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ADVANCED NANOMATERIALS AND NANOTECHNOLOGY

April 03-04, 2025

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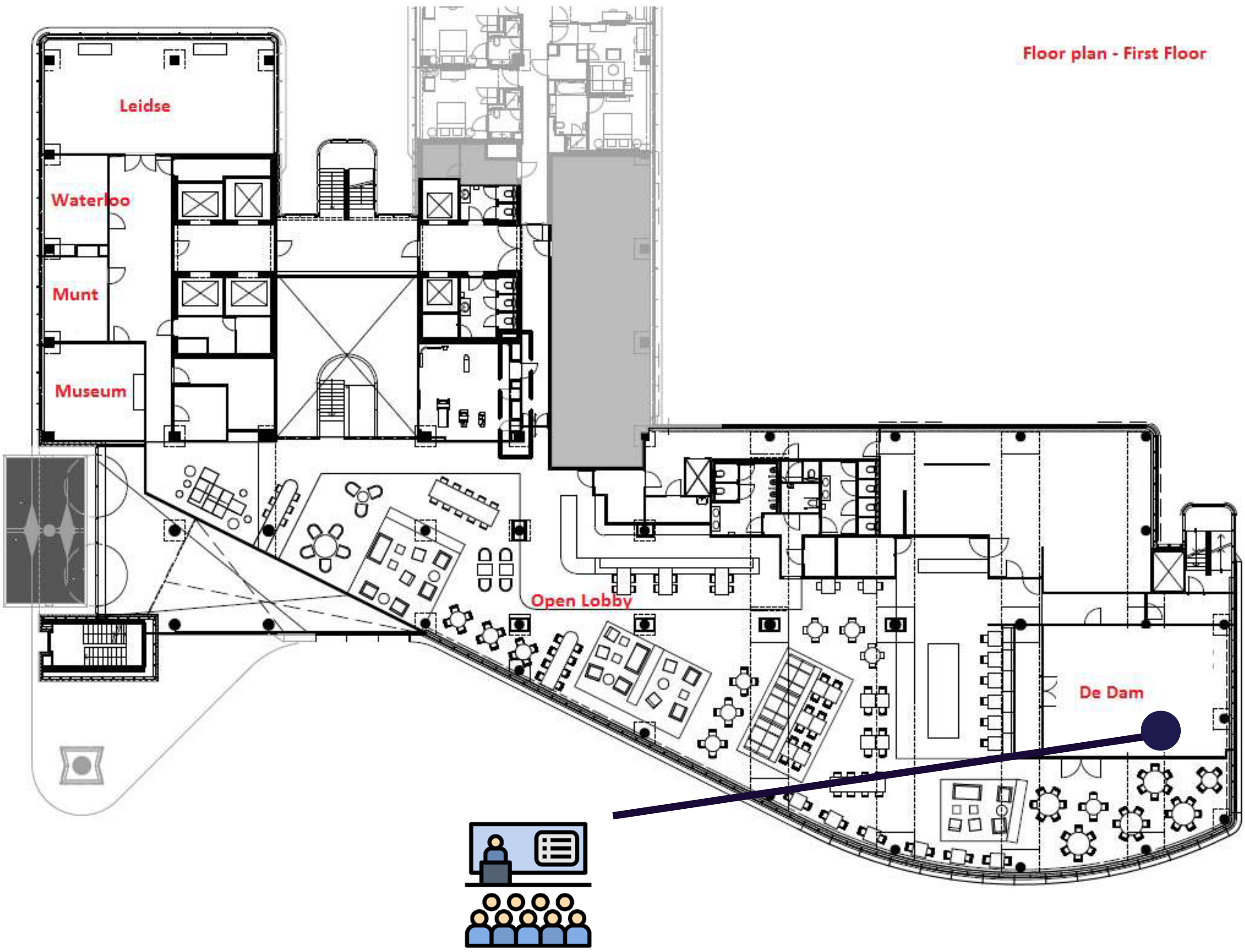

#ConferenceHall - De Dam

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SCIENTIFIC PROGRAM #DAY 1 - April 03, 2025

Meeting Hall: De Dam

08.30 - 09.15 Registrations

Moderator

Biswa Nath Bhadra, French National Centre for Scientific Research, France

09.15 - 09.30 Introduction

Keynote Presentations	
09.30 - 10.15	**Title:** Design Essentials for Future Ready Micro/Nano Cleanrooms
Eric Stuiver, Deerns Group, The Netherlands	
10.15 - 11.00	**Title:** 4D Analyses of Kirkendall Porosity and Microstructure in Diffusion Couples of Ni/Ni-Based Superalloy Cmsx-4
Bettina Camin, Hochschule Bremerhaven, Germany	
11.00 - 11.45	**Title:** Computation-Driven Design of Materials Related to Lithium-Ion Batteries through Theoretical Studies
Jyh-Chiang Jiang, National Taiwan University of Science and Technology, Taiwan	
11.45 - 12.00	**Networking and Refreshments @ Foyer**
12.00 - 12.15	**Group Photo**
Oral Presentations	
Session Chair: **Eric Stuiver,** Deerns Group, The Netherlands	
Sessions: Materials Science and Engineering | Energy & Hybrid Materials | Nanodevices & Sensors | Surface Science | Additive Manufacturing of Materials	
12.15 - 12.40	**Title:** Water Electrospray, Hydroxyl Radical Water, and its Applications
Seung S Lee, KAIST, Korea	
12.40 - 13.05	**Title:** Next-Gen Solar Photocatalysis: Vacancy-Tailored 1D Melem Nanorods for Enhanced Photocatalytic CO_2 Reduction Coupled with Organic Synthesis under Visible Light
Pratibha Saini Urhan, Friedrich-Schiller-Universitat Jena, Germany	
13.05 - 14.00	**Lunch @ Restaurant**

14.00 - 14.25	**Title:** Photomemristor Sensor Based on Two-Dimensional Crystals for Artificial Vision
Gennady N Panin, Russian Academy of Sciences, Russia	
14.25 - 14.50	**Title:** Development of Anti-Corrosive and Anti-Fouling Coatings for Marine Application
Sathiya Paulraj, National Institute of Technology Tiruchirappalli, India	
14.50 - 15.15	**Title:** Electrochemically Assisted Growth of Organic/Inorganic Hybrid Thin Films
Biswa Nath Bhadra, French National Centre for Scientific Research, France	
15.15 - 15.40	**Title:** Exploiting the Performance of Indoor Dye-Sensitized Solar Cells using Copper Polymer Gel Electrolytes with γ-Butyrolactone Solvent
Fatima Santos, University of Porto, Portugal	
15.40 - 16.05	**Title:** Grain Structure, Strength and Degradation Mechanisms of Hastelloy X Welds by Laser Bean Welding Process
Sathiya Paulraj, National Institute of Technology Tiruchirappalli, India	
16.05 - 16.30	**Refreshments @ Foyer**
16.30 - 16.55	**Title:** Mechanical Strength Analysis of Additive Manufactured PLA Specimens with Variable Infill Patterns and Densities
Gouri Vignesh Jawalkar, Indian Institute of Technology Kharagpur, India	
Poster Presentation	
P01	**Title:** Flexible Morphological Regulation of Photothermal Nanodrugs: Understanding the Relationship of Structure, Photothermal Effect and Tumoral Biodistribution
Shukun Li, Eindhoven University of Technology, Netherlands	
P02	**Title:** Development of Pani/$CuMn_2O_4$ Nanocomposite via Hydrothermal Method as a Novel Electrode Material for Supercapacitor
Abdulraheem SA Almalki, Taif University, Saudi Arabia	
e-Poster Presentation	
E-Poster 1	**Title:** The Use of Wool Fibers as a Column Packing Medium for the Dynamic Adsorption of Methylene Blue Dye from Aqueous Solutions
Bogdan-Constantin Condurache, Institute of Macromolecular Chemistry Petru Poni, Romania	
E-Poster 2	**Title:** Effect of Magnetic Properties on Deperming using Preisach Model
Sang Hyeon Im, Dong Eui University, South Korea	
E-Poster 3	**Title:** Development of Sustainable Thermoplastic Composites using Flax-Jute Hybrid Fibers as Reinforcement
Melisa Yeke, METYX Composites-Telateks A.S, Turkey	

E-Poster 4	**Title:** Analysis of Influence of Magnetic Materials during Deperming for Reducing the Magnetic signals of a Warship
Sang Hyeon Im, Dong Eui University, South Korea	
E-Poster 5	**Title:** Bending, Stability and Natural Vibrations of a Graphene Sheet
Samvel H Sargsyan, Shirak State University, Armenia	

Day 1 Concludes followed by Award Felicitation

SCIENTIFIC PROGRAM #DAY 2 - April 04, 2025

Meeting Hall: De Dam

Moderator

Nekane Guarrotxena, Spanish National Research Council, Spain

Keynote Presentations	
10.00 - 10.45	**Title:** Interface Analysis of Diffusion-Welded Nickel/Nickel-Based Superalloy Cmsx-4
Bettina Camin, Hochschule Bremerhaven, Germany	
10.45 - 11.30	**Title:** Electrocatalytic Mechanism of Nitrogen Reduction on Iro_2 (110) Surface: A DFT Study
Jyh-Chiang Jiang, National Taiwan University of Science and Technology, Taiwan	
11.30-11.45	**Networking and Refreshments @ Foyer**
11.45 - 12.30	**Title:** Eliminating Implant Infection: 30,000 Nanotextured Orthopedic Implants in Humans with No Infection
Thomas J Webster, Northeastern University, USA	
Oral Presentations	
Session Chair: **Bettina Camin,** Hochschule Bremerhaven, Germany	
Sessions: Nanomaterials | Mining and Metals	
12.30 - 12.55	**Title:** Polymer-Nanoparticle Synergistic Approach for Bio and Energy Applications
Nekane Guarrotxena, Spanish National Research Council, Spain	
12.55 - 14.00	**Lunch @ Restaurant**
14.00 - 14.25	**Title:** Creating an Innovative Electrochemical Nitrite Sensors Utilizing Zn-Schiff Base Complexes
Zahra Akbari, University of Messina, Italy	
14.25 - 14.50	**Title:** Numerical Investigation of Sulfur Removal During Heat Hardening Induration of Direct Reduction Grade Iron Ore Pellets
Mehdi Azizkarimi, Golgohar Mining and Industrial Company, Iran	
14.50 - 15.15	**Title:** Anticancer Potentials of Zinc Oxide - Chamaemelum Nobile against Breast Cancer: A Novel Approach for Synergistic Breast Cancer Therapy
Alaa Yousef Ghidan, International University of Science and Scientific Research Development, UK	

15.15 - 15.40	**Title:** *In situ* Antitumor Vaccine Composed of a Nanostructured Emulgel System Carrying Immunogenic Chemotherapeutics in Immunization in Pre-Clinical Breast Cancer Models
João Paulo Figueiró Longo, University of Brasília, Brazil	
Video Presentations	
15.40 - 16.00	**Title:** Circumventing Challenges in Developing CVD Graphene on Steels for Extraordinary and Durable Corrosion Resistance
Raman Singh, Monash University, Australia	

Day 2 Closing Ceremony followed by Award Ceremony

16.00 - 16.30	**Networking and Refreshments @ Foyer**

VIRTUAL PROGRAM #DAY 1 - April 03, 2025

09.45 - 10.00 Introduction

Keynote Presentations	
10.00 - 10.30	**Title:** Azodye Photoaligned Nanolayers for New Liquid Crystals Display and Photonics Devices
Vladimir G. Chigrinov, Hong Kong University of Science and Technology, Hongkong	
Oral Presentations	
Sessions: Materials Science and Engineering | Nano Materials | Surface Science | Polymers and Biopolymers | Biomaterials	
10.30 - 10.55	**Title:** Nanotechnology: A Review on Personalized Cancer Therapy and Diagnosis
A. V. Vasanthi, Sarojini Naidu Vanita Pharmacy Maha Vidyalaya, India	
10.55 - 11.20	**Title:** Development of Biofunctional Materials by Surface Engineering using Low-Energy Non-Thermal Electron Beam Technology
Nic Gurtler, Fraunhofer Institute for Electron Beam and Plasma Technology, Germany	
11.20 - 11.45	**Title:** Development of PVA-Chitosan-Polyaniline Hydrogels with Adjustable APS Concentrations for Enhanced Stability and Optimized Solar Vapor Generation Efficiency
Syazwani Mohd Zaki, International Islamic University Malaysia, Malaysia	
11.45 - 12.10	**Title:** The Synergistic Effects of Graphene Nanoparticles on the Surface Wettability and Barrier Properties of Polydimethylsiloxane based Composite Coatings
Sachin Sharma Ashok Kumar, Taylor's University, Malaysia	
12.10 - 12.35	**Title:** Use of Indocyanine Green Fluorescence Imaging in the Extrahepatic Biliary Tract Surgery
Orestis Ioannidis, Aristotle University of Thessaloniki, Greece	
12.35 - 13.00	**Title:** Nano Suspensions as a Promising Drug Delivery System
B. Medha Gayatri, Sarojini Naidu Vanita Pharmacy Maha Vidyalaya, India	
13.00 - 13.25	**Title:** Explore the Thermal Properties, Kinetic and Thermodynamics Analysis of Local Beverage Wastes Pyrolysis Using TG/DTG: Implications for Sustainable Energy in Ethiopia
Alebel Abebaw Teshager, Bahir Dar University, Ethiopia	
13.25 - 13.50	**Title:** Nano-Optics based on Silicon and Gold Core-Shell Architectures for Biophotonics and Bioassays
A. Guillermo Bracamonte, Universidad Nacional de Córdoba, Argentina	

13.50 - 14.15	**Title:** Current Applications of AI/MI in Hot Strip Mill
S. Sikdar, RVS College of Engineering and Technology, India	
Keynote Presentation	
14.15 - 14.45	**Title:** Thermal-Induced Coarsening: Nanoparticle Size Modulation
Paulo C. De Morais, Catholic University of Brasilia, Brazil	
Day 1 Concludes followed by Award Ceremony	

Day - 1
Keynote

DESIGN ESSENTIALS FOR FUTURE READY MICRO/NANO CLEANROOMS

Eric Stuiver
Deerns Group, The Netherlands

Abstract

Miniaturization, beyond Moore's law, micro/nano research & production cleanrooms, design, complexity, cost control, integral sustainability, case studies

Over the last decades scientific and technological developments have pushed miniaturization, resulting in devices with dimensions on micro, nano and pico scales (Moore's law). At the same time, abilities to direct and control the assembly of application specific biomolecules have emerged. Nowadays research is increasingly focused on the amalgamation of these two trends bringing us into the world of bionano-motors, sensors and personalized medicines. These miniaturization and amalgamation trends drive new, more stringent requirements for research laboratories and/or production cleanrooms. Key challenges include particles, vibrations, electromagnetic interference, airborne chemical contamination and temperature control. The planning and design to meet these extremely stringent conditions leads to ever more complex and costly cleanrooms.

In this presentation both the technical and financial impact of miniaturization and amalgamation trends on laboratory and cleanroom facilities will be discussed. Case studies introduce solutions on how to balance technical complexity with financial challenges. Lastly, a perspective will be presented how science and new technologies can drive us into future proof nanotechnology facilities.

Biography

Eric Stuiver is sector director with more than 35 years international experience in design, realization and operation of micro/nano-electronics facilities in The Netherlands, Germany, Spain, Denmark and South East Asia. He is an expert in translating the, future research or production requirements into building and installation concepts. Driven by his strong analytical and conceptual skills, being open minded and a focused team player, Eric is capable of realizing these technically and organizationally complex projects successfully. He is an expert in developing contamination control and cleanroom technologies. Eric is an honorary member of the Dutch Association Contamination Control, VCCN.

Eric Stuiver
Deerns Group, The Netherlands

4D ANALYSES OF KIRKENDALL POROSITY AND MICROSTRUCTURE IN DIFFUSION COUPLES OF NI/NI-BASED SUPERALLOY CMSX-4

Bettina Camin[1], Igor Nasonov[1], Thalea Retzlaff[1], Jan-Ole Kohlhorst[1], Malte Kemper[1], Ahmadreza Riyahi khorasgani[2], Julia Kundin[2] and Ingo Steinbach[2]
[1]*Hochschule Bremerhaven, Germany*
[2]*Ruhr-Universitat Bochum, Germany*

Abstract

Kirkendall porosity occurs in multi-component materials which are in close contact to each other and exposed to elevated or higher temperatures. Interdiffusion of atoms and vacancies across the phase boundary takes place as a function of temperature, time, and concentration of the elements. The vacancies accumulate at the phase boundary forming voids, the so called Kirkendall porosity. The investigation of the Kirkendall porosity is e. g. relevant for welded and brazed joints of gas turbine blades in operation. For this purpose, high temperature materials such as polycrystalline pure nickel and single crystal nickel base superalloy CMSX-4 with γ/γ'-microstructure were joined by diffusion welding and annealed. 3D µ-tomography using synchrotron X-ray radiation (3D-XCT) was carried out to analyse the formation and evolution of the Kirkendall porosity and the geometry of the Kirkendall voids. The analyses were conducted time-dependent.

The spatial resolved 3D-XCT data were related to diffusion profiles of the diffusing elements (Ni and alloying elements) measured by energy-dispersive spectroscopy (EDS). Interdiffusion is also dependent on the crystallography of the materials in addition to the parameters mentioned above. This leads to three different material combinations: Ni/CMSX-4 [001], Ni/CMSX-4 [001]-HIPed, and Ni/CMSX-4 [111]. These diffusion couple variants were exposed to different annealing temperatures (1200 °C, 1250°C, 1300 °C) and durations. It was observed that the Kirkendall porosity, the geometry of the Kirkendall voids as well as the propagation depth depend strongly on the annealing parameter, crystallography, and the distance to the material interface. From the 3D-XCT data it can be deduced that the Kirkendall porosity, pore size, pore complexity and porosity propagating depth into the CMSX-4 materials increase the higher the annealing temperature and/or the annealing time. However, the extent of the changes in the individual diffusion couples is different. These findings are supported by the EDS results and phase-field simulations.

Biography

Bettina Camin studied Mechanical Engineering in Berlin (Germany). After working as a construction engineer for a few years at the Department of Experimental Physics at Freie Universität Berlin, she changed to Technische Universität Berlin working at the Departments of Metal Physics and Metallic Materials. She completed her doctorate at the Department of Materials Science and Technology. She holds the Chair of Materials Engineering at Hochschule Bremerhaven.

