GOVERNMENT OF
KARNATAKA
Department of
Science & Technology

BENGALURU INDIA NANO

AUGUST 1st-3rd 2024

THE LALIT, BENGALURU

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Nanotechnology for Sustainability

Climate, Energy & Healthcare

POSTER DOCUMENT

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Karnataka Science and Technology Promotion Society (KSTePS)

KSTePS - Karnataka Science and Technology Promotion Society is a registered autonomous organization established in 2013 under the Department of Information Technology, Biotechnology and Science & Technology (DST), Govt. of Karnataka. KSTePS aims at serving as a mechanism in supporting the preparation and implementation of policy initiatives of Department of Science and Technology and act as a nodal agency in channelizing the funding and in coordinating programs of the Department across the State.

KSTePS is Chaired by Secretary to Govt., Department of Information Technology, Biotechnology and Science & Technology with members drawn from various line Departments. Director, Dept. of Science and Technology is the Member Secretary and Managing Director.

Objectives:

- To serve as a mechanism to support the Department of Science and Technology in the preparation and implementation of its policy initiatives.
- To act as a nodal agency or channelizing funding for programs and for coordination between various implementing agencies.
- To identify priority areas of science and technology, which are useful for long term development of the State, so as to develop core competency in such areas.
- To act as a nodal agency for development of Nano Park and to extend all support services for promotion of Nanoscience and Nanotechnology in Karnataka.
- To coordinate and liaise with organizations of the Government of India in working out collaborative and joint programs/ventures in the field of science and technology.
- To act as a facilitator and liaise with all concerned in establishment of science city, science centres and other types of scientific establishments across the State.

One of the important programs of KSTePS is the organization of Bengaluru India Nano Event as it is the next big technological surge impacting wide spectrum of Industry in the coming years. The aim of this event is to create a congenial ecosystem for the growth of this sunrise industry similar to the growth witnessed in Information Technology and Biotechnology sectors.

The Thirteenth edition of India's premier Nano-science and Nanotechnology Event Bengaluru India Nano 2024 will be held during **August 1-3, 2024** with pre conference tutorials on 1st August at Hotel The Lalit Ashok, Bengaluru. This event is guided by eminent visionaries, who have made significant achievements and contributions in the field of Nano Science and Nanotechnology under the guidance of distinguished scientist **Prof. CNR Rao, FRS**, who is the Honorary President, Jawaharlal Nehru Centre for Advanced Scientific Research Centre (JNCASR) & Linus Pauling Research Professor.

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BENGALURU INDIA NANO

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THE LALIT, BENGALURU

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Interactive Poster Session with Delegates

Venue : Magadh

The Lalit, Bengaluru

Schedule

2nd August, 2024 - 04:15 pm - 06:15 pm

3rd August, 2024 - 03:30 pm - 04:30 pm

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Surface Modification of Medical Grade Biomaterials by Using Low- Temperature -Processed Dual Functional Ag-TiO2 coating for preventing Biofilm Formation

Many healthcare centers heavily depend on modern technologies, including medical devices, for both diagnosis and treatment. These devices are manufactured using a wide range of materials such as silicone, ceramic, glass, polymers, metals, composites, etc, which proves to be an ideal environment for the growth and development of biofilm. Biofilm development is considered the major virulence component that leads to increased mortality and morbidity among patients receiving medical treatments. To address the issue of bacterial attachment in medical devices, we propose a novel antibacterial surface modification approach. In this paper, we developed a novel low-temperature based solution-processed approach to deposit silver nanoparticles (AgNPs) inside a titanium oxide (TiO2) matrix to obtain Ag-TiO2 nanoparticles coating. Different types of medical-grade biomaterials were then coated using Ag-TiO2 NPs to modify the surface of the materials. Both silver (Ag) and titanium (TiO2) have antimicrobial properties and serve as a dual protective layer that mitigates microbial infections. Several studies were performed to observe the antibacterial and antibiofilm properties of Ag-TiO2 coated medical devices and biomaterials. This study shows that Ag-TiO2 coating has a promising potential for use in healthcare applications in combating microbial infection and biofilm formation.

