared to the conventional drugs and herbal extract. Nowadays Dr. Matalqah investigating anti-cancer, anti-bacterial, anti-oxidant and wound healing activities of different plant extract loaded in different types of NPs.

ORGAN-ON-CHIP AS SMART BIOMEDICAL INTERFACES: REPLACING ANIMAL MODELS, TRANSFORMING DRUG DEVELOPMENT AND PERSONALIZED MEDICINE

A V Vasanthi and Joga Sarika
Sarojini Naidu Vanita Pharmacy Maha Vidyalaya, India

Abstract:

Organ-on-a-Chip (OoC) technology provides a state-of-the-art in vitro platform that is able to emulate human tissue and organ-level functions at a higher level of physiological relevance than traditional 2D cell cultures and animal models. These microfluidic devices couple living cells in engineered environments to mimic the biochemical, mechanical, and architectural properties of native organs. Recent advances have given rise to multi-organ systems—freely referred to as Body-on-a-Chip where researchers are able to investigate intricate inter-organ interactions and model diseases at the systemic level.

As compared to animal models, where it is common to get limited translatability due to genomic and physiological variation, OoC platforms employ human-derived cells, thus imparting improved predictive precision in drug efficacy and toxicity testing. The platforms are also being engineered more for personalized medicine by incorporating patient-specific cells. Microfluidic channels on these chips enable complete control of fluid dynamics, nutrient transfer, and cellular communication.

Moreover, the use of Artificial Intelligence (AI), including machine learning and deep learning, has revolutionized process automation and data analysis in the context of OoC platforms. It significantly enhances Organ-on-Chip system scalability and translational relevance, reduces the dependency on animal models, and allows to overcome the constraints of classical 'one-size-fits-all' medicine.

Biography

A. V. Vasanthi, an undergraduate researcher and a Bachelor of Pharmacy (B.Pharm) student at SNVPMV, currently ranked as the topper of her batch with an impressive academic score of 94.9%. She has made significant academic contributions, with 12 published works, more than 50 professional certifications, and 17 prestigious awards recognizing her achievements in both academic and extracurricular aspects.

She is deeply passionate about pharmacology, with focused interests in nanotechnology for cancer therapy, Herbal Drug Technology, Personalized Diagnosis, and Advanced Drug Delivery Systems. Her work emphasizes the exploration of natural products for targeted treatments, recognizing their vast potential in developing safer and more effective therapies.

Believing that personalized medicine is essential in modern healthcare, she advocates for moving beyond the limitations of one-size-fits-all approaches. She emphasizes that tailored, patient-specific therapies are crucial for achieving precision, safety, and optimal therapeutic outcomes.

Driven by a passion for innovation, she actively explores nature-inspired strategies for, aiming to bridge the gap between traditional medicine and modern pharmaceutical science. Her work reflects a commitment to blending ancient wisdom with cutting-edge research to address today's complex healthcare challenges.

SYNTHESIS OF N-DOPED SNO_2 NANOWIRE@VOID@N-DOPED CARBON AS A HIGH-PERFORMANCE ANODE FOR LITHIUM-ION BATTERIES

Zeinab Sanaee, Alireza Habibi and Mohammadreza Yasoubi
University of Tehran, Tehran, Iran

Abstract:

This study reports the successful design, synthesis, and electrochemical evaluation of a novel nitrogen-doped SnO_2nanowire@Void@ nitrogen-doped Carbon yolk-shell (N-Yolk) structured anode material for lithium-ion batteries. SnO_2-based anodes have attracted significant attention due to their high theoretical capacity; however, their practical applications are hindered by critical issues such as severe volume expansion during lithiation and delithiation processes, poor cycling stability, and the formation of an unstable solid electrolyte interphase (SEI). To overcome these challenges, we engineered a yolk-shell architecture that effectively accommodates volume changes through the internal void space, preventing electrode pulverization and enhancing mechanical stability. The introduction of nitrogen doping in both the SnO_2 core and the carbon shell plays a pivotal role in improving the material's electrical conductivity and lithium-ion storage capabilities. Nitrogen atoms in the SnO_2 core increase the number of active sites for lithium insertion and promote faster lithium-ion diffusion, while the nitrogen-doped carbon shell enhances electronic conductivity, protects the electrode surface, and stabilizes the SEI layer during extended cycling. Electrochemical testing demonstrated remarkable performance, with the N-Yolk anode exhibiting a high reversible capacity of 702 mAh g^1 and 91.4% capacity retention after 250 cycles at current density of 0.5C. Additionally, under high-rate conditions (2C), the material retained 95% of its capacity with a specific capacity of 665.8 mAh g^1 after 250 cycles, highlighting its excellent rate capability and durability. These findings underline the synergistic effect of nitrogen doping and yolk-shell structural design in significantly enhancing the electrochemical stability and mechanical integrity of SnO_2-based anodes. This work provides valuable insights and practical strategies for the development of next-generation lithium-ion battery electrodes with improved lifespan, capacity, and rate performance.

Biography

Dr. Zeinab Sanaee is an associate professor at ECE department of University of Tehran. She received the BSc, MSc, and PhD degrees in 2005, 2007, and 2011, respectively, all in Electrical Engineering from University of Tehran. She started working at ECE-University of Tehran since 2012. Her research interest is focused on fabrication of Lithium ion batteries and supercapacitors, and synthesis and implementation of Nanostructured materials for their performance improvement. She is also director of “Energy Storage Laboratory (ESL)”, where working on emerging technologies for Lithium-based batteries is followed as one of the main research subjects of the lab.

NANO SUSPENSIONS AS A PROMISING DRUG DELIVERY SYSTEM

B Medha Gayatri
Sarojini Naidu Vanita Pharmacy Maha Vidyalaya-Tarnaka, India

Abstract:

Although a large number of new drug molecules with varied therapeutic potentials have been discovered in the recent decade, most of them are still in developmental process. Nanotechnology has emerged as a tremendous field in the medicine. Nano refers to particles size range of 1-1000nm. Nano suspensions are part of nanotechnology. Rapid advancement in drug discovery process is leading to a number of potential new drug candidates having excellent drug efficacy but limited aqueous solubility . One of the major problems associated with poorly soluble drugs is very low bioavailability. The problem is even more complex for drugs like which are poorly soluble in both aqueous and non-aqueous media, belonging to BCS class II as classified by biopharmaceutical classification system. Formulation as Nano suspension is an attractive and promising alternative to solve these problems. A pharmaceutical Nano suspension is defined as very finely colloid, biphasic, dispersed solid drug particles in an aqueous vehicle, size below 1 μm stabilized by surfactants and polymers prepared by suitable methods for drug delivery applications. It provides efficient delivery of hydrophobic drugs and increases the bioavailability. Nano suspension is an attractive and promising technology to improve poor solubility and bioavailability of the drugs. This review article describes the methods of preparation, and applications of Nano suspensions in the field of pharmaceutical sciences

Biography

Medha Gayatri Bhatiprollu is a third-year Bachelor of Pharmacy student at SNVPMV, Hyder abad, India, with a growing footprint in pharmaceutical research and innovation. She was re cently selected for the prestigious TSSP TABMED Summer Internship at Nicolaus Copernicus University, Poland, where she is contributing to the synthesis of novel amidrazone derivatives with potential biological activity. Medha has received multiple accolades, including the Best Research Paper Award in Telangana State and several prizes for poster presentations, notably a 3rd Prize from the National University of Singapore and eight awards at the 5th International Conference of Rx Doctors. She also earned a Certificate of Recognition from MDPI–Basel, Switzerland, for her outstanding poster at the 4th Coatings and Interfaces Online Conference. With nine published review articles and a letter to the editor, her work spans topics such as na nosuspensions, alginate microbeads, adaptogenic herbs, PCOD, 3D printing in pharmacy, and more. An active science communicator, Medha has presented her work at both national and international platforms, including an oral presentation on “AI in Education.” Her passion for pharmaceutical sciences, innovation, and academic excellence continues to drive her toward a future of impactful research and global contributions