Bettina Camin
Hochschule Bremerhaven, Germany

COMPUTATION-DRIVEN DESIGN OF MATERIALS RELATED TO LITHIUM-ION BATTERIES THROUGH THEORETICAL STUDIES

Jyh-Chiang Jiang, Liang-Ting Wu, Shi-Hong Xu, Yu-Ting Zhan and Zhong-Lun Li
National Taiwan University of Science and Technology, Taiwan

Abstract

Lithium-ion batteries (LIBs) are widely used as a power source in various applications, such as energy storage and electronic devices. In recent years, Ni-rich layered lithium nickel-cobalt-manganese oxides (NCM) have been highlighted as advanced cathode materials for high-capacity LIBs. However, their low interfacial stability during cycling limited the cell's electrochemical performance. In addition, Extreme conditions, such as heat waves, cold snaps, deep seas, and high altitudes, markedly diminish the performance of lithium batteries. This results in low-capacity retention and safety concerns when these batteries are utilized in electric vehicles and energy storage stations (Nature 529, 515–518 (2016)). In my talk, I will introduce the first-principles density functional theory calculations to systematically investigate surface instabilities of NCM811 ($LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$), including O_2 formation and surface distortions, and explore the effect of doping, including S and Cl on structural stability. In addition, I will introduce our research using density functional theory (DFT) and real solvent class conductor screening model (COSMO-RS) to explore the liquid range of 190 binary mixtures. We also calculated the saturation solubility of LiTFSI salts to identify ideal mixtures with high solubility. The results showed high accuracy, making it suitable for early solvent evaluation.

Biography

Jyh-Chiang Jiang graduated from National Taiwan University in 1986 with a B.S. in Chemistry and received his PhD in Chemistry in 1994. After working as a postdoctoral fellow at IAMS, Dr. Jiang joined the National Taiwan University of Science and Technology (NTUST) faculty in 2001. He focuses on the theoretical and computational chemistry study of heterogeneous catalysis, optoelectronic materials, and Li-ion batteries. He has more than 220 papers in peer-reviewed journals. His research has also resulted in 4 patents. Dr. Jiang has been chairman of the Taiwan Theoretical and Computational Molecular Sciences Association from August 2019 to July 2023.

Jyh-Chiang Jiang
National Taiwan University of
Science and Technology, Taiwan

Day - 1
Oral

WATER ELECTROSPRAY, HYDROXYL RADICAL WATER, AND ITS APPLICATIONS

Seung S Lee[1], Ji Whan Chae[1] and Ji-Hun Jeong[2]
[1]*KAIST, Korea*
[2]*MIT, USA*

Abstract

Electrospray is a technology that produces fine droplets or aerosol by applying high voltage to a liquid through a nozzle. In water electrospray, due to the high surface tension of water, the applied high voltage may become larger than the electrical breakdown threshold of air, which leads to corona discharge and ozone generation.

Hydroxyl radicals (•OH), the neutral form of hydroxide ions (OH-), are created naturally in the atmosphere when UV rays of the sun react with water vapor, which is the photolysis process. Known as nature's detergent of troposphere, •OH are highly reactive and can remove pollutants and chemicals in the air and kill or inactivate bacteria, virus, and fungi by breaking down their outer membranes resulting in cell lysing, although they are well known safe and harmless substances to people and the environment.

NASA had developed a technology, air scrubber plus, to produce •OH artificially in the air for use onboard their space shuttles through the use of UV light rays on the surface of a catalyst, generally TiO2. Although NASA's technology was also commercialized, its business applications have been limited because the lifespan of •OH in the air is very short, less than 1 second.

Panasonic's Nanoe is an electrostatic atomization technology that generates tens of nano-size water droplets containing •OH, extending the lifespan of •OH and sending it far away. Panasonic has achieved business success by making many products such as air conditioners, air purifiers, and hair dryers with Nanoe technology. However, Nanoe technology has serious problems in that the amount of •OH water droplets produced is extremely small and ozone is generated during the process.

Our technology is to produce large quantities of water droplets containing •OH without ozone generation through water electrospray. The key to our study is to lower the applied voltage for electrospray and to make a high electric field at the tip of the nozzle enough for electrospray with a low voltage to prevent corona discharge or ozone from occurring. Methods of lowering

Biography

Seung S. Lee was born in Seoul, Korea in 1962. He received a bachelor's degree from Seoul National University in 1984 and a doctorate in the department of mechanical engineering from UC Berkeley in 1995. He worked as a principal researcher at Samsung Electronics and a professor at POSTECH, and he has been a professor at KAIST in Korea since 2003. His research area is MEMS. He severed as Dean of Students, Dean of Admission, Chairman of the Faculty Council, and Provost & Senior Vice President at KAIST. In 2023, he founded A2US Inc., a startup based on water electrospray technology that produces •OH water in large quantities without ozone generation.

the applied voltage or making a high electric field include selection of polymer as nozzle material, reduction of nozzle radius, high aspect ratio structure of a nozzle, hydrophobic nozzle surface with nano structures, and a circular in-plane electrode around a nozzle.

Both of cone-jet and simple-jet modes of electrospray were conducted with different types of polymer nozzles to spray tens of nano or micron-sized water droplets, respectively. Experiments of sterilization on adherent or airborne microbes and extending fresh period of fruits using •OH water were successfully conducted. The extending fresh period of fruits is due the chemical reaction of •OH with ethylene gas that causes the ripening of fruits.

NEXT-GEN SOLAR PHOTOCATALYSIS: VACANCY-TAILORED 1D MELEM NANORODS FOR ENHANCED PHOTOCATALYTIC CO_2 REDUCTION COUPLED WITH ORGANIC SYNTHESIS UNDER VISIBLE LIGHT

Pratibha Saini Urhan
Friedrich-Schiller-Universität Jena, Germany

Abstract

Cooperative CO_2 photoreduction, combined with tailored organic synthesis, represents a promising pathway for converting solar energy into both renewable fuels and valuable chemicals. This process takes advantage of the simultaneous generation of electrons and holes, enabling the dual function of reducing CO_2 and driving organic transformations. However, achieving high efficiency in this domain is challenging, particularly when working with metal-free molecular nanostructures. These materials, though environmentally benign, face several obstacles that hinder their photocatalytic performance in CO_2 reduction. Key challenges include limited CO_2 activation potential, inefficient multi-electron transfer processes, sluggish charge-separation kinetics, inadequate retention of long-lived photoexcited species, thermodynamic barriers, and difficulties in controlling product selectivity. In response to these challenges, this study explores the transformation of melem oligomer-based 2D nanosheets (MNSs) into 1D nanorods (MNRs) via a room-temperature method. This transformation is achieved through a combination of pyrolysis and vacancy engineering. The 1D nanorod morphology introduces several advantages, including an improved ability to control crystallization and enhance the overall photocatalytic activity of the material. Additionally, the introduction of vacancies within the nanostructure plays a pivotal role in enhancing its functionality.

Vacancy engineering in the MNRs addresses the issues related to charge separation and CO_2 activation. Transient absorption spectroscopy reveals that vacancies in the MNRs act as effective charge traps, significantly extending the lifetime of photoexcited charge carriers. This is a crucial factor in improving the overall efficiency of photocatalytic reactions, as prolonged charge separation provides more time for the reduction of CO_2 and the oxidation of organic substrates. Furthermore, the presence of carbon vacancies in the MNRs enhances CO_2 adsorption, particularly by increasing the density of amine functional centres, which act as active sites for the photocatalytic process. The photocatalytic performance of MNRs for CO_2 reduction coupled

Biography

Pratibha Saini Urhan earned her doctorate in organic chemistry from the University of Rajasthan, Jaipur, India, in 2021. She then expanded her research experience as a research assistant at Ruhr-Universität Bochum, Germany, working with Prof. Dr. Thomas Ernst Müller in 2022. Continuing her academic journey, she became a post-doctoral fellow at Friedrich-Schiller-Universität, Jena, Germany, with Prof. Wolfgang Weigand. Currently, Dr. Saini is a senior Post-Doc through the Walter Benjamin Programme in Prof. Benjamin Dietzek-Ivanšić's group at Friedrich-Schiller-Universität, Jena, Germany. She has 23 publications in internationally reputed journals and holds one patent. Her research interests focus on visible light-induced organic transformations using advanced nanomaterials like CxNy materials and carbon quantum dots, graphene oxide, etc. She is dedicated to upcycling carbon dioxide (CO_2) into valuable feedstocks and producing green hydrogen (H2) from water using visible light irradiation, demonstrating her commitment to advancing sustainable science.

with benzyl alcohols oxidation is approximately ten times higher (CH_3OH and aldehyde production rate 27 ± 0.5 and 93 ± 0.5 mmol g-1 h-1, respectively) than for the MNSs (CH_3OH & aldehyde production rate 2.9 ± 0.5 and 9 ± 0.5 mmol g-1 h-1, respectively). The CO_2 reduction mechanism follows a carbon-coordinated formyl pathway, involving the formation of *COOH and *CHO intermediates, as identified by in situ Fourier-transform infrared spectroscopy. The enhanced performance of MNRs is attributed to optimized energy-level alignment, increased amine surface sites, and a distinct morphology that boosts solar-to-chemical conversion efficiency.

PHOTOMEMRISTOR SENSOR BASED ON TWO-DIMENSIONAL CRYSTALS FOR ARTIFICIAL VISION

Gennady N Panin
Russian Academy of Sciences, Russia

Abstract

Processing of visual information in a photomemristor based on low-dimensional materials allows creating a compact and energy-efficient autonomous sensor of vision and recognition of visual information for use in personal medicine and other applications. The emergence of graphene family crystals opens up unique opportunities for processing electrical and optical signals in real time in a wide spectral range from ultraviolet to infrared radiation. Energy-independent resistive states in photomemristor nanostructures fabricated on the basis of two-dimensional crystals and quantum dots can be controlled by photoelectric polarization1, ferroelectric and ferromagnetic states photoinduced structural transitions, as well as the rearrangement of carbon atoms in sp2-sp3 hybridization in an electric field. Such devices have high photosensitivity and demonstrate dynamic behavior required for neuromorphic computing directly in the sensor, which allows to reduce energy and time costs during visual information processing associated with the transfer of data between the detector, memory and processor in the classical von Neumann architecture. This opens up the possibility of rapid classification and recognition of objects in an intelligent sensor with an embedded neural network, similar to the processing of visual information in the retina.

Biography

Gennady N. Panin graduated from the Moscow Institute of Electronic Technology with a degree in Applied Physics and Electronics and defended his PhD thesis in the field of solid-state electronics. He worked as a Research Fellow at the Institute of Microelectronics Technology RAS (IMT RAS), a Visiting Scientist at the Institute of Solid-State Physics, Halle, a Postdoc at the Complutense University of Madrid, Research Professor at the Quantum Functional Semiconductor Research Center (QSRC), Dongguk University, Seoul, Professor at the Academy of Nano-Information Technologies (NITA) and QSRC (2008-2020); Deputy Director of QSRC and NITA (2012-2020). Currently, he is a Leading Researcher at IMT RAS, an expert in the field of neuromorphic technologies, the author of more than 200 articles, 50 invited talks and 35 patents.

DEVELOPMENT OF ANTI-CORROSIVE AND ANTI-FOULING COATINGS FOR MARINE APPLICATION

Sathiya Paulraj and Deepak Patil
National Institute of Technology Tiruchirappalli, India

Abstract

The marine growth on the underwater part of the ships deteriorates the performance of the vessel. Corrosion and fouling occurred on ship hull consume more fuel cause of increased drag force and also affect the durability of the hulls. According to published data in Market and Market Research, the market for global antifouling paints will be increased from $5.61 billion in 2015 to $9.22 billion by 2021. Moreover, the requirement of such coatings from the Asia-Pacific region dominates the most. Different types of paints have been proposed in a recent decade; however, the coating/paints have a specific property, either anti-corrosion or anti-fouling property. Also, the uncontrolled release of the harmful chemical agents from such paint's harms sea life. Hence, the use of the paints containing Tributyltin and Copper has been banned.

Since 2015, we have been working on the development of efficient antibacterial and biocompatible metallic implants through surface modification. Thus, the idea of the development of antifouling and anti-corrosive coating came through. We are aiming that the composite coating of silver nanoparticles (AgNPs) and titanium oxide (TiO_2) shall solve this problem after optimizing the coating composition. TiO_2 possesses high antifouling and anti-corrosive property whereas AgNPs have antimicrobial and anti-fungal property. The AgNPs-TiO_2 composite coating can solve this problem easily with enough adhesion strength to the stainless steel and CuNi alloy substrate (the material used in ship hulls). The spray coating technique was used for applying coating on a large area. Moreover, we will be investigating the adhesion strength of the coating on stainless steel and CuNi alloy in detail. The additional advantage of a photocatalytic property of TiO_2 makes ship hull more protective outside of seawater from fungus and bacteria. The adopted spray coating technique overcomes the limitation of other processes like electrode-deposition, chemical vapor deposition, etc. which apply to a very small area and costly as well. Hence, the proposed study can be a breakthrough for enhancing the life of ships or marine components.

This study focuses the development of a new cost-effective multi-functional coating for ship hull which possesses anti-corrosion and anti-fouling property. The combined colloidal solution of

Biography

Sathiya Paulraj was born in Tamil Nadu, India, in 1973. He earned a BE degree from the University of Madras in Chennai, India in 1994, a ME degree from the Regional Engineering College in Tiruchirappalli, Tamil Nadu, India in 1997, and a PhD degree from the National Institute of Technology in Tiruchirappalli, Tamil Nadu, India, in 2006. In 2006, he joined NIT Trichy's Production Engineering Department. He has received numerous awards, including the Best Teacher Award in 2009 and the Young Technology Awards. He has extensive experience in research, teaching, and consulting in the fields of metal joining, allied manufacturing processes, material characterisation, and coatings.

silver nanoparticle (AgNPs) and titanium oxide (TiO_2) provides both properties.

In the contest of the above-said problem, initial trials of only TiO_2 coating were made on SS, Cu-Ni, and MS substrate. The polished samples of all three substrates and applied TiO_2 are shown in **Figure 1,2**

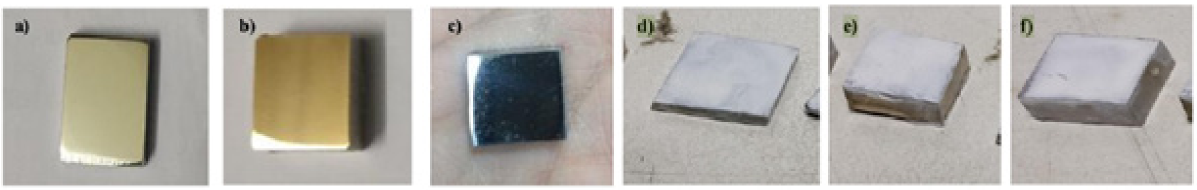

Figure 1: Polished (a) SS, (b) CuNi and (c) MS samples; TiO_2 coating on (d) SS (e) CuNi (f) MS samples

The SEM images of coated and uncoated SS and CuNi samples after a corrosion test for 7 days are shown in **Figure 3**. The pitting corrosion occurred on uncoated SS and CuNi alloy samples (see **Figure 2**a and c) whereas it is absent on coated samples (see **Figure 2**b and c)

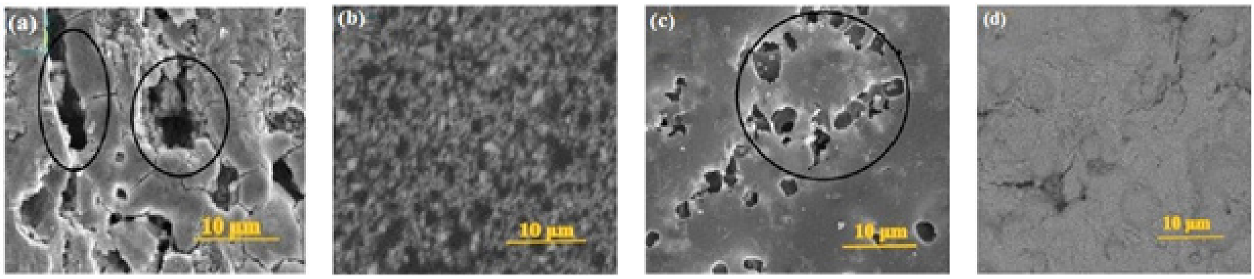

Figure 2 SEM images after corrosion test for 7 days on SS a) without coating b) with coating; CuNi alloy c) without coating d) with coating.

ELECTROCHEMICALLY ASSISTED GROWTH OF ORGANIC/ INORGANIC HYBRID THIN FILMS

Biswa Nath Bhadra, Marret Julien, Corine Gerardin and Gaulthier Rydzek
French National Centre for Scientific Research, France

Abstract

The synthesis of organic/inorganic hybrid thin films holds great promise for the development of next-generation materials in catalysis, sensing, and energy storage. Enhancing these films' functionalities can be achieved by integrating porous structures with organic functionalities, leading to tunable physicochemical properties suited to a variety of applications. This study introduces an innovative approach using electrochemically assisted self-assembly (EASA) to fabricate hybrid films by sol-gel using tetraethyl orthosilicate (TEOS) and oligochitosan. In this synthesis, TEOS acts as a silica precursor, providing a robust porous architecture with high structural stability, while oligochitosan adds valuable ion-conducting features while enhancing the film's hydrophilicity, surface reactivity, and biocompatibility.

The EASA technique is well known to enable precise control over sol-gel film growth parameters, allowing the achievement of uniform thickness, consistent pore distribution, and controlled orientation on conductive substrates. Here, the EASA synthesis of silica- oligochitosan hybrid films was followed by drying at 80°C overnight to ensure mechanical stability without compromising pore integrity or functional features. The dried films were subjected to extensive structural characterization to confirm their hybrid nature and assess their permselective capabilities. Spectroscopic ellipsometry (SE) was used to measure film thickness and uniformity, while atomic force microscopy (AFM) provided detailed surface topology information. Scanning electron microscopy (SEM) and energy-dispersive X-ray (EDX) analyses were employed to examine surface morphology and elemental composition, respectively. Transmission electron microscopy (TEM) was used to visualize the pore structure and confirm the successful integration of the organic oligochitosan within the silicic framework. Electrochemical assessments further revealed the hybrid films' enhanced stability, perm-selective conductivity, and pH-responsive surface properties. These findings position the TEOS-oligochitosan hybrid films as suitable candidates for applications such as molecular sieve electrodes, electrochemical biosensors, and solid electrolytes.