POS-01

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Pvp Stabilized Nanoparticle For Blood Clot Management And Thrombosis

Blood clot-related diseases have been challenging for decades; this includes severe conditions like thrombosis, thrombophilia, strokes, atrial fibrillation, and disseminated intravascular coagulation. Commercially used anticoagulation and antithrombotic agents, EDTA and heparin, too, have limitations. Herein, we have developed novel nanoparticles from the inorganic complex reaction. These oxalate-containing NPs were thoroughly characterized using FTIR, TEM, SEM, DLS, and XRD. We hypothesize that the presence of oxalate can chelate the calcium, and we found that nanoparticles display efficient anticoagulation properties when incubated with human blood. In vitro studies, including prothrombin time, activated partial thromboplastin time, and fibrinolytic assay, were evaluated, which confirms the anticoagulation property of NPs. BALB/C mice were used for all in vivo studies. In the tail bleeding assay, enhanced clotting was observed after NPs treatment, whereas the ferric chloride was used to induce thrombosis model. According to the histology reports, accumulation of leukocyte, fibrin, and red blood cells was the least in the NPs treated group. Moreover, CAM and hemolysis assay signifies the biocompatibility and hemocompatibility of the NPs. Hence, this can be used in the treatment of diseases that are associated with blood clot management.

POS-02

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Plasmonic Multispectral Color Filters Based On Nanoimprint Lithography

Image sensors equipped with color filter arrays are widely used for capturing high resolution color images and advanced spectroscopy. In recent years, hyperspectral and multispectral color filters have been extensively studied in advanced imaging applications exploiting their superior spectral resolution both in terms of narrow linewidths and high transmission intensities. These color filters that are the most effective in terms of linewidths and efficiency are often the most expensive to fabricate. This is due to the fact that they require a three- dimensional topography with many different thicknesses to target different spectral transmission bands. Plasmonic color filters can be designed in such a way that the transmission bands can be adjusted solely by modifying the lateral dimensions of the unit cell. This ability to tailor the transmission bands makes plasmonic color filters a cost-effective alternative. We have recently designed hybrid dielectric-plasmonic color filters and fabricated them on glass wafers in our 200mm pilot line using conventional CMOS processing [1]. These filters exhibit outstanding optical performance over the visible spectrum, with linewidths down to 30 nm and the transmission efficiencies exceeding 50%. In this work, we present a much-simplified process flow for the same filters based on nano-imprint lithography (NIL), severely reducing the amount of required process steps and the associated fabrication cost. Also, we are investigating the effect of residual layer thickness (RLT) and passivation thickness variation on transmission efficiencies using FDTD simulations.

Reference:

[1] A. De Proft et al., "Highly selective color filters based on hybrid plasmonic-dielectric nanostructures", ACS Photonics 9(4) pp. 1349-1357 (2022).

POS-03

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The wounds, arises from accidents, burns, surgeries, diabetes, and trauma, can significantly impact well-being and present persistent clinical challenges. Ideal wound dressings should be flexible, stable, antibacterial, antioxidant and anti-inflammatory in nature, facilitating a scarless rapid wound healing. Initiatives were taken to create antibacterial cotton fabrics by incorporating agents like antibiotics and metallic nanoparticles. However, due to lack of multifunctionality these materials were not highly effective to cause scarless and rapid wound healing. In this article, nickel thiocyanate nanoparticle (NiSCN-NPs) impregnated cotton gauze wound dressing (NiSCN-CG) was developed. These nanoparticles were non-toxic to normal human cell lines till 1 mg/mL dose and did not cause skin irritation in the rat model. Further, NiSCN-NPs exhibited antimicrobial, antibiofilm and antioxidant activities confirmed using different in vitro experiments. In vivo wound healing studies in rat models using NiSCN-CG demonstrated rapid scarless wound healing. The nickel thiocyanate impregnated cotton gauze presents a novel approach in scarless wound healing, and as an antimicrobial agent, offering a promising solution for diverse wounds and infections in the future.

POS-04

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Ultra-sensitive hydrogen sensors based on Metal@ Metal oxides (M@MOSs) hierarchical nanostructures

The burgeoning demand for sustainable and renewable energy solutions, coupled with the depletion of fossil fuel reserves, has spurred the development of alternative energy storage and conversion technologies. Hydrogen (H2) has emerged as a promising secondary energy source due to its potential to drive sustainable energy development. However, the widespread use of H2 necessitates the implementation of robust systems for the rapid detection of hydrogen leaks to prevent hazardous conditions. Ensuring the safe utilization of H2 requires the development of highly sensitive and selective sensors capable of detecting minute quantities of hydrogen leakage. Therefore, there is an urgent need to engineer high-performance, cost-effective, durable, and power-efficient sustainable hydrogen sensors. One promising approach involves leveraging multifunctional Metal@Metal oxides (M@MOSs) hierarchical nanostructures to address practical application requirements. Metal@Metal oxides (M@MOSs) offer several advantages for hydrogen sensing applications, including enhanced sensitivity, selectivity, and stability. Moreover, the integration of metal and metal oxide components enables synergistic effects, enhancing the overall sensing capabilities of the system. By harnessing the unique properties of multifunctional Metal@ Metal oxides nanostructures, researchers can develop innovative sensing solutions that contribute to the realization of a sustainable energy future.