HARDNESS AND CREEP EVALUATION OF NANOINDENTATION MEASUREMENTS

Tamás Tarjányi, András Jakab, Krisztián Bali, Márton Sámi, Bálint Nagyillés, Mercédesz Horváth and Márk Fráter
University of Szeged, SEMILAB Co. Ltd, Hungary

Abstract:

Nowadays dental composites are mainly reinforced with quartz particles, often called conventional, and polymerized in layers or in bulk-fill mode. A modern approach is to reinforce the composite with short optical fibres (SFRC). The optical fibres can enhance the polymerization process and improve mechanical behaviour.

In this study we tested 5 groups of dental composites, where the samples were standardized in a 5x5x5 mm geometry. In total n=18 samples were produced, the groups were the following: group 1: (control) conventional layered composite in 2+2+1 mm, group 2: layered SFRC in 2+2+1 mm, group 3: bulk-fill SFRC, group 4: bulk-fill conventional, group 5: layered in 2+2 SFRC and 1 mm conventional. After the polymerization the hardness of samples were measured with the nanoindentation technique both on the top, side and bottom along with creep measurement on the top. After the measurements the samples were stored in water for 30 days and finally the mechanical behaviour and parameters were measured once again. During the 30 days the water absorption of each sample were measured.

The conventional bulk-fill dental composite (group 4) showed significantly lower mean hardness ($p<0.001$). The SFRC did not show statistically significant difference in the hardness. Bulk-fill SFRC and conventional showed significant difference in the mean elastic modulus ($p=0.005$). The creep behaviour showed a significant difference as well, especially the time behaviour parameters (retarded modulus and viscosity in the standard linear model). The water absorption showed significant difference between the groups, the SFRC bulk-fill showed a significant less mean water absorption. The groups also showed a linear correlation between the water absorption and time passing ($p<0.001$, $r=0.71$-0.85).

The SFRC samples showed similar hardness while the bulk-fill conventional composite had less hardness.

Biography

Tamás Tarjányi studied physics at University of Szeged, Hungary. He received his PhD in physics from molecular dynamics simulations, studying the interactions of proteins and titanium surfaces. He is working as a researcher and instructor at University of Szeged since 2017, teaching physics, material science and biometrics. In 2023, he started working part-time as an application scientist at Semilab. At Semilab he is mainly working with the nanoindenter measurement device.

CRACKING AND SCRATCHING THE NANOSCALE: MEASURING FRACTURE TOUGHNESS WITH NANOINDENTATION

Tamás Tarjányi, Krisztián Bali, Gábor Gulyás
University of Szeged, SEMILAB Co. Ltd, Hungary

Abstract:

Fracture toughness at the nanoscale offers more detailed insights into the material behaviour than conventional bulk tests. Modern nanoindenter devices are capable of gently tapping and scratching the surface to test the material's fracture toughness by a sharp diamond tip. To test the material's resistance to damage and real-world wear, the instrument can also drag the tip across the surface revealing how durable the nanomaterial or coating is. By analysing the scratching test data the friction coefficients can be determined as well. The evaluation of the cracks and scratch resistance along with fracture toughness gives insights into failure mechanisms of the samples. This presentation will highlight more advanced nanoindentation techniques.

Biography

Tamás Tarjányi studied physics at University of Szeged, Hungary. He received his PhD in physics from molecular dynamics simulations, studying the interactions of proteins and titanium surfaces. He is working as a researcher and instructor at University of Szeged since 2017, teaching physics, material science and biometrics. In 2023, he started working part-time as an application scientist at Semilab. At Semilab he is mainly working with the nanoindenter measurement device.


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