The EASA-assisted synthesis presented here offers a versatile

Biography

Biswa Nath Bhadra, a Bangladeshi chemist, holds a PhD in Chemistry from Kyungpook National University, South Korea. He completed his BS in Chemistry at the University of Dhaka, Bangladesh, and his MSc at Kyushu University, Japan. He was awarded the JSPS postdoctoral fellowship, conducting research at the National Institute for Materials Science, Japan. Currently, he is a postdoctoral researcher at CNRS, France. His research focuses on the development of advanced nanohybrid materials for catalysis, adsorption, and sensing applications.

and customizable platform for creating hybrid films with tunable functional properties and precise interface control. This approach provides a simple route to integrate hybrid permselective films in advanced technological sectors, setting the stage for future innovations in functional material design.

EXPLOITING THE PERFORMANCE OF INDOOR DYE-SENSITIZED SOLAR CELLS USING COPPER POLYMER GEL ELECTROLYTES WITH γ-BUTYROLACTONE SOLVENT

Fátima Santos, D Ivanou and A Mendes
University of Porto, Portugal

Abstract

Indoor photovoltaics (iPVs) are becoming a reliable asset to address the supplier needs instigated by the continuous growth of the Internet of Things (IoT) market. The iPVs requirements comprise using low-cost, safe, and ecofriendly materials; good power conversion efficiencies (PCEs) under ambient light conditions; and the possibility of being integrated into flexible, small, and portable devices. All these requirements are fulfilled by dye-sensitized solar cells (DSSCs). DSSCs could be built using a single transparent conductive oxide (TCO) substrate, known as monolithic configuration, allowing a material cost reduction of 25% compared to the conventional DSSCs, which use two opposite TCO substrates. Plus, monolithic DSSCs (M-DSSCs) are compatible with roll-to-roll processing, easier to encapsulate, and more straightforward for module fabrication, making this structure the most advantageous for market-scale production of DSSCs. We hold the record PCE for M-DSSCs, 10.4% (AM1.5G) and 28.5% (1000 lx indoor LED light), using a copper-complex hole transport material (HTM) and a carbon- based counter-electrode. This copper-HTM is formed by the slow evaporation of electrolyte solvent (acetonitrile) at ambient conditions. Moreover, we recently developed copper polymer gel electrolytes (PGEs), by adding polyethylene oxide (PEO, average MW ~ 400 000) and poly(methylmethacrylate) (PMMA, average MW ~ 120 000) to the liquid Cu- electrolyte. The Cu-PGE were prepared using less volatile and more viscous solvents than acetonitrile, such as 3-methoxypropionitrile (MPN), propylene carbonate (PC), and γ-butyrolactone (GBL), preventing leakage problems through the polymeric sealants. This work presents PC and GBL as electrolyte solvents for indoor DSSCs for the first time. The best energy-performing device used a Cu-PGE with GBL solvent, rendering PCEs of 24.2%, 22.5%, and 18.5% under 300 lx, 600 lx and 1000 lx, respectively. Surprisingly, the PCE of M-DSSCs improves with the decrease in light intensity, due to fill factor enhancement and minimal voltage losses. To the best of our knowledge, it is the first time that this tendency has been shown for iPVs. Although more research is needed to understand the factors behind this behavior, these results prove that DSSCs using Cu- PGE with GBL solvents are a promising option to power IoT devices, since the maximum PCE is obtained at a light intensity closer than the one usually used in our homes.

Biography

Fatima Santos obtained her PhD degree in Chemical and Biological Engineering from the University of Porto in May 2022. Her PhD thesis was related to the development of highly efficient and stable monolithic dye-sensitized solar cells (M-DSSCs); she holds the worldwide record efficiencies of iodide, cobalt, and copper-mediated M-DSSCs, as well as record stability for glass-sealed cobalt-mediated DSSCs. Currently, she is a junior researcher on LEPABE/ALiCE, and team leader of work package 6.01 of ATE Agenda; within this project, she is developing solid-state M-DSSC modules to power IoT devices. In 2025, she started her research grant, Mono-iPVs, financed by the Foundation for Science and Technology (FCT), which intends to address fundamental studies and module production for efficient, low-cost, and sustainable M-DSSCs for IoT applications.

GRAIN STRUCTURE, STRENGTH AND DEGRADATION MECHANISMS OF HASTELLOY X WELDS BY LASER BEAN WELDING PROCESS

Sathiya Paulraj[1], G Sathishkumar[2] and S Senthil Murugan[3]
[1]*National Institute of Technology, India*
[2]*K. Ramakrishnan College of Technology, India*
[3]*Rajalakshmi Engineering College, India*

Abstract

This study investigates the microstructural evolution, mechanical properties, corrosion resistance, and wear behaviour of CO_2 laser-welded Hastelloy X (HX) alloy, widely used in high-temperature aerospace and nuclear applications. Autogenous CO_2 laser welding was performed using an L9 orthogonal array (L9-OA) design matrix with varying laser power, welding speed, and focal length to optimize process parameters. Microstructural characterization using electron backscattered diffraction (EBSD) revealed austenite texture along <001>, <101>, and <111> directions, with harmonic texture variations across orientations. Pole and inverse pole figures indicated equiaxed grains with twin boundaries in the base metal (BM), while the weld zone (WZ) exhibited broad, straight dendrites due to the metal transfer mode. The inverse pole figure (IPF) and image quality (IQ) map of sample EX5 revealed significant grain elongation in the WZ, with grain sizes ranging from 80 µm to 250 µm, where grains larger than 200 µm occupied the highest area fraction. Crystals in the WZ predominantly aligned with the (111) lattice, while the BM aligned with (001), with (101) present on both sides. The Orientation Distribution Function (ODF) mapping indicated periodic alignment every 90°. Mechanical testing per ASTM standards showed an inverse relationship between grain size and tensile strength (TS).

The BM, with a 16 µm grain size, exhibited a TS of 730 MPa, while EX5 (39.95 µm grain size) and EX8 (59.88 µm grain size) recorded TS values of 690 MPa and 540 MPa, respectively. Low-angle grain boundaries (LAGBs) in the BM were 63.9% (1°–5°) and 4.3% (5°–15°), whereas high-angle grain boundaries (HAGBs) constituted 31.8% (15°–180°). With increasing laser power and heat input, HAGB fractions rose to 90.3% (EX5) and 92.3% (EX8), influencing TS reduction. The highest joint efficiency reached 93%, with hardness increasing as welding speed decreased. Corrosion resistance analysis using Potentiostatic polarization revealed corrosion rates ranging from 7.4×10^{-3} to 8.6×10^{-5} mm/year, with optimal resistance observed at 25 J/mm heat input. Dry sliding wear tests conducted on the most corrosion-resistant sample indicated higher wear rates with increased load

Biography

Sathiya Paulraj was born in Tamil Nadu, India, in 1973. He earned a BE degree from the University of Madras in Chennai, India in 1994, a ME degree from the Regional Engineering College in Tiruchirappalli, Tamil Nadu, India in 1997, and a PhD degree from the National Institute of Technology in Tiruchirappalli, Tamil Nadu, India, in 2006. In 2006, he joined NIT Trichy's Production Engineering Department. He has received numerous awards, including the Best Teacher Award in 2009 and the Young Technology Awards. He has extensive experience in research, teaching, and consulting in the fields of metal joining, allied manufacturing processes, material characterisation, and coatings.

and sliding distance. A wear map was developed to correlate wear parameters with material loss, while FESEM analysis confirmed grain boundary effects, localized corrosion pits, and surface irregularities due to wear. The findings demonstrate that weld speed significantly influences joint strength, while laser power governs corrosion and wear behavior. This comprehensive study provides critical insights for optimizing process parameters to enhance the mechanical performance and durability of HX laser weldments in high-temperature applications.

MECHANICAL STRENGTH ANALYSIS OF ADDITIVE MANUFACTURED PLA SPECIMENS WITH VARIABLE INFILL PATTERNS AND DENSITIES

Gouri Vignesh Jawalkar, Bibhabasu Debnath, Akshil Jain, Sibani Mahapatra and Shampa Aich
Indian Institute of Technology Kharagpur, India

Abstract

Additive Manufacturing (AM) has emerged as a rapidly accepted smart manufacturing technology in various sectors, including aerospace, nuclear, automobiles, and beyond, owing to its reduced material wastage, customization possibilities, and supply chain flexibilities. Combining Shape Memory Polymers with 3D printing opens avenues for 4D, 5D, and 6D Printing. The cost of production can be significantly reduced, especially in wire-based additive manufacturing methods where the infill density and pattern can be varied to achieve the same functionality. In this work, tensile testing was performed on the samples printed with ASTM standard specimens made of Polylactic Acid (PLA) using fused deposition modeling (FDM). Fourteen common infill patterns, including Grid, Lines, Triangle, Cubic, Tetrahedral, Concentric, Concentric 3D, Zigzag, Gyroid, Octet, Cross, Cross 3D, Tri-hexagonal, and Quarter Cubic, have been examined with four variable densities of 20-80% with an interval of 20%. Further, machine learning (ML) algorithms were applied to predict the infill pattern using features generated from the results of tensile tests. An impressive accuracy of 96.126% was achieved with the random forest classifier model, providing a comparative analysis. Deep Learning (DL) algorithms were employed for fractography analysis, classifying approximately 350 fracture images by infill percentage. The dataset was expanded to around 2100 images through manual augmentation. Transfer learning was utilized to leverage pre-trained weights from state-of-the-art DL models, fine-tuning them for this specific application.

Biography

Gouri Vignesh Jawalkar, a final year post-graduate student from the Department of Metallurgical and Materials Engineering at IIT Kharagpur, India. I have diverse research experience working at top-tier research institutes and industries in my nation on Additive Manufacturing, Ni-Base Superalloys, High Entropy Alloys, Perovskites, Bulk Metallic Glasses, and beyond. I have authored three book chapters, which are currently under review. Beyond academics, I'm also the managing Governor of the Space Technology Student's Society at IIT Kharagpur.

Day - 1

Posters

FLEXIBLE MORPHOLOGICAL REGULATION OF PHOTOTHERMAL NANODRUGS: UNDERSTANDING THE RELATIONSHIP OF STRUCTURE, PHOTOTHERMAL EFFECT AND TUMORAL BIODISTRIBUTION

Shukun Li, Yudong Li and Jan CM van Hest
Eindhoven University of Technology, Netherlands

Abstract

The morphology of nanodrugs plays a critical role in photothermal therapy, as it directly affects their physicochemical behavior and biological responses. However, elucidating the intrinsic relationship between morphology and resulting properties remains challenging, primarily due to limitations in the flexible morphological regulation of nanodrugs. To investigate the relationship between the morphology of photothermal nanodrugs and their resultant properties. We created a range of morphologically controlled nano-assemblies based on poly (ethylene glycol)-block-poly (D, L-lactide) (PEG-PLA) block copolymer building blocks, in which the model photosensitizer phthalocyanine was incorporated. Four different topologies were compared, namely spherical vesicles, bowl-shaped vesicles, rodlike micelles and vesicular tubes. Photothermal properties and in vivo biodistribution were systematically analyzed, revealing the significant influence of particle morphology. Notably, rod-like micelles demonstrated high photothermal conversion efficiency, while bowl-shaped vesicles exhibited superior biodistribution. These optimized nanodrugs showcased remarkable efficacy in tumor treatment. This study provides a comprehensive investigation into the morphological regulation of nanodrugs, underscoring the importance of customizing supramolecular photothermal nanodrugs for clinical antitumor therapy.

Biography

Shukun Li is currently a postdoctoral researcher in the Bio-organic chemistry group at Eindhoven University of Technology (TU/e). Her research interests mainly include polymer- or peptide-modulated self-assemblies and their applications in tumor immunotherapy. Academic background: Shukun Li received her PhD degree from Institute of Process Engineering (IPE), University of Chinese Academy of Sciences (UCAS) in 2021. In the same year, she was supported by the International Postdoctoral Exchange Fellowship Program supported by Office of China Postdoc Council (OCPC), and started her postdoctoral research in IPE and Eindhoven University of Technology. In 2022, she was supported by the Young Scientists of the National Natural Science Foundation of China. In 2023, she was supported by the Marie Skłodowska-Curie Postdoctoral Fellowships, she then moved to TU/e again to continue the postdoctoral research.

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Advanced Nanomaterials and Nanotechnology
April 03-04, 2025 | Amsterdam, Netherlands

DEVELOPMENT OF PANI/CUMN$_2$O$_4$ NANOCOMPOSITE VIA HYDROTHERMAL METHOD AS A NOVEL ELECTRODE MATERIAL FOR SUPERCAPACITOR

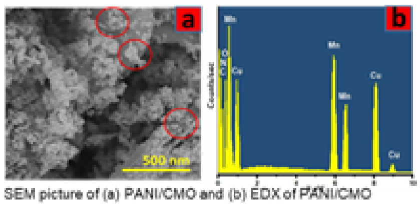
Abdulraheem SA Almalki
Taif University, Saudi Arabia

Abstract

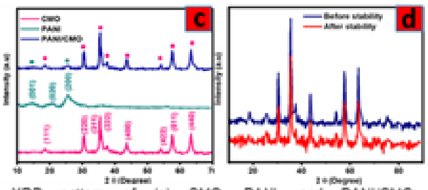
The copper manganese oxide, $CuMn_2O_4$ (CMO), is commonly selected as electrode material in supercapacitors owing to its cost-effectiveness and favorable performance as a binary transition metal oxide. The limited energy density of binary metal oxides restricts their widespread use as supercapacitors, thereby highlighting the need to develop a supercapacitor structure based on CMO. This study aims to enhance the electrochemical performance of CMO and polyaniline (PANI) by exploiting their complementary characteristics through their coupling via hydrothermal method. The structure and morphology of the PANI/CMO composite were analysed by means of characterization, such as X-ray diffraction (XRD), Fourier transform infrared (FT-IR), BET surface area analysis, scanning electron microscope (SEM-EDX), and Raman as well as cyclic voltammetry. Various physiochemical instruments were utilized to investigate the physical properties of synthesized nanomaterials. Specific capacitance (Cs) of PANI/CMO composite electrode was determined to be 1181 Fg_{-1} when tested at a 1 Ag_{-1}. Additionally, the cycle retention capacity of the supercapacitor was found to be 95% after undergoing 5000th cycles. The exceptional electrochemical performances of the three electrodes are believed to be attributed to the quick redox kinetics and the dynamic equilibrium between them. The outstanding electrochemical behavior of the nanohybrid can be ascribed to combine the effect of PANI and pseudo capacitance capabilities of CMO nanoparticles. Consequently, the excellent electrochemical performance of the PANI/CMO nanocomposite results from the synergy between the good properties of PANI and the pseudo-capacitance properties of $CoMnFeO_4$ nanoparticles. Hence, a new electrode material with superior performance and long-term stability has been developed for energy storage systems.

Biography

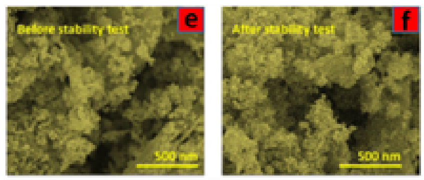
Abdulraheem SA Almalki is currently an Associate Professor in Department of Clinical Laboratory Sciences, College of Applied Medical Sciences at Taif University, Saudi Arabia.



SEM picture of (a) PANI/CMO and (b) EDX of PANI/CMO



XRD pattern of (c) CMO, PANI, and PANI/CMO nanocomposite; (d) XRD stability profile for PANI/CMO



Morphological study of PANI/CMO nanohybrid (e) before stability and (f) after stability

Day - 1
E-Posters

THE USE OF WOOL FIBERS AS A COLUMN PACKING MEDIUM FOR THE DYNAMIC ADSORPTION OF METHYLENE BLUE DYE FROM AQUEOUS SOLUTIONS

Bogdan-Constantin Condurache, Corneliu Cojocaru and Valeria Harabagiu
Petru Poni Institute of Macromolecular Chemistry, Romania

Abstract

This research of the authors presents an easy and economical method for water purification that employs recyclable natural fibers (coarse wool fibers) with an average diameter of 63 µm as a column-filling medium for adsorption in a dynamic system. Coarse wool fibers are typically regarded as waste biomass, frequently incinerated or discarded inappropriately. Consequently, using these fibers as a valuable material for the adsorption of cationic dyes from wastewater is highly significant.

The organic pollutant analyzed in this study is the cationic dye methylene blue (MB). Based on the Langmuir isotherm (measured at 300 K), the maximum adsorption capacity of the fibrous material was determined to be 24.86 mg/g for the retention of MB. Desorption experiments indicated that acidic eluents (such as $C_6H_8O_7$ or HCl) were the most effective for removing the retained MB dye from used wool.

Response surface methodology (RSM) was used for experimental design and model-based optimization of the adsorption process conducted in dynamic regime (fixed-bed column). The optimal conditions determined by RSM specified an adsorbent column height of H = 13.5 cm and a feed flow rate of Fv = 3 mL/min. These parameters achieved a dye removal efficiency of 99.77% at a contact time of 90 minutes (breakthrough point) and 92.56% after 240 minutes. Furthermore, the adsorption column (with wool as a fixed bed) can function effectively, maintaining over 90% separation efficiency for contact times extending up to 280 minutes.

The breakthrough curve obtained under optimal conditions was further analyzed using five quantitative mathematical models (Adams–Bohart, Thomas, Yoon–Nelson, Yan, and Clark) to evaluate the dynamic behavior in the fixed-bed column. The Thomas and Yoon–Nelson models provided the best fit for the data. Therefore, the coarse wool fibers employed in a fixed bed exhibited appreciable efficiency in removing cationic organic pollutants from contaminated water in both batch and dynamic systems1.

Biography

Bogdan-Constantin Condurache, is from Romania and I work at the "Petru Poni" Institute of Macromolecular Chemistry Iasi, specifically in the Department of Inorganic Polymers. I graduated the Faculty of Chemistry at "Alexandru Ioan Cuza" University of Iasi. I also completed my master's studies at the same institution, while my doctoral studies were pursued at the School of Advanced Studies of the Romanian Academy at "Petru Poni" Institute of Macromolecular Chemistry.