Keywords: Metal oxide nanostructures, noble metals, alloys, ZnO, hydrogen sensor

POS-05

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Keywords: h-BN quantum dots; nanozyme; biopolymer; sensor; colorimetric; pathogens

Pathogen detection has become a major research area all over the world for water quality surveillance and microbial risk assessment. Therefore, designing simple and sensitive detection kits plays a key role in envisaging and evaluating the risk of disease outbreaks and providing quality healthcare settings. Herein, we have designed a facile and low-cost colorimetric sensing strategy for selective and sensitive determination of β-galactosidase producing pathogens. The hexagonal boron nitride quantum dots (h-BN QDs) were established as nanozyme that showed prominent peroxidase-like activity, which catalyzes 3,3′,5,5′-tetramethylbenzidine(TMB)oxidationbyH2O2.Theh-BNQDswereembeddedonlayer-by-layerassembled agarose biopolymer.. The β-galactosidase enzyme partially degrades β-1,4 glycosidic bonds of agarose polymer resulting in accessibility of h-BN QDs on the solid surface. This assay can be conveniently conducted and analysed by monitoring the blue colour formation due to TMB oxidation within 30 min. The nanocomposite was stable for more than 90 days and was showing TMB oxidation after incubating it with E. coli. The limit of detection was calculated to be 1.8×106 CFU/mL and 1.5×106 CFU/mL for Escherichia coli (E. coli) and Klebsiella pneumonia (K. pneumonia), respectively. Furthermore, this novel sensing approach is an attractive platform that was successfully applied to detect E. coli in spiked water samples and other food product with good accuracy, indicating its practical applicability for the detection of pathogens in real samples.

Scheme: Schematic representation of h-BN QD Embedded Biopolymer for Peroxidase-Assisted Colorimetric Detection of Pathogens

POS-06

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Hydrophobic or Hydrophilic Micro Helices: Crafting Surfaces with Electrospun Magnetic Polystyrene Fiber and an Innovative Top-Down Technique

Micro helices are an important structure capable of overcoming low Reynolds number limitations and can be used in various microfluidic and biological applications. The fabrication of such micro helices is a challenge as existing fabrication techniques are restrictive in material choices and require sophisticated equipment. Here we demonstrate a simple top-down approach to fabricate micro helical structures using surface modification of helical electrospun fibers to produce both hydrophilic, silica coated (Si-HMPF) and hydrophobic, caramel sol- based (Ca-HMPF) magnetic micro helices post modification. The glassy coating obtained on the surface in both the cases facilitated obtaining magnetic micro helices via mechanical fracture of the fibers by grinding at room temperature. SEM images of the samples confirm the successful fabrication of micro helical structures which resembles the popular microswimmer morphology. The FTIR and VSM characterization were performed to study the functional groups present and the magnetic nature of the fabricated micro-helices. The thermal stability of the samples was investigated using DSC and TGA studies. Both hydrophilic and hydrophobic magnetic micro-helices were successfully fabricated through a simple sol-based coating technique and confirmed by wettability study.

Keywords: Micro helices, Helical magnetic microswimmer, Silica functionalization, Sugar glass coating.

POS-07

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Surfactant-Assisted Synthesis of Smooth-Surfaced Polyaniline Nanoparticles: Enhancing Electrochemical Performance for Supercapacitors

One of the important factors that control the electrochemical behaviour of polyaniline is known to be its morphology. Morphological alterations are known to significantly impact the polymer properties and can be controlled during the polymerization process. This study reports the synthesis of a surfactant-assisted polyaniline through a simple and inexpensive in situ chemical polymerization method. The physical characterization results such as electron micrographs, confirmed the topographical changes during synthesis, resulting in smooth surfaced electrode material. The presence of surfactant during polymerization had a synergistic effect on the electrochemical properties of the polyaniline as compared to bare polyaniline. Addition of the surfactant during synthesis improved the electronegativity of the as synthesised polyaniline, thus enhancing its performance such as specific capacitance and cyclic stability.

Keywords: Polyaniline electrode, Surfactant, Electrochemical study, Supercapacitor electrode, Specific capacitance, Cyclic stability.