EFFECT OF MAGNETIC PROPERTIES ON DEPERMING USING PREISACH MODEL

Sang Hyeon Im
Dong Eui University, South Korea

Abstract

During the warship's manufacturing process, the hull generates a permanent magnetic field due to external stress. This magnetic signal is detected by mines installed on the sea, causing the ship to be attacked. The process of reducing permanent magnetic fields is called deperming. Deperming is performed by winding a coil around the outside of the warship and applying a continuous, alternating current that gradually decreases. Deperming to reduce the permanent magnetic field is carried out according to the hysteresis characteristics of the magnetic material. Therefore, a hysteresis modelling technique is required to accurately analyse the deperming.

In this paper, Preisach model, one of the hysteresis modelling techniques, was used for analysing the effect of magnetic properties on deperming. Since magnetic materials have unique hysteresis characteristics, they are affected differently even when the same current is applied externally. Therefore, the deperming effect and results were analysed according to the magnetic materials by reflecting the hysteresis characteristics in the same deperming process.

Biography

Sang Hyeon Im received the PhD degree in electrical engineering from Pusan National University, Busan, South Korea in 2020. From 2021 to now, he is an Assistant Professor with Dong Eui University, Busan.

DEVELOPMENT OF SUSTAINABLE THERMOPLASTIC COMPOSITES USING FLAX-JUTE HYBRID FIBERS AS REINFORCEMENT

Melisa Yeke and Gulnur Baser
METYX Composites-Telateks A.S.,Turkey

Abstract

This research investigates the development of biobased, sustainable and high-performance composite parts using woven fabric composed of flax-jute hybrid yarn and PA 11 thermoplastic powder resin. Flax-jute hybrid woven fabric is used as a biodegradable and high-performance reinforcement material. PA11 powder resin provides easy processability and effective impregnation because it has a low melting temperature and fine particle size. In addition, the resulting composites are characterized by low density and excellent impact resistance.

Prepregs were produced by homogeneously impregnating the resin into the single-layer fabric under heat and pressure using the double-belt press and powder scattering method. Then, multiple layers of these prepregs were compressed and demolded by applying heat and pressure under a hydraulic press at the melting temperature of PA11. Tensile and Charpy impact tests were conducted to characterize the mechanical properties of the resulting composite parts. The results showed that the panels exhibited high tensile strength, elastic modulus and impact resistance, providing an environmentally friendly alternative to traditional composites. In addition, SEM (Scanning Electron Microscope) analysis confirmed that the resin had impregnated the fibers homogeneously, demonstrating a strong bond between the fibers and the resin.

These findings highlight that natural fiber composites offer an innovative solution that can replace traditional composites in sectors such as automotive and construction, thanks to their improved mechanical properties and environmental advantages.

Biography

Melisa Yeke, has completed her master's degree in Mechanical Engineering from Izmir Institute of Technology. Currently, she is pursuing her PhD at Izmir Institute of Technology in Materials Science and Engineering. As an R&D Engineer at METYX Composites, she works on polymer matrix composites, focusing on sustainability and innovative technologies.

ANALYSIS OF INFLUENCE OF MAGNETIC MATERIALS DURING DEPERMING FOR REDUCING THE MAGNETIC SIGNALS OF A WARSHIP

Sang Hyeon Im
Dong Eui University, South Korea

Abstract

A Warship made of magnetic materials inevitably generate an induced magnetic field (IM) due to the Earth's magnetic field and a permanent magnetic field (PM) due to stress generated during the manufacturing process. These magnetic fields become magnetic signals from the outside and can be attacked by magnetically sensitive mines. Therefore, much research has been conducted on degaussing to reduce induced magnetic fields and deperming to reduce permanent magnetic fields.

However, studies on deperming have generally been conducted by a single magnetic material as a warship, which has the limitation of not being able to accurately represent an actual warship composed of multiple magnetic materials. Therefore, in this study, when a warship was represented with two magnetic materials, the mutual influence between the magnetic materials that occurred during deperming was analysed.

Biography

Sang Hyeon Im received the PhD degree in electrical engineering from Pusan National University, Busan, South Korea in 2020.From 2021 to now, he is an Assistant Professor with Dong Eui University, Busan.

BENDING, STABILITY AND NATURAL VIBRATIONS OF A GRAPHENE SHEET

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[1]*Institute of Mechanics of NAS RA, Armenia*
[2]*Shirak State University, Armenia*

Abstract

In the present work previously developed moment-membrane linear theory of plane stress state and transverse bending of elastic thin plates is presented (including corresponding variational principles) as continuum theories of the deformation behaviour of a graphene sheet.

For the graphene sheet, this continuum theory corresponds to a discrete approach where the interactions between two atoms in the graphene crystal are both force and moment interactions. Additionally, the elastic stiffness characteristics of the moment-membrane theory of thin plates are numerically determined using the physical parameters of elasticity for the harmonic potential of carbon.

In this work, based on this continuum theory the problems of statics and natural vibrations of transverse bending of a graphene sheet are specifically considered. The problem of stability of the initially compressed state of a graphene sheet is also considered.

In solutions of these applied problems of a graphene sheet a finite element method is developed, based on the variational formulation of the corresponding problems. A four-node rectangular finite element is used. The theory and basic relations of the rectangular finite element are presented accordingly. As a result, stiffness, mass and geometric stiffness matrices for the rectangular finite element of a graphene sheet are constructed.

The finite element solution for the problems of static transverse bend, natural vibrations, and stability of the initially compressed shape of a graphene sheet is considered. In corresponding tables, the numerical results of solving these problems with a uniform division of the graphene sheet (plate) into different numbers of rectangular finite elements are shown. The issues of practical convergence of approximations are discussed and where possible, comparisons of the obtained numerical results with theoretical ones are given. From the characteristic results we note that the natural frequencies of bending vibrations of the graphene sheet are in the GigaHertz range. This property of graphene sheet makes it an extremely sensitive sensor for detecting mass and force.

Biography

Samvel H. Sargsyan (b. December 5, 1944, Gyumri, Armenia) graduated from Yerevan Polytechnic Institute (1968), earned his Ph.D. (1974), and became a Doctor of Sciences (1987). A Professor since 1989, he has been a Corresponding Member of the National Academy of Sciences of Armenia since 2006. From 1998 to 2017 he served as Head of the Department of Higher Mathematics of Shirak State University and has been its Honorary Head since 2017. His research focuses on the constructing continuum models for the deformation behaviour of two-dimensional nanomaterials.

Day - 2

Keynote

INTERFACE ANALYSIS OF DIFFUSION-WELDED NICKEL/NICKEL-BASED SUPERALLOY CMSX-4

Bettina Camin[1], Thalea Retzlaff[1], Jan-Ole Kohlhorst[1], Malte Kemper[1], Birgit Skrotzki[2] and Wolfgang Wedell[2]
[1]Hochschule Bremerhaven, Germany
[2]Bundesanstalt für Materialforschung und - prüfung, Germany

Abstract

To investigate the Kirkendall effect by diffusion couple technique, a material combination of pure nickel (Ni) and the nickel-based superalloy CMSX-4 was joined by diffusion welding. The pure nickel has a polycrystalline structure, while CMSX-4 is directionally solidified as single crystal with a γ/γ' microstructure. Since the Kirkendall effect depends on the crystallography of a material two different single crystal orientations, the [111] and [001] directions, were selected. From our own investigations with synchrotron X-rays radiation 3D µ-tomography (3D XCT), it is known that hot isostatic pressing (HIP) leads to a reduction in the porosity of CMSX-4, which is due to the solidification and homogenisation of the single crystal during production. For this reason, material combinations of pure nickel and three CMSX-4 variants were selected and joined by diffusion welding: Ni/ CMSX-4 [111], Ni/CMSX-4 [001] and Ni/ CMSX-4 [001]-HIPed. The interface layers formed during diffusion welding were examined using optical microscopy (OM) and scanning electron microscopy (SEM) as well as energy dispersive spectroscopy (EDS) analyses. In all diffusion couples a strong bonding was achieved. In all samples, a pore fringe forms on the pure nickel side of the interface, while a γ'-free zone forms on the CMSX-4 side. This γ'-free zone has a polycrystalline structure. The average layer thicknesses of the γ'-free zone are different in all three different diffusion couples. EDS line scan measurements taken from the CMSX-4 side across the γ'-free zone into the nickel part show different curve progressions of the nickel and aluminum content for the three different diffusion couples. From this it can be concluded that the diffusion of nickel across the interface into the CMSX-4 material takes place differently depending on the crystal orientation.

Biography

Bettina Camin studied Mechanical Engineering in Berlin (Germany). After working as a construction engineer for a few years at the Department of Experimental Physics at Freie Universität Berlin, she changed to Technische Universität Berlin working at the Departments of Metal Physics and Metallic Materials. She completed her doctorate at the Department of Materials Science and Technology. She holds the Chair of Materials Engineering at Hochschule Bremerhaven.

Bettina Camin
Hochschule Bremerhaven,
Germany

ELECTROCATALYTIC MECHANISM OF NITROGEN REDUCTION ON IRO$_2$ (110) SURFACE: A DFT STUDY

Jyh-Chiang Jiang and Shih-Huang Pan
National Taiwan University of Science and Technology, Taiwan

Abstract

Ammonia is vital in renewable energy and agriculture. Traditional Ammonia production in industry via the Haber-Bosch process poses significant energy and CO_2 emissions issues. Electrocatalytic nitrogen reduction reaction (NRR) offers a more sustainable alternative that operates under ambient conditions. However, progress in NRR has been hampered by unintentional adsorption of N_2 and issues related to selectivity and efficiency. IrO_2 has previously shown high efficiency in electrocatalytic reactions and exhibits strong adsorption of N_2 on its surface, motivating further exploration of its NRR potential. This study uses a hybrid method of density functional theory (DFT) combined with an efficient screening mediator-reference interaction site model (ESM-RISM) to study the reactivity of NRR. The state-of-the-art ESM-RISM method provides a more flexible method to accurately simulate electrode/electrolyte interface reactions and screen suitable electrolytes. Our results show that N_2 exhibits high adsorption capacity on Ir sites. Furthermore, the limiting potential of NRR on the IrO_2 (110) surface is significantly more favorable than that of HER, which highlights the efficiency of the IrO_2 catalyst in converting N_2 to NH_3, especially under acidic conditions (pH = 0).

Biography

Jyh-Chiang Jiang graduated from National Taiwan University in 1986 with a B.S. in Chemistry and received his PhD in Chemistry in 1994. After working as a postdoctoral fellow at IAMS, Dr. Jiang joined the National Taiwan University of Science and Technology (NTUST) faculty in 2001. He focuses on the theoretical and computational chemistry study of heterogeneous catalysis, optoelectronic materials, and Li-ion batteries. He has more than 220 papers in peer-reviewed journals. His research has also resulted in 4 patents. Dr. Jiang has been chairman of the Taiwan Theoretical and Computational Molecular Sciences Association from August 2019 to July 2023.

Jyh-Chiang Jiang
National Taiwan University of Science and Technology, Taiwan

ELIMINATING IMPLANT INFECTION: 30,000 NANOTEXTURED ORTHOPEDIC IMPLANTS IN HUMANS WITH NO INFECTION

Thomas J Webster
Northeastern University, USA

Abstract

Implant infection is rising with the U.S. Centers for Disease Control predicting one person every three seconds will die from a bacterial 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 25year journey of commercializing nano orthopedic implants now in over 30,000 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: 128) degrees are in chemical engineering from the University of Pittsburgh (B.S., 1995; USA) and in biomedical engineering from RPI (Ph.D., 2000; USA). He has formed over a dozen companies who have numerous FDA approved medical products currently improving human health in over 30,000 patients. His technology is also being used in commercial products to improve sustainability and renewable energy. He is currently helping those companies and serves 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.

Thomas J. Webster
Northeastern University, USA

Day - 2
ORAL

POLYMER-NANOPARTICLE SYNERGISTIC APPROACH FOR BIO AND ENERGY APPLICATIONS

Nekane Guarrotxena
Spanish National Research Council, Spain

Abstract

The purpose of this talk is to report innovative and simple approaches that yield desirable active and efficient nanomaterial platforms for practical applications in health-life, energy, environment and society. The nano-structuration effect in the multifunctionality of these nanomaterials, by covering functionalization approaches and assembly methods, will be discussed in order to provide insights into the growing utility of these synergistic entities and the understanding of their physicochemical properties, that enable interesting nanotechnological applications. Functional and/or smart polymers along with plasmonic or fluorescent nanoparticles will be the foundation of our nanostructured systems development and application.

Biography

N. Guarrotxena is a Research Scientist at the Institute of Polymer Science and Technology (ICTP) of the Spanish National Research Council (CSIC), Spain, an and External Expertise Consultant on I+D+i Management and Policy for National and International Agencies. She was vice director of ICTP-CSIC (2001-2005) and visiting professor at UCSB-USA and UCI-USA (2008-2011 and 2019). Her research focuses on the synthesis and assembly of hybrid nanomaterials, smart nanomaterials and nano gels, nanoplasmonics, and their nano biotechnology and green energy applications. She has published many papers in reputed journals and has been serving as an editorial board member of repute.

CREATING AN INNOVATIVE ELECTROCHEMICAL NITRITE SENSOR UTILIZING Zn-SCHIFF BASE COMPLEXES

Zahra Akbari and Giovanni Neri
University of Messina, Italy

Abstract

A novel electrochemical sensor for the determination of nitrites based on the modified screen-printed electrode (SPCE) by Zn- Schiff base complexes (ZnLX2) is presented. ZnLX2 complexes have been synthesized and characterized using several morphological and microstructural techniques such as scanning electron microscopy (SEM), X-ray powder diffraction (XRD), and fourier transformed-infrared (FT-IR) spectroscopy. Cyclic voltammetry (CVs) proved the good electrochemical performances of the ZnLX2/SPCE for nitrite ions determination.

Then, the electrochemical behaviors of zinc complexes were investigated revealing that the modified screen-printed electrode (SPCE) by them could purpose a suitable reference signal to construct an ampere-metric nitrite electrochemical sensor.

After optimization of the operating parameters, the developed ZnLX2/SPCE sensor displayed two linear relationships between response current and nitrite concentration in the overall range 2–4838 μM and a lower detection limit estimated to be 0.78 μM based on 3σ/m. Finally, the analytical application of the developed sensor was evaluated to quantify nitrite in a real sample of mineral water. Results obtained demonstrate that the ZnLX2/SPCE electrochemical sensor provided an effective tool for the detection of nitrite ions.

Advantages in using this sensor by the chronoamperometric method are the simple and cheap preparation procedure of the proposed modified electrode, along with its wide linear concentration range and low detection limit for nitrite. However, a main disadvantage could be related with the selectivity, so an extensive testing with more interfering substances is required for excluding cross-sensitivity, especially with more complex and polluted water matrix where a high number of organic substances can be present.

Biography

Zahra Akbari, originally from Iran, earned her M.Sc. Degree in Inorganic Chemistry from Shahid Bahonar University, Kerman, Iran, in 2015, followed by her Ph.D. Degree in Inorganic Chemistry from Yasouj University, Iran, in 2022. In 2019, she served as a visiting researcher for one year at the University of Messina, Italy, collaborating with Prof. Giovanni Neri's group. Her main research activities include the synthesis and characterization of metal complexes, and their applications in antimicrobial, antioxidant, and electrochemical sensors. Additionally, she worked in nanomaterial chemistry, specializing in nanocatalyst thin films. Currently she is a Postdoc researcher at Messina University, Italy.

NUMERICAL INVESTIGATION OF SULFUR REMOVAL DURING HEAT HARDENING INDURATION OF DIRECT REDUCTION GRADE IRON ORE PELLETS

Mehdi Azizkarimi, Hafez Amani and Eskandar Keshavarz Alamdari
Golgohar Mining & Industrial Company, Iran

Abstract

Direct reduction-based steelmaking is a promising method to reduce environmental impacts and carbon footprint associated with traditional blast furnace method. However, nickel-based catalysts in direct reduction plants which is used for the natural gas conversion to reducing agents, require a critical limit (0.01 wt.%) for impurities like sulfur in the feedstock. This study employs computational fluid dynamics coupled with discrete element method (CFD-DEM) packed bed reactor model to evaluate the sulfur removal during the induration of direct reduction grade iron ore pellets. Our findings revealed that an initial sulfur content up to 1 wt.% in the pelletizing mix increases the final bivalent iron (FeO) content by up to 0.5 wt.%, with negligible sulfur remaining in the final pellet. However, for pellets prepared with a raw material containing more than 1 wt.% sulfur, a linear correlation emerges between residual FeO and initial sulfur. Every 0.5 wt.% increase in the raw material's sulfur content leads to an approximate 0.7 wt.% increase in bivalent iron content. Furthermore, the amount of remaining sulfur in the final pellet exhibits an exponential growth when the initial sulfur content surpasses 1.5 wt.%.

Biography

Mehdi Azizkarimi is a senior process engineer at Golgohar Mining & Industrial Company, Kerman, Iran. Hafez Amani and Eskandar Keshavarz are with School of Materials and Advanced Processes, Amirkabir university of technology (Tehran Polytechnic), Tehran, Iran.

ANTICANCER POTENTIALS OF ZINC OXIDE - CHAMAEMELUM NOBILE AGAINST BREAST CANCER: A NOVEL APPROACH FOR SYNERGISTIC BREAST CANCER THERAPY

Alaa Yousef Ghidan[1] and Fatima Yousef Ghethan[2]
[1]*International University of Science and Scientific Research Development, UK*
[2]*Makkah Healthcare Cluster, Saudi Arabia*

Abstract

The nanoparticulate Zinc oxide prepared by our method was characterized by X-ray diffraction (XRD), Fourier transform infrared (FT-IR) scanning electron microscopy, SEM, and energy dispersive X-ray spectroscopy. SEM micrographs of the synthesized ZnONPs represented that the ZnO nanoflakes featured a smooth surface with a random arrangement and an average thickness of less than 10 nm in size distribution from 20 to 40 nm on average which might be developed to mesoporous ZnO, this growth is related with the presence of Chamaemelum nobile on the surface of the nanoflakes, Zinc oxide nanoparticles have exhibited selective cytotoxicity against breast cancer cells, especially MCF-7 and MDA-MB-231, upon fabrication using natural plant extract like Chamaemelum nobile. The findings reveal that ZnO NPs can effectively provoke oxidative stress in those cancer cells at a concentration of 10–100 µg/mL which further leads to apoptosis, leaving healthy cells unharmed, also the presence of bioactive compounds like flavonoids and phenolic acids from Chamomile nobile additionally elicits more DNA damage on those abnormal cells and further promotes the death of the cell by these effects.

Also, contributed to lowering inflammation related to cancer progression; hence it acts as a dual approach in inhibiting cancer cell growth and reducing treatment side effects. Zinc oxide nanoparticles, particularly when fabricated by natural plant extracts like Matricaria chamomilla, have demonstrated selective cytotoxicity against breast cancer cells. Some of these include the MCF-7 and MDA-MB-231 cell lines; in this way, for breast cancer therapy, ZnO NPs can be potential drug delivery systems, they were equally biocompatible at similar concentrations (10–100 µg/mL) with the efficient delivery of chemotherapeutic agents towards tumor sites. The use of Chamaemelum nobile in green synthesis ensures safety and a controlled release of drugs, which would enhance treatment efficiency without harming healthy tissues. Although very optimistic, more in vivo studies and clinical trials are necessary to ascertain the safety and efficiency of green-synthesized ZnO NPs in breast cancer patients; such approaches could offer less toxic means toward fighting cancers.

Biography

Alaa Yousef Ghidan–A Leading Innovator in Nanotechnology, Dr. Alaa Y. Ghidan is a renowned scientist and academic, currently serving as the Head of the Nanotechnology Department at the International Group for Science Studies and Technology in the United Kingdom. A visionary in the field of nanoscience, Dr. Ghidan has made significant contributions to advancing interdisciplinary research in nanotechnology, materials science, and applied sciences with over two decades of experience, Dr. Ghidan has led groundbreaking efforts in developing innovative nanotechnological solutions to tackle global challenges in energy, healthcare, and environmental sustainability. Her research focuses on the design, synthesis, and application of nanomaterials for cutting-edge technologies, including drug delivery systems, renewable energy innovations, and advanced electronic devices. Dr. Ghidan is not only a respected academic but also a role model for aspiring scientists, particularly women in STEM fields, proving that determination and excellence can overcome barriers and inspire generations.

IN SITU ANTITUMOR VACCINE COMPOSED OF A NANOSTRUCTURED EMULGEL SYSTEM CARRYING IMMUNOGENIC CHEMOTHERAPEUTICS IN IMMUNIZATION IN PRE-CLINICAL BREAST CANCER MODELS

João Paulo Figueiró Longo and Victoria Paz Machado
University of Brasília, Brazil

Abstract

Breast cancer remains one of the leading causes of cancer-related deaths among women worldwide, making the development of effective immunotherapies crucial. Our research project aims to innovate cancer treatment by creating an injectable in situ hydrogel that releases immunogenic cell death (ICD) inducers, specifically addressing metastatic breast tumors. The central hypothesis is that by utilizing a nanostructured emulgel system, we can improve the delivery and efficacy of therapeutic agents, harnessing the body's immune response to combat tumor progression. In previous studies, we observed that specific chemotherapeutics, such as doxorubicin, induce ICD in tumor cells, facilitating the generation of an immune response against mammary tumors. Building on this foundation, we have successfully developed a novel nanostructured emulgel capable of controlled release of protein lysates obtain after the exposition of breast cancer cells (4T1 cells) to these specific chemotherapeutics agents. The emulgel exhibits interesting thermos-gelling properties, with gelation occurring at temperatures above 37°C and the gel becoming fluid at temperatures below 10°C. With these properties, gelation will take place following subcutaneous administration, forming an antigenic depot that will enhance breast cancer immunization. This emulgel serves as a drug delivery platform that not only ensures the sustained release of therapeutic agents but also enhances their bioavailability at the tumor site. Our initial results demonstrate that this nanoemulgel effectively releases protein lysates in a controlled manner, which is essential for promoting a robust immune response. The ability to deliver these lysates steadily over time may significantly amplify the immunogenic potential of the treatment, leading to increased recognition and elimination of cancer cells by the immune system. The implications of this work are profound, as the successful implementation of the in-situ hydrogel could pave the way for more practical and effective immunotherapeutic strategies in breast cancer treatment. Our ongoing studies aim to further evaluate the immunological impact of the released lysates in preclinical models, ultimately striving for a translational approach that brings these innovative therapies

Biography

João Paulo Figueiró Longo is an associate professor at the University of Brasília, Brazil. He leads the Nanobiotech Laboratory in the same University with the focus on the development of innovative research in the nanomedicine field. Dr João Paulo has more than 90 published papers and supervise five doctoral students in the same field.

closer to clinical application. In conclusion, the development of this nanoemulgel represents a significant step towards harnessing the power of the immune system in breast cancer therapy, potentially transforming treatment paradigms and improving patient outcomes.

Day - 2
Video

CIRCUMVENTING CHALLENGES IN DEVELOPING CVD GRAPHENE ON STEELS FOR EXTRAORDINARY AND DURABLE CORROSION RESISTANCE

Raman Singh
Monash University, Australia

Abstract

The talk will discuss the challenges in developing corrosion resistant graphene coating on most common engineering alloys, such as mild steel, and present recent results demonstrating circumvention of these challenges.

Corrosion and its mitigation costs dearly (any developed economy loses 3-4% of GDP due to corrosion, which translates to ~$300b to annual loss USA). In spite of traditional approaches of corrosion mitigation (e.g., use of corrosion resistance alloys such as stainless steels and coatings), loss of infrastructure due to corrosion continues to be a vexing problem. So, it is technologically as well as commercially attractive to explore disruptive approaches for durable corrosion resistance. Graphene has triggered unprecedented research excitement for its exceptional characteristics. The most relevant properties of graphene as corrosion resistance barrier are its remarkable chemical inertness, impermeability and toughness, i.e., the requirements of an ideal surface barrier coating for corrosion resistance. However, the extent of corrosion resistance has been found to vary considerably in different studies. The author's group has demonstrated an ultra-thin graphene coating to improve corrosion resistance of copper by two orders of magnitude in an aggressive chloride solution (i.e., similar to sea-water). In contrast, other reports suggest the graphene coating to actually enhance corrosion rate of copper, particularly during extended exposures. Authors group has investigated the reasons for such contrast in corrosion resistance due to graphene coating as reported by different researchers. On the basis of the findings, author's group has succeeded in demonstration of durable corrosion resistance as result of development of suitable graphene coating.

Biography

Raman Singh's primary research interests are in the relationship of Nano/microstructure and Environment-assisted degradation and fracture of metallic and composite materials, and Nanotechnology for Advanced Mitigation of such Degradations. He has worked extensively on advanced materials (e.g., graphene) for corrosion mitigation, stress corrosion cracking, and corrosion-mitigation. He is a senior professor at Monash University, Australia. He is/was a Guest Professor at ETH Zurich, Switzerland (2020, 2023, 2024), US Naval Research Lab, Indian Institute of Science, and University of Connecticut. Prof Singh's professional distinctions and recognitions include: Guest Professor of ETH Zurich, Editor of a book on Cracking of Welds (CRC Press), Lead Editor of a book on Non-destructive Evaluation of Corrosion (Wiley), Editor-in-Chief of an Elsevier and two MDPI journals, leader/chairperson of a few international conferences and numerous plenary/keynote lectures at international conferences, over 285 peer-reviewed international journal publications and 15 book chapter, and several competitive research grants. He has supervised 60 PhD students.

Day - 1
Virtual

AZODYE PHOTOALIGNED NANOLAYERS FOR NEW LIQUID CRYSTALS DISPLAY AND PHOTONICS DEVICES

Vladimir G Chigrinov
Hong Kong University of Science and Technology, Hong Kong

Abstract

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

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

Biography

Vladimir G. Chigrinov is a Professor of Hong Kong University of Science and Technology since 1999. He is an Expert in Flat Panel Technology in Russia, recognized by the World Technology Evaluation Centre, 1994, and SID Fellow since 2008. He is an author of 6 books, 31 reviews and book chapters, about 333 journal papers, more than 718 Conference presentations, and 121 patents and patent applications including 50 US patents in the field of liquid crystals since 1974. He got Excellent Research Award of HKUST School of Engineering in 2012. He obtained Gold Medal and The Best Award in the Invention & Innovation Awards 2014 held at the Malaysia Technology Expo (MTE) 2014, which was hosted in Kuala Lumpur, Malaysia, on 20-22 Feb 2014. He is a Member of EU Academy of Sciences (EUAS) since July 2017. Since 2018 until 2020 he works as Professor in the School of Physics and Optoelectronics Engineering in Foshan University, Foshan, China. 2020-2024 Vice President of Fellow of Institute of Data Science and Artificial Intelligence (IDSAI) Since 2021 distinguished Fellow of Institute of Data Science and Artificial Intelligence.

NANOTECHNOLOGY: A REVIEW ON PERSONALISED CANCER THERAPY AND DIAGNOSIS

A V Vasanthi
Sarojini Naidu Vanita Pharmacy Maha Vidyalaya, India

Abstract

Cancer is an important cause of morbidity and mortality worldwide, irrespective of the level of human development. In cancer chemotherapy, anti-cancer drugs damage both malignant and normal cells alike. One of the important strategies in cancer therapy selectively targets the malignant tumour is sites known as “Nanotechnology”, involves manipulating particles or structures within the 1 to 100 Nano-meter range, offering revolutionary advancements in drug delivery systems. Semiconductor nanoparticles known as quantum dots (QDs) have remarkable fluorescent characteristics that enable multiplexed cancer cell detection and high-resolution imaging, but because of its adaptable optical qualities, low toxicity, and biocompatibility, carbon dots (CDs) have attracted interest. Gold Nano shells’ tuneable surface Plasmon resonance can be used to improve imaging contrast. Polyethylene glycol (PEG) surface modification results in these nanoparticles having longer circulation times, decreased immunogenicity, and increased durability and penetration. Nanotechnology-based cancer therapies, diagnostics, and Nano robots enable real-time patient monitoring, visualize efficacy and enhance patient education, offering a tangible understanding of precision treatment outcomes and advancements. The role of these nanomaterials, in improving cancer diagnosis and treatment is significant as they enable precise targeting of therapeutics, controlled release mechanisms, improved efficacy while minimizing side effects and showcasing the ongoing progress and future prospects in this cutting-edge field.

Biography

I am **A V Vasanthi** B Pharmacy student at SNVPMV, currently ranked as the topper of her batch with an impressive 94.9%. My current role includes Vice President of the SCRMP Pharmacy Central Executive Council - Student Forum. I have significant academic contributions, holding 11 published works, 50+ professional certifications, and earned 15+ awards for her academic and extracurricular efforts. I’m passionate about pharmacology and pharmaceutics, focusing on nanotechnology in cancer therapy, personalized diagnosis, and drug delivery. Exploring natural products for targeted treatments, I believe they offer great potential. Personalized medicine is essential, as one-size-fits-all approaches are insufficient—tailored therapies ensure more precise and effective outcomes.

DEVELOPMENT OF BIOFUNCTIONAL MATERIALS BY SURFACE ENGINEERING USING LOW-ENERGY NON-THERMAL ELECTRON BEAM TECHNOLOGY

Nic Gurtler, Lysann Kenner and Ulla Konig
Fraunhofer Institute for Electron Beam and Plasma Technology, Germany

Abstract

The demand for efficient eco-conscious solutions and advanced customized manufacturing technologies is constantly increasing. The development of bio-based and bio functional materials therefore opens numerous opportunities for sustainable applications in various branches of industry. Low-energy electron beam technology is an advanced method for the selective modification and adaptation of material characteristics through a targeted selection of process parameters without affecting the bulk properties. In particular, low-energy non-thermal electron beam (e-beam) technology is a sustainable and gentle process because the accelerated electrons do not penetrate deep into the material and no heat is generated. This technology is carried out at acceleration voltages of up to 300kV and ensures uniform, scalable modification processes like functionalisation, cross-linking or coating. A promising e-beam process is the covalent immobilisation of biobased or biocompatible substances on textiles, films or other substances through the so-called e-beam grafting in order to enhance functionality or optimise interactions with biological systems. In general, a wide range of surface and materials engineering processes can be realised with our research based on the e-beam technology while the innovative potential for life science applications can be implemented.

One example of e-beam assisted surface engineering is the application of low-energy accelerated electrons to covalently immobilise defined biocompatible substances on textile or polymer surfaces as durable thin layers. The e-beam grafting process was used to functionalise a conventional PET film with hydrophilic and anti-adhesive surface properties. For this purpose, functional polymers such as polyethylene glycol (PEG) and polyvinylpyrrolidone (PVP) were utilised. By adhesion experiments, the biological response was analysed via the subsequent determination of the metabolic activity.

Low-energy electron beam technology is also suitable for cross-linking bio-based materials. For example, a functional nanocellulose film was first produced by solvent casting, then cross-linked with citric acid and finally modified with chitosan

Biography

Nic Gurtler, was born in Germany and received my bachelor’s degree in chemistry from TU Dresden in 2016. I successfully completed my master’s degree at the Leibnitz Institute of Polymer Research Dresden in 2021. Since then, I have been a research assistant at the Fraunhofer Institute for Electron Beam and Plasma Technology FEP in Dresden, where I am working on my PhD thesis. I am focusing on establishing low energy non-thermal electron beam technology for the development of functional surface coatings.

applying e-beam technology. In addition to the surface properties, the mechanical characteristics of the finished material were analysed by tensile strength measurements and the cytocompatibility with human keratinocytes was investigated.

One aim of our current research is the e-beam-assisted covalent immobilisation of natural substances on polymer materials. For this purpose, polylactide (PLA) nonwovens are being modified with humic acids (HA), which are high-molecular, amorphous compounds obtained from humus. Due to the complex structure and the large number of functional groups of humic acids, they have antiviral properties. Humic acids inhibit the uptake of viruses by blocking the receptors on the cell surface in the early stages of viral infection. The antiviral properties of humic substances were verified by a plaque assay using the bacteriophages MS2 and Phi6. The polylactide nonwovens equipped with regenerative humic substances have applications in particle-filtering respiratory masks and air filters.

DEVELOPMENT OF PVA-CHITOSAN-POLYANILINE HYDROGELS WITH ADJUSTABLE APS CONCENTRATIONS FOR ENHANCED STABILITY AND OPTIMIZED SOLAR VAPOR GENERATION EFFICIENCY

Syazwani Mohd Zaki, Flora Serati and Ahmad Akid Zulkifli
International Islamic University Malaysia, Malaysia

Abstract

The development of next-generation hydrogels with multifunctional capabilities is critical for sustainable environmental technologies. In this work, we report the fabrication of polyvinyl alcohol-chitosan-polyaniline (PVA-CS-PANI) hybrid hydrogels via a green synthesis method, varying ammonium persulfate (APS) concentrations (0.4 mol%, 0.7 mol%, and 1.4 mol%) to optimize both mechanical integrity and photothermal performance. FTIR and FESEM analysis revealed that reducing APS to 0.4 mol% promoted the formation of well-defined PANi nanofibers, resulting in a highly porous structure with superior hydrogen bonding within the PVA-CS matrix. The nanostructured hydrogel exhibited remarkable antifungal properties and long-term dimensional stability when immersed in neutral and alkaline media for up to five months, outperforming bare PVA-CS hydrogels, which are prone to microbial degradation. Crucially, under simulated solar irradiation, the optimized PVA-CS-APS-PANi hydrogel demonstrated significant solar vapor generation (SVG) efficiency. The 0.4 mol% APS-PANi hydrogel achieved a vapor generation rate of 1.25 kg m^{-2} h^{-1} with an energy conversion efficiency of 78.5%, outperforming higher APS concentrations due to its enhanced light absorption and well- connected nanofiber network facilitating localized heating and water transport. This study highlights the synergistic role of APS concentration in tailoring both the nanomorphology and photothermal capabilities of the hydrogel, paving the way for scalable production of eco-friendly hydrogels with dual functionality: antifungal resilience and efficient solar-driven water purification. These findings position the engineered PVA-CS-APS-PANI hydrogels as promising candidates for sustainable water treatment technologies.

Biography

Syazwani Mohd Zaki is a materials scientist and educator at the Department of Manufacturing and Materials Engineering, International Islamic University Malaysia (IIUM), with a strong research focus on developing advanced hybrid hydrogels and nanomaterials for environmental and engineering applications. Her work primarily addresses global challenges, including water scarcity, the development of sustainable materials, and the creation of clean energy solutions utilizing innovative polymeric systems. Her research has pioneered the design of multifunctional PVA- Chitosan/Polyaniline (PANi) hybrid hydrogels, achieving impressive results in solar vapor generation (SVG) for freshwater treatment. Dr. Syazwani is also actively involved in multiple high-impact research grants, including the elucidation of PEGDA-PANI/Carbon Dots hybrid materials for photothermal applications and collaborative projects on graphene quantum dots and $NiCo_2O_4$-based hybrid membranes for fuel cell technologies. Additionally, she contributed to eco-friendly biosorption technologies utilizing red seaweed for the removal of heavy metals in water treatment.

THE SYNERGISTIC EFFECTS OF GRAPHENE NANOPARTICLES ON THE SURFACE WETTABILITY AND BARRIER PROPERTIES OF POLYDIMETHYLSILOXANE BASED COMPOSITE COATINGS

Sachin Sharma Ashok Kumar[1,2], K. Ramesh[1] and S. Ramesh[1]
[1]*University of Malaya, Malaysia*
[2]*Taylor's University, Malaysia*

Abstract

Acrylic-epoxy based polydimethylsiloxane (PDMS) composite coatings loaded with different concentrations (0.5-3 wt.%) of graphene nanoparticles were successfully prepared via solution intercalation approach. The primary goal of this study was to investigate the hydrophobicity and barrier properties of the graphene-based coatings for corrosion applications. Furthermore, the ultraviolet-visible (UV-Vis) spectroscopy and water contact angle (WCA) instrument were employed to evaluate the degree of transparency and surface wettability of the coatings. The surface adhesion analysis of the coatings was conducted using cross-hatch test (CHT) and the dispersion of the graphene nanoparticles was examined via field emission scanning electron microscope (FESEM) respectively. The coating samples were exposed to 3.5 wt.% NaCl over a period of 30 days and the electrochemical impedance spectroscopy (EIS) was employed to evaluate the corrosion performance of the coatings. In terms of hydrophobicity, the 1% G coating sample exhibited the highest WCA value of approximately 100˚.