POS-08

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Nanomaterials and advanced materials are gaining traction across industries due to their unique properties and wide-ranging applications. However, concerns about their environmental impact, particularly ecotoxicity, necessitate effective assessment methods. Here, we discuss the use of Quantitative Structure-Activity Relationships (QSARs) and Species Sensitivity Distributions (SSDs) in addressing these concerns. QSARs provide a computational approach to predicting chemical toxicity based on physicochemical properties and structural characteristics. By establishing quantitative relationships between molecular descriptors and ecotoxicological endpoints, QSAR models enable the estimation of potential environmental risks associated with these materials. Concurrently, SSDs offer a statistical framework for integrating toxicity data from multiple species and deriving ecotoxicity thresholds for environmental risk assessment. Analyzing the distribution of species sensitivities, SSDs facilitate the estimation of hazardous concentrations affecting a given proportion of species in an ecosystem. In summary, this work highlights the advantages and limitations of various computational tools in ecotoxicity assessment, along with current challenges and future directions. Case studies demonstrate the practical implementation of these approaches in environmental risk assessment, supporting informed decision-making and sustainable development practices in nanotechnology and materials science.

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5. Gajewicz-Skretna, et al. Science of The Total Environment 861 (2023): 160590.

Acknowledgement
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POS-09

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Affordable two-dimensional layered Cd(II) coordination polymer: High- performance pseudocapacitor electrode behavior

In recent years, pseudocapacitive have undergone rigorous investigation due to their potential for achieving high-energy and high-power densities. However, innovative approaches involving rational design and synthesis of new materials are still vital to address their concerns, such as degradation, low conductivity, low cycling performance, high resistance, and production costs. Working in this direction, we present a cost-effective synthesis, characterization, and exceptional pseudocapacitive performance of a Cd(II)-based coordination polymer (COP) abbreviated as Cd(DAB). It has been realized in quantitative yield through a facile one-pot reaction occurring among N4-ligand, 3,3′-diaminobenzidine (DAB), and Cd(II) ions, derived from Cd(OAc)2.2H2O, at room temperature. The proposed structure of the COP was ascertained by subjecting it to various standard spectroscopic and electron microscopic analysis, which demonstrated the self-assembly of indefinitely long coordination strands into a two-dimensional layered structure. The electrochemical performance of Cd(DAB) was evaluated as an electrode material for supercapacitors. Owing to its high conductivity, it portrayed remarkable energy storage (pseudocapacitor) behavior; it exhibited a high specific capacitance of 1321.6 F g−1 and a long cycle life with 88 % retention over 1500 cycles at 20 A g−1.

Keywords: Coordination polymer; diaminobenzidine; Cd(DAB); supercapacitors.

POS-10

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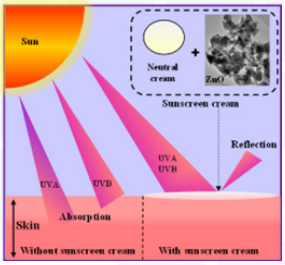
Comparative Study on Solvothermal and Sonochemical Synthesis of Zinc Oxide Nanomaterials and Unraveling the Efficacy in Sunscreen Formulations for Enhanced UV Protection

As the demand for highly efficient UV-protective sunscreens continues to rise, the exploration of advanced materials becomes imperative. This paper introduces a novel approach to synthesize zinc oxide (ZnO) nanomaterials through one-step solvothermal (ZnO-A) and sonochemical (ZnO-B) methods, eliminating the need for stabilizers or capping agents. The materials have undergone rigorous characterization, focusing on structural and optical properties, and are subsequently evaluated for their UV shielding efficacy. The synthesized ZnO nanomaterials are seamlessly incorporated into a pure cream matrix at varying concentrations (5, 10 and 15 wt.%), offering a versatile application for skin protection against UVA/UVB irradiation. Remarkably, the cream with 15 wt.% ZnO-A emerges as a standout performer, demonstrating immense UV blocking efficacy with 96.44 % for UVA and 97.22 % for UVB. The in vitro sun protection factor (SPF) value of 30.76 further underscores its exceptional performance. This research not only establishes a comprehensive comparative analysis of ZnO-A and ZnO-B nanomaterials but also emphasizes their potential as active ingredients in next-generation skin care sunscreen formulations. The findings contribute to the ongoing efforts in advancing UV protection technologies, addressing both efficacy and safety considerations.

Reference: Srikanth R. Veerabhadraiah, Sachin A. Bhat, Rohit Kumar Sharma, C. V. Yelamaggad, Nagaraja Naik, ChemistrySelect, 9 (2024) e202400617.



POS-11

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2D Cr2CTx MXene-Infused PVA Nanofibers: A High-Performance Electrospun Catalyst for Electrocatalytic Water Splitting

Transition metal carbide-based electrocatalysts have demonstrated high efficiency and effectiveness in boosting the kinetics of water splitting reactions, thereby improving hydrogen and oxygen production. In this study, we developed a composite material by integrating Cr2CTx MXene and polyvinyl alcohol (PVA) using an electrospinning technique. Carbonization of the MXene-PVA nanofibers resulted in the formation of Cr2CTx/carbon nanofiber (Cr2CTx/CNF) composite, which exhibited enhanced electrocatalytic properties and high porosity, stability, and surface area. A thorough examination and optimization of the electrocatalytic water splitting reaction showed remarkable performance, highlighted by significantly reduced overpotentials of 265 mV and 160 mV at the constant current density of 10 mA cm-1 with a lower Tafel slope value of 85 mV dec-1 and 52 mV dec-1 for hydrogen evolution and oxygen evolution reactions, respectively. We hereby present a Cr2CTx/CNF composite, synthesized through an economical and straightforward electrospinning and carbonization process, which enhances electrocatalytic water splitting applications, especially for oxygen evolution reactions.

Keywords: 2D Cr2CTx; PVA; Cr2CTx/CNF; electrospinning; hydrogen evolution reaction; oxygen evolution reaction

POS-12

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Tungsten Oxide Thin Films: Optimizing Thickness for Superior NO2 Gas Sensing at low temperature

This study focused on investigating the gas sensing capabilities of tungsten oxide (WO3) thin films. Initially, tungsten (W) metal films were fabricated using the DC magnetron sputtering process and subsequently thermally oxidized to produce WO3 thin films with varying thicknesses. The primary aim was to assess the ability of these WO3 thin films to detect low concentrations of nitrogen dioxide (NO2) at low temperatures. A variety of techniques were employed to characterize the WO3 samples, providing insights into their phase, chemical composition, morphology, and other relevant properties. Grazing incidence X-ray diffraction (GIXRD) and field-emission electron microscopy (FESEM) were utilized to examine the film structure and surface morphologies concerning thickness. XRD analysis revealed that the preferred orientation and phase intensities of the WO3 thin films varied with changes in thickness. Additionally, FESEM investigations showed that surface morphology underwent changes corresponding to variations in thickness. Among all the samples tested, the WO3-100 sample exhibited an outstanding response, demonstrating a benchmarked response of approximately 1130.37 % for NO2 gas at a concentration of 10 ppm, particularly at a low operating temperature of 100°C. Impressively, the sensor displayed sensitivity even to extremely low NO2 concentrations, detecting as low as 0.1 ppm. Overall, the sensor showcased remarkable sensing abilities, including strong selectivity and rapid response times. These findings underscore the potential of WO3 thin films for highly sensitive and selective gas sensing applications, particularly in detecting low concentrations of NO2 at low temperatures.

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POS-13

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Anti-Arthritic Effect of Methotrexate loaded Zein-chondroitin Sulfate Nano micelle to Target Inflammatory Synovial Cell in Rheumatoid Arthritis

Rheumatoid arthritis (RA) is an autoimmune, systemic, and chronic disorder particularly affecting the knee joints. The existing options for RA management are immunosuppressive combined palliative treatment, limited to minimizing the disease progression with more side effects. Methotrexate (MTX) is used as a first-line therapeutic drug for the treatment of RA observed with hepato- and renal toxicity. In the present study, amphipathic ZChS has been prepared using Zein (Z), FDA - approved GRAS protein, and chondroitin sulfate (ChS) through EDC coupling chemistry. Such amphipathic ZChS were self-assembled as nano micelle with minimal critical micelle concentration to control the symmetrical progression of the RA by selectively targeting CD44 expressing invasive inflamed synovial cells including M1 Macrophage and RA specific fibroblast-like-cells. These micelles were further loaded with anti-inflammatory drug methotrexate (MTX) with the maximum loading efficiency (44.2 ± 8.50 %). Further, chemical interaction of MTX with ZChS micelle were confirmed by FTIR, proton NMR and DSC analysis. Scanning Electron Microscope and dynamic light scattering analysis showed the homogenous distribution of nano micelles sized as 187.7 ± 34 nm (D h = 198.1 nm; PDI = 0.319). Cellular internalization of the model drug-loaded ZChS micelle was found to be higher in activated M1 macrophage, SW982 cell line, and primary synovial fibroblast-like-cells compared to non- activated Synoviocytes. Cytotoxicity of the MTX loaded micelle showed their selective toxicity on the activate synovial cells at minimum concentration of MTX (IC_{50} = 3μg/mL) compared to free drug. Anti-migration and anti-invasion potential of MTX-ZChS micelle treatment on activated synovial fibroblast-like-cells has showed more than 80% inhibition of cellular migration. The strong interaction of the targeted nano micelles towards CD44 expressing cells in RA synovial tissue compared to the healthy tissue clearly indicates that ZChS micelle may be a promising nanocarrier to target the inflammatory macrophages in RA conditions.