Moreover, at lower loading rates (e.g., 1 wt.%), the FESEM results confirmed the excellent distribution of the graphene nanoparticles within the polymer matrix. On the other hand, at higher loading rates of graphene nanoparticles, the overall performance of the coatings was observed to decrease due to the presence of large agglomeration, which resulted the WCA and other properties to exhibit a decreasing trend. Last but not the least, among all the coating samples, the EIS studies revealed that the 1% G offered effective barrier properties for corrosion mitigation in both short and long-term performances. Despite having high impedance modulus values ($|Z|_{0.01\ Hz}$) throughout the immersion time, however, the highest loading rate of graphene nanoparticles (3 wt.%) employed within the matrix exhibited some levels of reduction in the corrosion resistance, which was attributed by the agglomeration phenomena. In summary, graphene nanofillers within the matrix displayed promising results in terms of enhancing the barrier properties and corrosion protection ability of the coating film.

Biography

Sachin Sharma Ashok Kumar is a material scientists 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. He received his PhD in Advanced Materials Science Engineering in University of Malaya in 2023. His current research involves the synthesis of super-hydrophobic graphene-based polymer nanocomposite coatings to enhance corrosion protection performance. He has published numerous articles in high ranked journals, participated in international conferences/exhibitions as a keynote/distinguished speaker and has received several excellence awards at international levels. He is currently a member registered with the Board of Engineers Malaysia (BEM) and Malaysia Board of Technologists (MBOT).

USE OF INDOCYANINE GREEN FLUORESCENCE IMAGING IN THE EXTRAHEPATIC BILIARY TRACT SURGERY

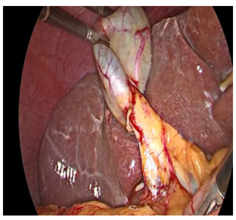
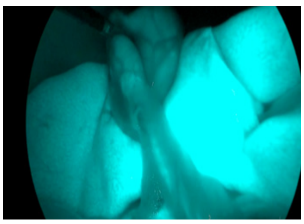
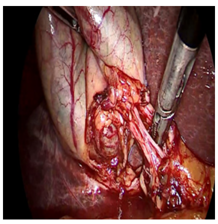
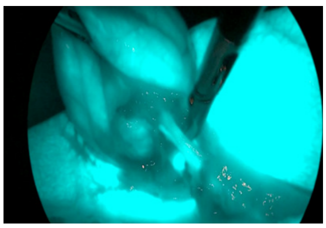
Orestis Ioannidis
Aristotle University of Thessaloniki, Greece

Abstract

Cholelithiasis presents in approximately 20% of the total population, ranging between 10% and 30%. It presents one of the most common causes for nonmalignant surgical treatment. The cornerstone therapy is laparoscopic cholecystectomy, urgent of elective. Laparoscopic cholecystectomy is nowadays the gold standard surgical treatment method, however bile duct injury occurred to as high as 0.4-3% of all laparoscopic cholecystectomies. The percentage has decreased significantly to 0.26-0.7% because of increased surgical experience and advances in laparoscopic imaging the past decade which have brought to light new achievements and new methods for better intraoperative visualization such as HD and 3D imaging system. However, bile duct injury remains a significant issue and indocyanine green fluorescence imaging, mainly cholangiography but also angiography, can further enhance the safety of laparoscopic cholecystectomy as it allows the earlier recognition of the cystic and common bile duct, even in several times before dissecting the Callot triangle. Fluorescence cholangiography could be an ideal method in order to improve bile tree anatomy identification and enhance prevention of iatrogenic injuries during laparoscopic cholecystectomies and also it could be helpful in young surgeons training because it provides enhanced intraoperative safety, but however this method does not replace CVS. Finally, our ongoing current study results comparing intravenous to direct administration of ICG in the gallbladder will be presented.

Biography

Orestis Ioannidis is currently an Assistant Professor of Surgery in the Medical School of Aristotle University of Thessaloniki. He studied medicine in the Aristotle University of Thessaloniki and graduated at 2005. He received his MSC in "Medical Research Methodology" in 2008 from Aristotle University of Thessaloniki and in "Surgery of Liver, Biliary Tree and Pancreas" from the Democritus University of Thrace in 2016. He received his PhD degree in 2014 from the Aristotle University of Thessaloniki as valedictorian for his thesis "The effect of combined administration of omega-3 and omega-6 fatty acids in ulcerative colitis. Experimental study in rats." He is a General Surgeon with special interest in laparoscopic surgery and surgical oncology and also in surgical infections, acute care surgery, nutrition and ERAS and vascular access. He has received fellowships for EAES, ESSO, EPC, ESCP and ACS and has published more than 180 articles with more than 3000 citations and an H-index of 28.

What will audience learn from your presentation?

- ICG fluorescence cholangiography can enhance the safety of laparoscopic cholecystectomy as it allows the earlier recognition of the cystic and common bile duct, even in several times before dissecting the Callot triangle
- The best timing and dosage of ICG administration in order to perform ICG cholangiography and angiography
- ICG fluoresce imaging doesn't replace the critical view of safety

NANO SUSPENSIONS AS A PROMISING DRUG DELIVERY SYSTEM

B Medha Gayatri and AV Vasanthi
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

I'm **Medha Gayatri Bhatiprollu** studying B. Pharm 3rd Year at SNVPMV, Hyderabad, India. I am passionate about research in medicinal chemistry, drug synthesis, nanotechnology, and drug delivery. My interests include 3D printing of drugs, biodegradable nanoparticles, vaccine development, leukemia research, and total synthesis of bioactive natural products. I also explore patient assistance programs in India and research project planning.

EXPLORE THE THERMAL PROPERTIES, KINETIC AND THERMODYNAMICS ANALYSIS OF LOCAL BEVERAGE WASTES PYROLYSIS USING TG/DTG: IMPLICATIONS FOR SUSTAINABLE ENERGY IN ETHIOPIA

Alebel Abebaw Teshager, Adugna Nigatu Alene, Jemanesh Abole Ketema, Daniel Berhane Maru, Adissu Getahun Adugna, Tadele Mihret Kndie, Smegnew Moges Mintesnot and Mulugeta Kasaw Feleke
Bahir Dar University, Ethiopia

Abstract

In this presentation, we will explore the pyrolysis mechanism, kinetics, and thermodynamic properties of locally sourced beverage wastes, including Areqe residue, Barley tea residue, Teji residue, and Tella residue. The average activation energy for each residue was determined using the iso-conversional methods of Flynn-Wall-Ozawa (FWO) and Kissinger- Akahira-Sunose (KAS). Building on this, we will discuss the correlation between the conversion factor and the pyrolysis process. Additionally, the order of reaction mechanisms for each beverage waste was investigated using the Coats and Redfern (CR) model-fitting approach, and the findings will be presented in detail. Furthermore, we will evaluate the potential of these beverage wastes for bioenergy production through pyrolysis, based on the derived kinetic and thermodynamic parameters. This analysis will provide insights into the feasibility of utilizing these residues as sustainable energy sources.

Biography

Alebel Abebaw is passionate and very interested in science and creativity by combining different skills to develop new ideas. He has research experience on, waste management, packaging material development and material synthesis for energy storage and other application with strong laboratory skills in chromatography, spectroscopy, thermal properties, cyclic voltammeter and others. He is eager to advance his skills related to analytical chemistry, biosensor development, energy storage and recovery, electrochemistry, and polymer sciences to come up with innovative solutions that concern with material development, optimization and creating better application.

NANO-OPTICS BASED ON SILICON AND GOLD CORE-SHELL ARCHITECTURES FOR BIOPHOTONICS AND BIOASSAYS

A. Guillermo Bracamonte
Universidad Nacional de Córdoba (UNC), Argentina

Abstract

In this Research work it was tuned mono-coloured and multi-coloured Silicon Nanophotonics incorporating varied Nanomaterials such as plasmonics, Laser dyes, and further hybrid materials. Thus, it was tuned different enhanced phenomena within the Nanoscale as Metal Enhanced Fluorescence (MEF), Fluorescence Resonance Energy Transfer (FRET), MEF-FRET coupling, and varied energy mode coupling with optical active and non-active Biostructures such as amino-acids, proteins, bacteria, and cells. In this context, it was evaluated the energy transfer through space and time, highlighting current Research works related with Nano-Biolabelling of Cyanobacteria such as Microcystis sp, Anabaena sp., etc. from Sierras of Cordoba, and Patagonia lakes, Argentine. Thus, it is presented Synthetic non-classical luminescence generation by Enhanced Silica Nanophotonics based on Nano-Bio-FRET applying Hybrid Silicon Nanoemitters. Moreover, affording from biomolecules to Nano-Biostructures, it is presented Nanophotonics towards smaller biomolecules, proteins and Nanostructured proteins such as Human Serum Albumin. Thus, it is discussed about Bi-coloured Enhanced Luminescence Imaging by targeted switch on/off Laser MEF coupling for synthetic Biosensing of HAS by developing Core-shell Nano-emitters. In this manner, it is intended to discuss about how tuning the Nanoscale, it is afforded to new Nanophotonics approaches from the near field towards the far field irradiation within Biological media with perspectives of Nanotechnology, Biodetection, Biophotonics and Nanomedicine applications.

Biography

A. Guillermo Bracamonte is an assistant professor at UNC and researcher at CONICET (Commission of Research in Science, Argentina). During his research career, he held postdoctoral positions at COPL, Laval University, and the University of Victoria, Canada. He was a research visitor at the University of Regensburg, Germany, and a researcher at the NASA Astrobiology Institute and the University of Akron. Then, he began his own research group within nanophotonics, biophotonics, and nanomedicine. And he is founder of Biohighlighting Solutions Start Up Entrepreneurship.

CURRENT APPLICATIONS OF AI/MI IN HOT STRIP MILL

S Sikdar
S. Sikdar, RVS College of Engineering & Technology, India

Abstract

With the priority to embrace the modern technology for faster production and achievement of precise dimensional accuracy, either the new hot strip mill or the existing mills are upgrading the facilities to get leverage from the application of Artificial intelligence and machine learning. Artificial intelligence and machine learning has been adopted in various hot strip malls across the globe. This is aimed at augmenting the existing traditional hot strip mills for their technical upgradation, apart from a sustainable development path for the new plants. Application of automation and further analysis with artificial intelligence/machine language has advanced the technology further beyond imagination to move ahead with the precision. Major areas of applications in the case of hot strip mills include the prediction of roll force, crown apart from the detection of defect of products. Different models of machine learning have been adopted for the analysis of the above area. Newly available models/ algorithms of ML, available in literature are showing avenues of advanced analysis, yielding results of better prediction. Applications and analysis of machine learning act as guidance to the controlling parameters for the strip profile and defects, and eventually determine the quality of the produced hot-rolled steel. Future challenges remain with the exploitation of benefits of machine learning for further use in hot strip mill.

Biography

S. Sikdar, is a doctorate in Thermal-Fluid Science, with research and industrial experience in heat transfer area with a total of 32+ year’s experience in combination of steel industry and academic areas along with role as applicant/ co-applicant for patents and publications in international/ national journals/ conferences.

THERMAL-INDUCED COARSENING: NANOPARTICLE SIZE MODULATION

Paulo Cesar De Morais
Catholic University of Brasilia, Brazil

Abstract

This talk aims to discuss the coarsening of freshly precipitated metal oxide nanoparticles (NPs) via short time (1-2 hours) hydrothermal treatment in mild temperature (T) range (100 to 300°C). Transmission electron microscopy data can be used to assess the average particle diameter (DT) of both the as-precipitated NPs and the hydrothermally treated samples at increasing temperatures. Surprisingly, the DT versus T trend can follow a sub-linear, a linear or a super-linear behavior, depending upon the condition the diffusion is set to take place during coarsening and the characteristics of the species diffusing in the medium. Experimental data showing different DT versus T trends (sub-linear, linear, or super-linear) will be presented and discussed based on a physical model picture for the underlying coarsening process, which takes into account diffusion of species in and out of the NP. Moreover, the model picture predicts the limits for the sub-linear as well as the super-linear DT versus T behavior; the former sets in as long as the thermal activated diffusion process is dominant whereas the latter may be observed for higher diffusivity values. The linear trend can be observed either in a competitive scenario involving the two above-mentioned limits (dominant thermal activated diffusion process and at higher diffusivity values) or in the absence of them. Within the limits of the model picture a linear relationship between DT and t (coarsening time) was found, accounting for both Lifshitz and Slyozov and Wagner coarsening models (introduced in early 60's) at relatively short times.

Biography

Paulo Cesar De Morais, 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 HUST – China (2012-2015); Distinguished Professor at AHU – China (2016-2019); Full Professor at the Catholic University of Brasília (UCB) – Brazil (2018); CNPq-1A Research Fellow since 2010; 2007 Master Research Prize from UnB. He held two-years (1987-1988) post-doc position with Bell Communications Research, New Jersey – USA and received his Doctoral degree in Solid State Physics (1986) from the Federal University of Minas Gerais (UFMG) – Brazil. With more than 13,000 citations, He has published over 500 papers and more than 15 patents.

Accepted Abstracts

FUNCTIONAL CARBON MATERIALS FOR ADVANCED CATALYSIS

Jieshan Qiu
Beijing University of Chemical Technology, China

Abstract

Functional carbon materials with tuned structure and properties are of great potential in many fields, which can be produced from different carbon-containing precursors by various technologies. By making use of molecular chemical engineering methods including molecular science, surface and interface engineering, multi-dimension carbon materials with engineered functionalities have been fabricated and demonstrated to enable advanced catalysis for production of fine chemicals and for electro-conversion of CO_2 and N_2 molecules.

Biography

Jieshan Qiu, Cheung-Kong Distinguished Professor of Carbon Science and Chemical Engineering at Beijing University of Chemical Technology, China. His research encompasses both fundamental and applied aspects of carbon materials and science, with a focus on the methodologies of producing carbon materials for energy storage and conversion, catalysis, and environment protection. He has published 900+ papers in peer-reviewed journals, including Nature Mater., Adv. Mater., Adv. Funct. Mater., Adv. Energy Mater., Energy Environ. Sci., PNAS, Nature Commun., ACS Nano, Angew. Chem. Int. Ed., J. Am. Chem. Soc., Joule, Matter, Chem, etc., with citations 67700+ times and h-index of 129 (google scholar), and his work has been featured on 70 covers of international journals. He has been invited to give 160+ plenary/invited/keynote talks in conferences and at universities and research institutes. He has filed 170+ Chinese and International patents. He has been honored with 30+ prestigious awards and prizes including the First-class award for fundamental research and industrialization technologies from the Education Ministry of China and Liaoning Province. He is a highly cited researcher by Clarivate Analytics from 2018 to 2023 and by Elsevier from 2019 to 2023 in the field of chemical engineering science. Right now, he is the Associate Editor of Battery Energy (Wiley) and Chemical Engineering Science (Elsevier).

ADVANCES IN POTASSIUM-ION BATTERIES: MATERIALS DESIGN AND SOLID ELECTROLYTE INTERFACE ANALYSIS

Kwun Nam Hui
University of Macau, China

Abstract

Energy storage plays a pivotal role across a wide range of applications, including portable electronics, electric vehicles, and renewable energy integration. Presently, lithium-ion batteries (LIBs) are extensively used for various applications due to their unique features. However, concerns have arisen regarding their feasibility and long-term sustainability, owing to the scarcity and uneven geographical distribution of lithium resources. Amidst these considerations, potassium-ion batteries (PIBs) have attracted substantial interest due to their cost-effectiveness and widespread availability. Nonetheless, the significant ionic radius of potassium ions (1.38 Å) presents challenges within graphite electrodes, resulting in electrode materials that demonstrate diminished capacity and limited cyclic stability in PIBs. Among the various reported anode materials for PIBs, phosphorus-based electrodes stand out with the most remarkable theoretical specific capacity (2596 mAhg$_{-1}$). Unfortunately, these electrodes experience notable volume expansion during operation, leading to reduced capacity and insufficient cycling stability.

In this presentation, I will demonstrate that phosphorus-based electrodes in PIBs hold the potential to emerge as competitive alternatives to LIBs for large-scale, sustainable, eco-friendly, and secure energy storage systems. Strategies to enhance the capacity of phosphorus-based electrodes, improve cycling stability, and enhance the electrolyte safety of PIBs will be explored. Of paramount significance, X-ray photoelectron spectroscopy (XPS) has been utilized to reveal essential insights into the dynamic evolution of solid electrolyte interphases on phosphorus-based anodes in organic phosphate-based electrolytes. This approach provides an explanation for the extended cycling stability observed in these systems. Lastly, approaches to enhance the cathode electrode for PIBs will also be discussed.

Biography

Kwun Nam Hui is an associate professor at the Institute of Applied Physics and Materials Engineering at the University of Macau. He earned his PhD in Electrical and Electronic Engineering from the University of Hong Kong in 2009. His current research efforts are dedicated to designing and synthesizing advanced energy storage materials. This involves the exploration of metal-organic frameworks, porous carbon materials, layered oxides, polyanion compounds, disordered compounds, and single-atom catalysts for various energy storage and conversion applications, such as supercapacitors, batteries, and water electrolyzers. His research findings have gained widespread recognition, with over 250 SCI papers published and a Google Scholar h-index of 65, accompanied by more than 13,000 citations.

A PROSPECTIVE IN HIGH-ALTITUDE PLATFORM STATIONS (HAPS)

Klaudio Bari
University of Wolverhampton, UK

Abstract

Although all-electric aircraft have many advantages, including zero-emission, low noise, and operating cost reduction, the enabling battery technology has not achieved sufficient maturity to cover the exact distances as jet fuel-driven aircraft. All-electric propulsion is currently viable for various aerial vehicles, such as vertical take-off and landing (VTOL) aircraft, powertrain retrofits of conventional fixed-wing aircraft, and new fixed-wing long-endurance aircraft. Key examples include disaster response, extreme weather events, and maritime domain awareness; high-altitude platform stations (HAPS), a solar-powered aircraft that offer the latest advancements in Uncrewed Aerial Vehicles (UAV). Their design must operate within the limits of contemporary technology to achieve long endurance in stratospheric flight. However, their aerostructure is usually heavy and expensive, and solar cells have limited irradiation efficiency. These obstacles restrict their commercial feasibility, particularly when considering the deployment of large fleets of HAPS regionally or globally to monitor complex events on our planet. HAPS are electrically powered UAVs capable of perpetual flight in the stratosphere, depending solely on solar irradiation, which impacts its airframe as its primary energy source; We have developed HAPS aircraft that have successfully achieved eleven low altitude test flights.