POS-14

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The development and use of eco-friendly renewable energy sources is becoming an extremely urgent task all over the world. Recently, Binder-free super capacitors have been shown to be more sustainable than traditional super capacitors. The use of binder-free active material electrodes has led to significant improvements in the performance of super capacitors, including increased specific capacitance and excellent stability to multiple charge-discharge cycles1. Further, research has focused on the effect of various binders on the working of super capacitors, aiming to enhance their efficiency . The development of all-in-one integrated flexible super capacitors which are more resistant to deformation and have lower interface resistance has also contributed to the sustainability of these devices. In addition, binder-free carbon based metal oxide super capacitors have shown remarkable improvements in charge transfer and capacitive storage. These advancements in binder-free super capacitors using different materials and structures demonstrate their potential for sustainable and efficient energy storage devices . So here we demonstrate simple LLI synthesis of rGO-Ag- Bi2O3 super capacitor active material directly loaded on stainless steel with/with out any binder and electrochemical super capacitor measurements like cyclic voltammogram (CV) with different scan rate, Galvanic Charging discharging (GCD) results, Electrochemical impedance spectroscopy (EIS) will be explained.

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POS-15

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Semiconductor-based SERS active materials are an emerging trend in recent sensor research. Among other semiconducting materials, Metal oxide semiconductors have gained attention in SERS-based detection due to their unique surface properties, greater chemical stability, customized photoelectrical properties, cost-effectiveness, and diverse simple synthesis methods. In general, the Enhancement factor (EF) offered by the semiconductor-based substrate is as low as 102 – 103. Hence the research is driven towards the SERS active system of metal oxide hybrids with carbon/plasmonic composites to achieve enhanced SERS performance1. One such semiconductor, ZrO_2 and its metal-doped form has been earlier explored for its SERS activity towards 4-mercaptobenzoic acid (4-MBA)2. Recently, Graphene-based ZrO_2 SERS substrate has also shown promising SERS performance towards pesticides3. Nevertheless, metal-doped reduced graphene oxide (rGO) based ZrO_2 could offer greater SERS performance due to their remarkable surface properties and plasmon exciton coupling effect.

Here we demonstrate rGO-ZrO_2 and rGO-Ag-ZrO_2 hybrid thin film nanocomposites for the highly sensitive detection of Rhodamine 6G dye and Organophosphorus pesticide which are toxic water pollutants. These substrates are prepared by a simple Liquid-Liquid Interface (LLI) synthesis method for the first time.

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Dopamine functionalized, red carbon quantum dots for in vivo bioimaging, cancer therapeutics, and neuronal differentiation

One of the crucial requirements of quantum dots for biological applications is their surface modifications for very specific and enhanced biological recognition and uptake. Toward this, we present the green synthesis of bright, red-emitting carbon quantum dots derived from mango leaf extract (mQDs). These mQDs were conjugated electrostatically with dopamine to form mQDs-dopamine(mQDs:DOPA)bioconjugates. Bright red fluorescence of mQDs was used for bioimaging and uptake in multiple cell lines, tissues, and in vivo models like zebrafish. mQDs exhibited the highest uptake in brain tissue as compared to others. mQD:DOPA conjugate induced cellular toxicity only in cancer cells while showing increased uptake in epithelial cells and zebrafish. Additionally, the mQDs: DOPA promoted neuronal differentiation of SH-SY5Y cells to complete neurons. Both mQDs and mQDs: DOPA exhibited potential for higher collective cell migration implicating their future potential as next- generation tools for advanced biological and biomedical applications.

Keywords: Red-emitting carbon quantum dots, green synthesis, bioimaging, neuronal differentiation, tissue, and in vivo uptake.

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In_2O_3 Gas Sensor: Optimizing Operating Temperature for NO_2 Detection

Nitrogen dioxide is a major air pollutant that is emitted from a variety of sources including motor vehicles, industries, gas stoves, thermal power plants, and many more. It is a major contributor to air pollution and can cause several health problems, including respiratory problems, heart disease, and cancer thereby, its detection at lower levels is an important task. Metal oxide-based gas sensors are highly sensitive, stable, low cost, and easy to fabricate, making them a viable option for gas sensing applications. Herein, we report an indium oxide- based gas sensor, that can detect NO_2 gas even at very low concentrations. Indium oxide (In203) is a transparent conducting material with n-type semi-conductivity and a band gap equal to 3.6 eV. These materials are promising for gas sensors due to their low dimension, portability, and simplicity. Indium metal of 200 nm is deposited onto a sapphire substrate using the DC magnetron sputtering technique at room temperature and then oxidized in a furnace at 550 ° C to create an indium oxide thin film. SEM data showed that the thin film has uniform grain distribution with a grain size of approximately 2.36 µm and GIXRD studies confirmed that the thin film is aligned in (2 2 2) direction and has a cubic structure with a calculated lattice parameter of 10.03 Å. Operating temperature studies were conducted, ranging from room temperature to 200 °C, revealing optimal sensitivity at 100 °C. At this temperature, the sensor exhibited a remarkable response of 52.46 % towards 10 ppm NO2. These findings underscore In203 as a promising material for detecting NO_2 gas at lower temperatures. Furthermore, concentration-dependent investigations demonstrated the capability of the sensor to detect concentrations as low as 100 ppb of NO_2. Notably, our studies showcased indium oxide as an excellent gas sensor with notable stability, alongside low response and recovery times. These results position indium oxide as a compelling choice for NO_2 detection, particularly in applications requiring sensitive, stable, and fast-responsive gas-sensing technology

POS-18

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The growing concern about the escalating contamination of water bodies by various dyes remains a major threat in the field of water treatment. Here we introduce a biomass-derived activated carbon with excellent performance as a remedy for such a situation and was successfully synthesized by a one-step integrated pyrolysis via KOH activation. The morphological and textural properties of the activated carbon were explored by field emission scanning electron microscopy (FESEM), and BET surface area analysis. The developed high surface area of activated carbon can be effectively used for the adsorption and removal of the Methylene blue (MB) dye from aqueous solutions. The porous network of the biomass-derived activated carbon offers more sites for dye adsorption. The studies were performed in various concentrations of activated carbon and at higher concentrations the activated carbon exhibited a 99% of dye adsorption capacity within a minute. The results showed that the addition of activated carbon substantially improved the dye adsorption capacity, which leads to potential application in wastewater treatment.

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Immunotherapy has emerged as a potent strategy for the prophylaxis and management of diverse ailments, encompassing cancer, infectious maladies, inflammatory conditions, and autoimmune disorders.Disease-modifying drugs have improved the treatment for autoimmune joint disorders, such as rheumatoid arthritis, but inflammatory flares are a common experience Despite its promise, this therapeutic avenue encounters several challenges, including suboptimal immune activation, off-target effects, and diminished bioactivity of immune agents during circulation. Immunomodulatory nanosystems represent a promising approach to enhance therapeutic efficacy while surmounting these hurdles. In recent years, significant strides have been made in the development of nanomaterials endowed with novel structures, properties, and functions.

This comprehensive review delineates the latest advancements in nanotechnology tailored for immunostimulation and immunosuppression. In the realm of cancer immunotherapy, nanosystems assume pivotal roles in eliciting immune cell activation, orchestrating tumor microenvironment modulation, and synergizing with complementary antitumor modalities. Encouraging outcomes have also been witnessed in combatting infectious diseases, with nanomaterial-based vaccines demonstrating notable efficacy against viral and bacterial pathogens. Furthermore, nanoparticles exhibit the potential to augment the therapeutic efficacy of immunosuppressive cell populations for addressing inflammatory and autoimmune conditions. Lastly, this review deliberates upon the challenges and prospects inherent in leveraging nanotechnology to modulate immunotherapeutic interventions.

POS-20

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Modular Gating of Ion Transport by Post-synthetic Charge Transfer Complexation in a Metal–Organic Framework based Nanochannel

Nature's design of biological ion channels that demonstrates efficient gating and selectivity brings to light a very promising model to mimic and design for achieving selective and tunable ion transport. Abiotic nanochannels that permit modulation of the pore wall charges are a compelling approach to gain control over the ion transport mechanism through the pores. This makes way for employing a noncovalent supramolecular approach for attaining charge reversal of a nanoscale metal-organic framework (MOF) pore walls using donor–acceptor pairs that can demonstrate strong charge transfer interactions. Herein, nanoscale Zr^{4+}-based mesoporous MOF-808 was post-synthetically modified into an anion-selective nanochannel (MOF-808- MV) by modification with dicationic viologen-based motifs. Charge modulation and even reversal of the MOF-808-MV pore walls were then explored taking advantage of strong charge transfer interactions between the grafted dicationic viologen acceptor moieties and anionic, π- electron-rich donor guest molecules such as pyranine (PYR) and tetrathiafulvalene tetrabenzoic acid (TTF-TA). Tunability of the MOF pore charge from positive to neutral to negative was achieved via simple methodologies such as diffusion control in case of guest molecule like PYR and by pH modulation for pH-responsive guest like TTF-TA. This results in a concomitant modulation in the selectivity of the nanochannel, rendering it from anion-selective to ambipolar to cation-selective. Furthermore, as a real-time application of this ion channel, Na+ ion conductivity ($\sigma = 3.5 \times 10^{-5}$ S cm^{-1}) was studied.