The design and development of solar-powered aircraft have gained increasing interest over the last three decades; however, technological advancements, particularly in battery and solar cell technologies combined with ultra-light aerostructures, have only now led to the feasibility of HAPS developments. Most of the research work focuses on concerted efforts towards environmentally green energy sources and research into alternative renewable energy technology. Recently, a bigger picture has evolved toward extending its capability for long-endurance mission ranges to obtain high-resolution images of our Earth using optical multispectral and synthetic aperture radar (SAR) at a lower cost than satellites. This project aims to re-design and manufacture a large wing aerostructure with integrated electric propulsion. The composite wing will strengthen Kea Aerospace's ability to perform perpetual flight for the MK1 model and gain wing proof of concept for MK2 for future endurance flight in the

Biography

Klaudio Bari focuses on developing composite materials to improve the efficiency of the aerospace and automotive industries and enable the implementation of low-carbon power and technologies. He is determined to understand microstructural formation mechanisms, stability, and degradation within the fibre/matrix interface, linking this to the key properties of the composite to inform the design, development, and optimization process. Dr. Bari is particularly interested in novel fibre/matrix and lightweight systems for civil and defence aircraft. I design composite materials that balance key properties for engineering applications with extreme operating environments, such as the core of gas turbine engines and supersonic speed. Dr. Bari developing ways to stabilise and balance resin/fibre content and assess the implications for the prepreg's tack level, mechanical properties, and fibre damage tolerance. I will also be exploring the rapid manufacturing of lightweight materials through additive layer manufacturing and Automatic tape placement.

stratosphere. The research questions will focus on integrating high-energy density lithium-ion batteries into wing airframes and upgrading their solar cells with higher irradiation efficiency (~40%).

DIRECT INK WRITING SUB-MICROMETER STRAIN SENSORS WITH LIQUID METAL FOR MONITORING PLANT GROWTH STATUS

Zeji Sun, Mei Zhou, Kai Zhuang, Naerkezha Nuermuhanmode, Wenrui Zhang, Jiang Hao, Shuaiqi Liu and Mojun Chen
The Hong Kong University of Science and Technology, China

Abstract

Real-time in situ monitoring of plant physiological functions is crucial for research in plant pathology. A key factor in achieving this monitoring is the development of a device capable of ultra-high precision detection of plant growth conditions and converting biological signals into digital signals. Here, we present a method to fabricate a high-precision strain sensor to detect plant growth using direct ink writing (DIW) with high conductive liquid metal. This approach modifies the wettability of high surface tension liquid metal inside the printing nozzle by heating the liquid metal and gold plating the inside of the nozzle. Consequently, we achieved a minimum printable line width of 1.24 µm and applied this high-resolution method to stretchable strain sensors. Sensors with different line widths exhibited varying sensitivities, with a 5 µm line width sensor achieving a gauge factor (GF) of 4.3. This sensor demonstrated excellent stability after 5000 cycles of repeated stretching, a minimum detectable strain of 0.01%, and a response time of 41 ms. The sensor was used to monitor plant growth rates and status at different time intervals during their growth cycle and different wetting environments, capable of capturing minute tensile signals. On mature leaves, the sensors can detect growth signals over multiple consecutive days, down to 0.07% strain. The state of the plant before and after being watered can also be visibly detected by the sensor, through different growth rates, which indicates its potential suitability for wearable electronic devices and real-time monitoring applications. This research provides a practical framework for designing and manufacturing highly sensitive flexible stretchable sensors.

Biography

Zeji Sun is a Mphil student of Smart Manufacturing at HKUST University. My research focuses on nanoscale 3d printed flexible electronics.

GaN BASED ELECTRONIC DEVICES FOR NEXT-GENERATION COMMUNICATION

Hao Lu
Xidian University, China

Abstract

With the coming of B5G/6G era, higher data rates and much broader bandwidths are giving to an increasing challenge for the power amplifier (PA) design. AlGaN/GaN-on-SiC HEMTs have gained much attention owing to their higher power handling capabilities compared to Si and group III-V materials. However, the small size and expensive substrate cost have hampered the large-scale implementation of GaN-on-SiC HEMTs for 5G infrastructure.

In this presentation, we report recent progress in the high-power performance of GaN-based HEMTs grown on large-size and low-cost silicon substrates. Here, the presented GaN-on-Si HEMTs with careful device design have achieved gained a high drain efficiency at sub-6G and millimeter-wave band, which are benchmarked against the GaN-on-SiC technique. These excellent results have demonstrated the GaN-on-Si HEMTs with careful device design could be an attractive platform to enable low-cost, high-efficiency and high-power RF applications.

Biography

Hao Lu is now a postdoctoral researcher at Xidian University, China. He received the Ph.D. degree in electrical engineering from Xidian University, Xi'an, China in 2022. His current research interest are GaN-based microwave/millimeter wave electronic devices and Si CMOS/GaN heterostructure integration. He has published 50 technical papers in international high-level journals and conferences such as IEEE Electron Devices Letters, IEEE Transactions on Electron Devices, Applied Physics Letters, IEDM, etc. He holds 27 chinese filed/pending patents. He has made several oral reports at international conferences such as IEDM, IEEE WiPDA, IEEE ICTA, IWN, APWS, CSW etc. In 2021, he won the IEEE WiPDA-Asia Best Presentation Award, AMSE Best Presentation Award, and Xidian Excellent Doctoral Dissertation Funding. Dr. Lu is Member of IEEE, China Institute of Electronics (CIE), and Chinese Physical Society (CPS).

PHOTO-DESIGN OF MULTIFUNCTIONALS METAL@POLYMERS COATINGS

Lavinia Balan, Jessica Ple and Didier Zanghi
Université d'Orléans, France

Abstract

Nanocomposites play a key role when it comes to developing advanced materials and functional materials. Typically, the addition of nanoparticles (NPs) to solid matrixes such as polymers either provides entirely new properties or enhances preexisting ones. Metal nanoparticles (Ag, Au)-based composites in particular have opened up new horizons in catalysis, sensing, electronics and biomedical fields, thanks to their unique physical and chemical properties. More recently, NPs such as quantum dots (QDs) have made photoluminescent polymer composites increasingly attractive, with applications ranging from fashion to security, biomedical or interior design industries. In this context, our research group has been actively developing NP-based photopolymer composites as reflective and light-emitting coatings, respectively.

Various chemical or physical synthesis methods have been developed to synthesize and homogenously disperse such nanoparticles. Chemical reductions of metallic precursors are usually preferred as they do not require severe temperature/pressure conditions and can be used to coat complex substrate shapes. However, multiple steps are often needed to ensure nanoparticle coalescence. Recently our research group has developed a green one-pot, one-step photoinduced method at room temperature and under air to synthesize highly reflective AgNP/polymer coatings on a variety of substrates i.e. textile, glass, plastic, paper, etc., of various shapes and sizes. Moreover, the QD-loaded photosensitive formulations were either used as photocurable inks for 2D and 3D printing or to create photoluminescent coatings emitting in the blue, green-yellow or red spectral regions.

Biography

Lavinia Balan obtained the PhD degree from the University Henry Poincaré in Nancy, France, in 2005. Her PhD was devoted to the elaboration of an original material for the anode of Li-ion batteries. After a post doctorate in Orleans and then in Mulhouse, she joined the Department of Photochemistry of Mulhouse in 2006 as a CNRS Researcher. She opened a new field of research in this laboratory, viz. the photo-assisted synthesis of metal nanoparticles and metal-polymer nanocomposite and then for 10 years at the Institute of Materials Science of Mulhouse, France. Since October 2019, she is CNRS Senior Researcher/ Research Director at CEMHTI (Conditions Extrêmes et Matériaux Haute Température et Irradiation) UPR CNRS in Orléans, France. L Balan has published more than 140 scientific publications, 4 book chapters and 5 patents and has been serving as an editorial board member for many scientific journals and conferences in nanomaterials.

HEAT EXCHANGER TECHNOLOGY AND APPLICATIONS: GROUNDSOURCE HEAT PUMP SYSTEM FOR BUILDINGS HEATING AND COOLING

Abdeen Mustafa Omer
Energy Research Institute (ERI), UK

Abstract

Geothermal heat pumps (GSHPs), or direct expansion (DX) ground source heat pumps, are a highly efficient renewable energy technology, which uses the earth, groundwater or surface water as a heat source when operating in heating mode or as a heat sink when operating in a cooling mode. It is receiving increasing interest because of its potential to reduce primary energy consumption and thus reduce emissions of the greenhouse gases (GHGs). The main concept of this technology is that it utilises the lower temperature of the ground (approximately <32°C), which remains relatively stable throughout the year, to provide space heating, cooling and domestic hot water inside the building area. The main goal of this study is to stimulate the uptake of the GSHPs. Recent attempts to stimulate alternative energy sources for heating and cooling of buildings has emphasised the utilisation of the ambient energy from ground source and other renewable energy sources. The purpose of this study, however, is to examine the means of reduction of energy consumption in buildings, identify GSHPs as an environmentally friendly technology able to provide efficient utilisation of energy in the buildings sector, promote using GSHPs applications as an optimum means of heating and cooling, and to present typical applications and recent advances of the DX GSHPs. The study highlighted the potential energy saving that could be achieved through the use of ground energy sources. It also focuses on the optimisation and improvement of the operation conditions of the heat cycle and performance of the DX GSHP. It is concluded that the direct expansion of the GSHP, combined with the ground heat exchanger in foundation piles and the seasonal thermal energy storage from solar thermal collectors, is extendable to more comprehensive applications.

Biography

Abdeen Mustafa Omer (BSc, MSc, PhD) is an Associate Researcher at Energy Research Institute (ERI). He obtained both his PhD degree in the Built Environment and Master of Philosophy degree in Renewable Energy Technologies from the University of Nottingham. He is qualified Mechanical Engineer with a proven track record within the water industry and renewable energy technologies. He has been graduated from University of El Menoufia, Egypt, BSc in Mechanical Engineering. His previous experience involved being a member of the research team at the National Council for Research/Energy Research Institute in Sudan and working director of research and development for National Water Equipment Manufacturing Co. Ltd., Sudan. He has been listed in the book WHO'S WHO in the World 2005, 2006, 2007 and 2010. He has published over 300 papers in peer-reviewed journals, 200 review articles, 30 books and 150 chapters in books

HALIDE PEROVSKITE THIN FILMS FOR NEUTRON DETECTION

Leunam Fernandez-Izquierdo and Manuel Quevedo-Lopez
University of Texas at Dallas, USA

Abstract

The need for high-efficiency wide-area coverage radiation detectors is essential in applications related to nuclear medicine, industrial imagining, environmental monitoring, spacecraft applications, homeland security, among others. In all of these applications, the detector material interacts with high-energy particles or photons, while operating at high electric fields. The material should also show negligible leakage current, high resistivity, and be able to scale. Cesium lead bromide ($CsPbBr_3$) is an excellent candidate that needs must of these requirements. $CsPbBr_3$ has excellent electric, optical and spectroscopic properties, while stable under extreme operating conditions. These properties make $CsPbBr_3$ an ideal material for high-energy radiation detectors. However, the use of $CsPbBr_3$ for charged particle and photon sensing is normally limited to single crystals. This is primarily due to the lack of deposition techniques for $CsPbBr_3$ films, which is necessary for high-energy radiation sensing. To overcome this, thin films were deposited using the close space sublimation (CSS) process, that allows the deposition of stoichiometric and high-quality CsPbBr3 films with reduced defects, large grains, and high deposition rates. Alpha particles, neutron and X-ray sensing using a p-n diode are also presented. Planar $CsPbBr_3/Ga_2O_3$ p-n junction diodes coupled with 10B neutron conversion film have been demonstrated by showing a thermal neutron detection efficiency of 2.5%. The theoretical neutron detection efficiency of planar detectors is limited to <4.5% due to the self-absorption of reaction products within the neutron conversion layer. Higher efficiencies (20%–35%) have been demonstrated when using micro-structured silicon diodes backfilled with a neutron conversion material. Micro-structured detectors fabricated using thin-film semiconductors can be easily scaled for large-area applications than detectors using single-crystal semiconductors. Neutron detection efficiency using micro-structured detectors has also been demonstrated recently.

Biography

Leunam Fernandez-Izquierdo received a B.S. in Chemistry (2012) at the University of Havana, where he worked on the development of nanomaterials and coordination compounds as materials for the construction of solar cells. He received his PhD in Chemistry from the Pontificia Universidad Catolica de Chile (2020) where he worked on the development of water-splitting systems using carbon nanotubes and semiconductors. After earning a PhD degree, he joined the University of Texas at Dallas (UTD) as a Research Scientist in the Materials Science and Engineering Department, where he works on developing materials to be used as radiation detectors.

MODIFICATION OF PHILIPPINE NATURAL ZEOLITE INTO AN MFI-TYPE FRAMEWORK: POTENTIAL FOR VOC ADSORPTION

Don Nelson C Potato, Apraile Hope P Dumrigue, Hannah Shamina O Cosinero and Ramuel John I Tamargo
University of the Philippines Diliman, Philippines

Abstract

Aluminosilicates have traditionally been used in filtration and purification processes, as well as in the medical and pharmaceutical industries. Their potential in these fields has garnered attention due to their well-defined structures, ability to reversibly bind small molecules, porosity, and shape and size selectivity. However, impurities can affect these applications. To address this, modifications and structure transformation are applied, which can alter the properties and structure of aluminosilicates to its target application. As nanoporous crystals, aluminosilicates have a well-defined structure that provides extensive interior and exterior surface areas. This study aims to provide further insights into the transformation of natural aluminosilicate into an MFI-type framework material and its potential for VOC adsorption. This study will explore the properties of recrystallized and functionalized natural aluminosilicates, focusing on natural sources found in the Philippines in both qualitative and quantitative aspects. The modifications will concentrate on hydrothermal synthesis and alkaline pretreatment. The potential of the material for VOC adsorption will focus on the adsorption of isobutylene gas using an adsorption set-up.

Biography

Don Nelson C Potato, currently a PhD student in Energy Engineering at the University of the Philippines, Diliman, with a solid academic background in Environmental Engineering, having earned both MS and BS degrees in the field. My career includes diverse roles in environmental consultancy, contributing to projects that address pressing environmental issues. I am actively involved in the AIRSAVER initiative, which focuses on developing air purification solutions using sustainable aluminosilicate for environmental remediation in Valenzuela. Additionally, I am part of an Australian clean tech startup in the Philippines, working on innovative technologies to convert municipal solid waste into energy, showcasing my dedication to sustainable and energy-efficient solutions. Energy Engineering Program, College of Engineering, University of the Philippines Diliman.

POTENTIAL OF ZEOLITIC IMIDAZOLATE FRAMEWORK (ZIF-8) NANOCOMPOSITE FOR SEPARATION OF ORGANIC COMPOUNDS FROM WASTE WATERS

Mohammad Ranjbar and Mahin Schaffie
Shahid Bahonar University of Kerman, Iran

Abstract

Recent studies on organic compound removal from waste waters focused on effective sorbents having high degree of recyclability with an option to recover the organic materials (oils). Generally, hydrophobicity and specific surface area are the two main factors controlling sorbents oil removal capacity. Therefore, it is a need to develop simple, innovative routes to create easily separable, highly recyclable, highly porous nanostructures. In this study, a facile synthesis method is applied to produce a novel highly hydrophobic zeolitic imidazolate framework (ZIF-8) coated onto carbon fiber (CF) fabric as a substrate without pre-modification. The product ZIF-8/CF was characterized by X-ray diffraction (XRD), energy dispersive X-ray spectroscopy (EDX), scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FT IR), thermogravimetric analysis (TGA), and surface area estimation as well as sorption and desorption tests. The porous structure of ZIF8/CF consisted of fixed layers of carbon fabric and nanocrystalline ZIF-8. The ZIF-8 crystals increased the water contact angle of the carbon fabric to 150°C, creating a shield toward water penetration. The ZIF-8/CF exhibited excellent reusability and recyclability (up to 25 cycles), without losing its efficiency.

Biography

Mohammad Ranjbar is an academic professional at Shahid Bahonar University of Kerman, Iran. He specializes in engineering, with a focus on applied sciences and technology. Over the years, Ranjbar has contributed significantly to research in his field, publishing numerous papers and engaging in various academic projects. His work spans areas such as materials science, structural engineering, and sustainable technologies. As a faculty member, he has also mentored students and collaborated with other experts to advance scientific knowledge. Ranjbar's dedication to education and research has made him a respected figure at Shahid Bahonar University and within the academic community.

A TWIN-TRACK THERAPEUTIC STRATEGY FOR MASSIVE ROTATOR CUFF TEARS BASED ON ROBUST AND PIEZOELECTRIC NANOCOMPOSITE HYDROGEL FILMS

Jiajie Wang, Jiacheng Dai, Dejin Jiao, Jinhua Fang, Kaiwang Xu, Tengjing Xu, Xinning Yu, Kaijie Qiu, Yuting Zhong, Hongyun Song, Sunan Zhu, Siheng Wang, Zongyou Pan, Zi Liang Wu and Xuesong Dai
Zhejiang University, China

Abstract

The high retear rate after massive rotator cuff tear (MRCT) repair is a significant roadblock that trouble both patients and doctors. Compared with traditional surgery, MRCT bridging repair with fascial autografts has great potential. However, the underlying risk of graft failure due to stretching and deformation during the postoperative stage is a grand challenge for its further use. In this study, we prepared robust, antimicrobial, and piezoelectric nanocomposite hydrogel films and used them for MRCT bridging repair with fascial autografts. The nanocomposite gel films incorporate excellent mechanical properties (≈166MPa) and remarkable antibacterial capacity. These properties ensure the gel films sustain long-term cyclic stretching and improve the anti-fatigue performance of fascial autografts. Besides, the composite gels with weakly-charged polyacrylic acid network exhibit appropriate piezoelectric behaviors, which generates electric stimulation and promotes tenogenic differentiation in vitro. Furthermore, compared to autografts alone, the combination of the nanocomposite gel films with fascial autografts shows more satisfactory results in a rabbit MRCT model, among which piezoelectric hyper-strong gels are superior to merely robust gels. This work demonstrates use of a robust, piezoelectric and antibacterial material to provide a twin-track therapeutic strategy to achieve mechanical reconstruction and biological regeneration synergistically, paving the new way to management for MRCT.

Biography

Jiajie Wang received the B.S. degree in Clinical Medicine from Wenzhou Medical University, Wenzhou, China, in 2020. He is currently working toward the Ph.D. degree in Osteology with the Second Affiliated Hospital, School of Medicine, Zhejiang University, Hangzhou, China. His research interests include sports medicine and nanocomposite tissue engineering.

UREA-ASSISTED HYDROGEN PRODUCTION THROUGH NICKEL-ORGANIC COMPLEX

Suryaraju Pampothi, Tan Cher Ming and Hsiao-Chien Chen
Chang Gung University, Taiwan

Abstract

Conventional water splitting for hydrogen production is highly energy-intensive due to its slow kinetics of the anodic oxygen evolution reaction (OER). An innovative alternative is urea oxidation, which not only requires low energy with the theoretical potential (0.37 V vs RHE) but also purifies contaminated water containing urea from various sources. In our work, we synthesized transition metal-based complexes with salicylic acid (Ni-SA, Fe-SA, Co-SA) via a hydrothermal process to explore their catalytic performance in urea oxidation. Extended X-ray absorption fine structure (EXAFS) results show only one main peak at 1.6 A corresponding to Ni-O scattering path which says that it forms a metal complex rather than metal oxide. The X-ray absorption spectroscopy (XAS) confirmed that the oxidation state of nickel site in Ni-SA is higher than +2, meaning that it is more favorable for UOR. Among these, the nickel-salicylate complex (Ni-SA) demonstrated outstanding catalytic activity, achieving a high current density of 100 mA/cm^2 at 1.46 V in an electrolyte solution of 1M KOH and 0.33M urea. Additionally, Ni-SA exhibited a low Tafel slope of 22 mV/decade, indicating efficient catalytic kinetics. These findings highlight the potential of Ni-SA as a cost-effective and energy-efficient catalyst for hydrogen production through urea oxidation.

Biography

Suryaraju Pampothi, is from India, and I am currently a master's student at Chang Gung University, Taiwan, in the Center for Reliability Science and Technologies (CReST) lab under Professor Hsiao-Chien Chen. I am an ongoing researcher focused on advanced materials synthesis to support hydrogen production and wastewater treatment through the urea oxidation reaction (UOR).

SUSTAINABLE DESIGN AND MECHANICAL EVALUATION OF AL-BASED BIO- COMPOSITE FOR STRUCTURAL APPLICATIONS

Akram Balaswad, Muhammad Ijaz and Shahid Parvez
King Saud University, Saud Arabia

Abstract

The bio-composite is made from recycled aluminium beverage, cans, and two organic fillers, eggshell carbonized powder (ECP), and date seed powder (DSP). The objective is to design an eco-friendly metal with improved mechanical properties and corrosion resistance by combining agro-waste and food waste in a metallic matrix. This approach reduces dependency on conventional materials and lowers environmental impact.

Methods: Topics focus on the reasoning behind materials such as recycled aluminum and agro-waste fillers, supporting the global shift to circular economies and lowering carbon footprints. The fabrication process primarily involves stir casting ECP and DSP into an aluminum matrix. Extraction, purification, and processing of powders, as well as the parameters governing fabrication, will be discussed.

On the measurement side, mechanical characterization methods including tensile and Vickers macro hardness tests will indicate how strong and durable the materials are. SEM images of the composite microstructure confirm ideal particle dispersion and good interfacial bonding, which improves mechanical properties. Corrosion testing procedures analyze the material's performance in aggressive environments, ensuring its suitability for long-term structural applications.

Results: Statistical analysis via ANOVA will assess the effect of varying composition levels on the composite's properties. Studying various compositions is aimed at determining the best ECP and DSP percentages that yield high mechanical and corrosion properties.

Conclusion: This presentation illustrates how bio-composites can serve as a link between resource sustainability and performance. The outcomes of this research may inform future strategies for developing low-cost, eco-friendly materials that meet the stringent requirements of contemporary structural projects, contributing to a more sustainable and responsible industrial future.

Biography

Akram Balaswad is a Master of Science candidate in Mechanical Engineering at King Saud University, specializing in material science and engineering. His current research focuses on integrating agro-waste and food byproducts into recycled aluminum, striving to enhance mechanical performance and corrosion resistance while reducing environmental impact. Grounded in metals characterization and recycling techniques, Akram seeks to minimize reliance on traditional resources and lower carbon footprints through innovative, cost-effective materials. Motivated by the pressing need for greener engineering solutions, Akram aims to inspire dialogue, advance knowledge, and ultimately help shaping a future where materials development aligns with global sustainability goals.

ENHANCING TRANSISTOR PERFORMANCE WITH NEGATIVE CAPACITANCE – A NEW ERA IN NANOELECTRONICS

Shalini Chaudhary
Poornima Institute of Engineering and Technology, India

Abstract

As the demand for more efficient and powerful electronic devices grows, traditional transistor scaling faces significant challenges, particularly in reducing power consumption and heat generation. Negative Capacitance Field-Effect Transistors (NCFETs) have emerged as a promising solution, leveraging the unique properties of ferroelectric materials to achieve lower operating voltages, improved energy efficiency, and enhanced switching performance.

This work explores how negative capacitance can be harnessed to overcome the fundamental limits of conventional MOSFETs, enabling transistors to operate at reduced supply voltages without compromising performance. By integrating a negative capacitance layer into the gate stack, NCFETs exhibit steeper sub-threshold slopes, leading to lower power dissipation and faster switching speeds.

Key aspects of NCFET technology, including device architectures, material considerations, and analytical modeling, will be discussed to highlight its impact on next-generation nanoelectronics. Additionally, challenges such as hysteresis, thermal stability, and interface effects will be examined, along with potential solutions for optimizing device reliability.

With advancements in semiconductor technology driving the need for low-power, high-performance electronics, NCFETs represent a transformative approach that could redefine the future of computing, mobile devices, and energy-efficient circuits.

Biography

Shalini Chaudhary is an accomplished academician and researcher specializing in nanoelectronics, semiconductor device modeling, and advanced transistor technologies. She is currently an Associate Professor in the Department of Computer Engineering at Poornima Institute of Engineering and Technology (PIET), Jaipur, Rajasthan. She earned her Ph.D. from NIT Jaipur, focusing on Negative Capacitance Field-Effect Transistors (NCFETs), and holds an M.Tech. in VLSI Design from Banasthali University and a B.Tech. in Electronics and Communication Engineering from Uttar Pradesh Technical University. Her research spans NCFETs, steep subthreshold devices, biosensors, and TCAD simulations, with extensive SCI-indexed publications. She has received prestigious fellowships, including UGC-SRF and JRF, and is a member of IEEE and a reviewer for reputed journals. With over a decade of teaching and research experience, she has held faculty positions at Poornima University, PIET Jaipur, and UPTU, mentoring students and contributing to FDPs and workshops in Machine Learning, IoT, and Embedded Systems.

SYNERGISTIC EFFECTS OF POLYANILINE AND GRAPHENE NANOPLATE HYBRID FILLERS ON THE MECHANICAL, ELECTRICAL, AND MICROWAVE ABSORPTION PROPERTIES OF THERMOPLASTIC RUBBER NANOCOMPOSITES

Sahrim Hj Ahmad, Chen Ruey Shan and Farrah Diyana Zailan
Universiti Kebangsaan Malaysia, Malaysia

Abstract

Conventional polymers are typically known for their insulating properties, exhibiting poor electrical conductivity and magnetic behavior. This study focuses on the fabrication of a thermoplastic natural rubber (TPNR) blend with polyaniline (PANI), reinforced with graphene nanoplatelets (GNP), using a melt blending method with an internal mixer, followed by compression molding. A control sample of TPNR/PANI, based on previous research, was formulated with an optimized PANI content of 3 wt%. The influence of GNP content (ranging from 1 to 5 wt%) on the mechanical properties (tensile, flexural, and impact strength), thermal stability, electrical conductivity, and morphology of the TPNR/PANI/GNP composites was investigated. Results indicate that the incorporation of 2 wt% GNP led to notable improvements in tensile strength (5.96 MPa), flexural strength (1.83 MPa), flexural modulus (21.68 MPa), and impact strength (4.61 kJ/m²). However, thermal analysis revealed that the addition of GNP did not significantly enhance thermal stability. In terms of electrical properties, the optimal conductivity of 2.6 x 10^{-9} S/cm was observed at 2 wt% GNP, representing a 23.8% increase compared to the control sample. Scanning electron microscopy (SEM) images demonstrated a well-distributed dispersion of GNP at the optimum loading, along with strong interactions between the TPNR and PANI phases. These findings suggest that TPNR/PANI blends with low GNP loading and ferrite nanoparticles can serve as novel conductive and magnetic materials. The developed hybrid thermoplastic elastomer nanocomposite exhibits promising potential for applications in electromagnetic interference (EMI) shielding and radar-absorbing materials

Biography

Sahrim Ahmad obtained his PhD from University of Loughborough, United Kingdom in 1988. He is an expert in the field of magnetic, nanocomposites and advanced materials. He has completed more than 60 research projects and consultancy work as a leader and co-researcher. His work on novel radar absorbing materials (RAM) subjected to transverse electromagnetic (TEM) has been successfully developed. His team managed to produce products that offered proper characteristics for handling, flexibility and lightweight, meeting requirement for various applications. He has published more than 270 papers in various journals related to polymer, composites, materials and supervised more than 63 PhD students. Dr Sahrim was former Dean of Faculty Science of Technology and Editor In Chief of Journal Sains Malaysiana (ISI/WOS). Currently he is the Fellow Academy of Science Malaysi

HETEROATOMS TERNARY-DOPED POROUS CARBONS DERIVED FROM POLY (CYCLOTRIPHOSPHAZENE-CO-4, 4-AMINOPHENYLETHER) MICROSPHERES AS ELECTRODES FOR SUPERCAPACITORS

Zahid Ali[1,2], Weiyong Yu[2] and Zhanpeng Wu[1]
[1]*Beijing University of Chemical Technology, China*
[2]*Shandong University, China*

Abstract

Polyphosphazenes (PPNs) are considered as an ideal class of inorganic-organic hybrid materials with structural stability inherited from inorganic backbone (-P=N-). PPNs are being employed as precursors for co-doped porous carbon materials which are highly suitable for energy production and storage due to their intrinsically enriched heteroatoms like phosphorous, oxygen and nitrogen. PPNs-based codoped carbon materials owe micro- and meso-porous structures, outstanding pore-volume, high surface area, exceptional ions transportation, good surface wettability, and high capacitive performance, which is pre-requisite for energy storage applications. With this inspiration, we prepared codoped porous constructed simply by adjusting the ramp-conditions with better char yield, disordered structure, ultra-high surface area of 3407.8 m2/g, and ~ 10-13% heteroatoms content. The codoped porous carbon microspheres (PZM-MS) were elucidated by XRD, Raman spectroscopy, XPS analysis, and Brunauer–Emmett–Teller (BET) method. The fabricated intrinsically doped N, P, and O carbon material provides a good capacitance out-put of 265.0 F/g at 0.5 A/g current density in a 6M-KOH electrolyte in the symmetric-electric-double-layer capacitors (EDLCs). The PZM-MS delivers 75% columbic efficiency and 91% cycling stability after 10,000 GCD cycles with a 5.0 A/g current density. The codoped material delivers 6.5 W·h/Kg energy density at a power density of 24.68 W/Kg at a 0.1 A/g and surges down with an upsurge of power density.

Biography

Zahid Ali has joined Department of Chemistry and Chemical Engineering Shandong University (QS Ranking 370) on 15 October 2024 as a highest young talent (Post-doc Fellow). Dr. Zahid Ali has completed his graduation from College of Materials Science and Engineering (Ranked top 3rd in China) Beijing University of Chemical Technology (BUCT) in 2023. Dr. Zahid Ali has joined Department of Chemistry of The University of Lahore in September 2016 as a lecturer. He has earned his MPhil degree in chemistry from the University of Engineering and Technology in 2016. Mr. Zahid has earned his master's and bachelor's degrees from University of Punjab Quai-i-Azam Campus Lahore. He has specialization in physical chemistry and worked as a research associate at INMOL hospital Lahore for one year.

OVERCOMING STRENGTH-DUCTILITY TRADE-OFF IN ADDITIVELY MANUFACTURED NI-BASED SUPER ALLOYS THROUGH HIGH-PRESSURE HEAT TREATMENT

Khurshed Alam, Kim kibong, Young-Taek Seo and Sangsun Yang
Korea Institute of Materials Science, South Korea

Abstract

This research focuses on additively manufactured Ni-based super alloys treated using normal heat treatment (NHT) and high-pressure heat treatment (HPHT) in Hot Isostatic Pressing (HIP). HIP is widely used to reduce internal porosity in components produced via additive manufacturing and casting. HIP conducted at high temperature and pressure, enhances material properties. The latest research regarding the synthesis of super alloys paved the way towards the synthesis by using HPHT. In HPHT the pressure is extended to quenching and during aging. The samples were quenched to desired temperature i.e. 680°C and 150 and 100 MPa is maintained inside HIP. The process is completed in a single cycle, optimizing process time. The purpose of this research is to discuss and compare the Ni based super-alloys manufactured using NHT, HPHT and 3DPed. The main purpose of using HPHT was to control the precipitation and microstructure. These phases were controlled with high pressure by using Time temperature transformation diagram (TTT) approach for In625. We introduced "pressure" as a fourth parameter during quenching and the first aging stage in HPHT, effectively overcoming the strength-ductility tradeoff. The HPHT process effectively controlled the number, size, and distribution of precipitates (PPTs), enhancing mechanical properties at 700°C. Elongation increased from 29% to 36%, while strength improved from 576 MPa to 602 MPa compared to NHT and 3D-printed samples. HR-TEM analysis of fractured HPHT specimens revealed numerous slip bands, facilitating dislocation movement and enabling plastic deformation instead of fracture. Additionally, in another study, optimizing 100 MPa at a different annealing temperature further improved ductility (32.7% to 38.3% EL), UTS (586 MPa to 617 MPa), and hardness (223.8 HV to 264.7 HV). This demonstrates a simultaneous increase in strength and ductility, defying the conventional tradeoff between these properties.

Biography

Khurshed Alam, his B.Sc. degree in materials engineering from Ghulam Ishaq Khan Institute of engineering sciences and technology (GIKI), Pakistan, his master and PhD degree from Chonnam National University from department of materials science, South Korea. Previously during his master and PhD he developed the skills in the synthesis of nanomaterials and nano thin film in synthesizing graphene, a variety of high entropy alloys, drug synthesis and cell culturing for biological applications. Khurshed is currently doing post doctorate at Korea Institute of Materials Science in Nano Materials Research Division and is working on hot isostatic pressing and additive manufacturing.

OPTIMIZED ANTIBACTERIAL PERFORMANCE OF NOVEL ACRYLOYLOXY TAMARIND KERNEL POWDER-BASED BIOCOMPOSITES

Sakshi Saini and Jagram Meena
Gurukula Kangri University, India

Abstract

This study focused on developing sustainable biocomposites by grafting tamarind kernel powder (TKP) with acryloyl chloride to enhance its antibacterial efficacy. The modification involved esterifying TKP with pre-synthesized acryloyl chloride, resulting in a novel derivative with improved material properties. Comprehensive characterization, including morphological, structural, thermal, and antibacterial analyses, was conducted to evaluate the biocomposites. The introduction of acrylic functionality significantly increased crystallinity to approximately 51.77%, compared to 33.56% in unmodified TKP. Furthermore, the biocomposites demonstrated remarkable antibacterial performance, exhibiting an 88% increase in activity against Escherichia coli and 74% against Staphylococcus aureus. With these enhanced properties, the developed biocomposites hold promising potential for biomedical applications.

Biography

Sakshi Saini is a research scholar in the Department of Chemistry at Gurukula Kangri University, Haridwar. She is pursuing her Ph.D. under the supervision of Dr. Jagram Meena since Sep. 2023. She has completed her Master's degree in Industrial Chemistry from Gurukula Kangri University, Haridwar,2022. During her tenure in the oil and soap industry, she honed her skills in quality assurance methodologies. She is working in Biochemistry and focuses on Natural Biopolymers. Her research interests include Nanomaterials and Derivatization of Biopolymers with a particular focus on Tamarind Kernel powder.

NANOMATERIALS: BRIDGING ENGINEERING INNOVATIONS WITH EFFECTIVE MANAGEMENT FOR FUTURE TECHNOLOGIES

Iulia P Graur, Carmelia Mariana Dragomir Balanica, Geanina Marcela Podaru and Constantin Ionel Mitea
Dunarea de Jos University of Galati, Romania

Abstract

Due to improvements in conductivity, strength, and energy efficiency from different industries, the industry of materials science is now able to develop new technologies with the help of nanomaterials. The novel engineering applications of nanomaterials show how much these management practices are needed to commercialize the laboratory inventions.

To deal with the logistic, financial, and technical obstacles of using nanomaterials, this part of the presentation will focus on the required management practices for these materials as well as explain how they are implemented on an engineering level. The wonders achieved in both the design and synthesis of nanomaterials and how they are changing the world across a vast array of industrial sectors will also be discussed.

Engineering nanomaterials into systems poses challenges, and they require well formulated plans with set objectives to be progressed. To better serve the industries expectations, topics like risk and supply chain management, legal frameworks, and meeting the set manufacturing standards will provide the needed backbone to ensure innovative strides in nanotechnology.

The presentation seeks to paint a picture of leadership and what it can contribute to innovation. Scientific discoveries linking the results to industrial objectives, efficiency, and sustainability in the manufacture of nanomaterials are the aspects of concern. Additionally, the presentation would discuss technological advancement, including how it deals with technological advancement for practical feasibility, and would pave the way for nanomaterials in engineering solutions that solve challenges of resource management, manufacturing, and commercialization. Furthermore, the presentation will encourage a further discussion among the target audience for critical analysis of management processes in the nanomaterials sector for further optimization for large-scale application.

Biography

Iulia P Graur is an academic and researcher specializing in mechanical engineering and material science. She holds a PhD in Mechanical Engineering from "Dunarea de Jos" University of Galati, Romania, where her doctoral research focused on the mechanical properties of ionic substances-filled epoxy matrices using ultrasonication techniques. Currently, she is Assoc. Prof. PhD. Eng. and Vice Dean for Student Relations and Partnership with the Economic and Social Environment at the Cross-Border Faculty of "Dunarea de Jos" University of Galati. Her research interests primarily lie in the areas of material science, particularly the study of polymeric composites, corrosion processes, and tribology. She has contributed significantly to the field, authoring 6 books and over 45 indexed articles. Iulia is also an active member of several scientific research and innovation projects, including those focused on renewable energy systems and environmental quality. Iulia has presented her work at numerous international conferences and has been recognized for her contributions with awards and honors, including best oral presentation. Fluent in Romanian, English, Spanish, and German, Iulia is a versatile communicator with strong organizational and managerial skills, making her a valued educator and collaborator in both academic and research settings.

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