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Mild Chemistry Synthesis of Ultrathin Bi2O2S nanosheets exhibiting 2D- Ferroelectricity at Room Temperature

Modern technology demands the miniaturization of electronic components to create small, lightweight, and portable devices. Consequently, the discovery and synthesis of new non-toxic, low-cost, ultra-thin ferroelectric materials are crucial for advancing electronic and optoelectronic applications. Achieving room-temperture ferroelectricity in two-dimensional (2D) ultra-thin systems is particularly challenging, as conventional three-dimensional ferroelectric materials typically lose their ferroelectric properties below a critical thickness due to the depolarization field. In this study, we report the room-temperature ferroelectricity in ultra-thin single-crystalline 2D nanosheets of Bi2O2S. These nanosheets were synthesized using a simple, rapid, and scalable solution-based soft chemistry method. The ferroelectric ground state of Bi2O2S nanosheets was confirmed through temperature-dependent dielectric measurements, piezoelectric force microscopy, and spectroscopy. High-resolution transmission electron microscopy and density functional theory calculations indicate that the ferroelectricity arises from local distortions in the Bi2O2 layers, which break the local inversion symmetry of Bi2O2S. Our findings suggest that Bi2O2S nanosheets are promising candidates for next-generation electronic and optoelectronic devices, addressing the critical need for room-temperature ferroelectricity in ultra-thin materials.

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CVD Grown SnS2 based Chemiresistive H2O2 sensor for different Biomedical application

Hydrogen peroxide (H2O2) is a widely used chemical compound in various industries and can be found in diverse biological settings, as well as in water and air. However, H2O2 can be dangerous and poisonous within specific concentration ranges. Thus, it is imperative to ascertain its concentration under various conditions for the sake of safety and diagnostic objectives. In this work, we utilised chemical vapour deposition (CVD) to grow SnS2 sensing thin films. Subsequently, we applied a Cr/Au electrode through thermal evaporation. Next, we passivated the electrodes with Si3N4 to prevent chemical shorting. Then, the liquid biomolecules were applied to the sensor using a drop-casting method. The SnS2-based chemiresistive biosensor gives a higher response to H2O2 as compared to other biomolecules. Further, we decorate SnS2 with different metal (Au, Ag) nanoparticles to improve its selectivity towards H2O2. A bias voltage was applied to examine the variations in response resulting from different concentrations of H2O2. The further experiments were conducted to assess the performance of the Au/Ag-decorated SnS2 based biosensor in the presence and absence of H2O2 molecules. Later, the selectivity of the sensor towards different biomolecules was also evaluated, and it was found to exhibit a high level of selectivity towards H2O2. The SnS2 based device decorated with Au/Ag exhibited a response rate of 130% when exposed to a concentration of 100 mM H2O2 molecules. This response rate was higher compared to all other devices and 2.2 times higher than that of the pristine SnS2 device. The results of this study indicate that Au/Ag-decorated SnS2 is an effective material for detecting H2O2, showing promise for future applications. This research aims to improve our abilities to monitor and detect H2O2, which will lead to advancements in biomedical, environmental, and industrial applications.

Keywords: H2O2; biosensor; Chemiresistive; 2D material; SnS2; Asthma.

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Nanoparticle-embedded Biodegradable Food Packaging material for a Sustainable Environment

Food quality is maintained until it reaches the consumer with the help of a proper packaging system. However, the packaging materials used and preferred by the manufacturers because of their low cost and high durability like PET, PS and PP take millions of years to decompose creating a hostile environment for all living beings. The Biodegradable packaging materials obtained from natural sources but considered agricultural or kitchen waste can help to improve the economy by converting 'waste to wealth'. With the implementation of nanotechnology in the packaging industry, a current trend in the food packaging field, the active properties of the packaging material are enhanced. The nanoparticles upsurge the benefits of biodegradable packaging material. The packaging film's sustainability and physicochemical properties were improved by encapsulating nanoparticles (ZnO) with Biocomposite (Moringa and Rice bran) in polyvinyl alcohol. FESEM was used to confirm the homogeneous distribution of nanoparticles, leading to improved mechanical strength. The film was UV protective with high antibacterial efficiency and thermal stability, enhancing the food's shelf-life.

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A biosensor consists of a sensitive biological system and a detection system equipped with suitable transducers to acquire the output signals. These devices have a diverse array of applications, such as illness screening, environmental pollutant detection, agriculture, and routine medical checkups. The utilisation of electrochemical nano biosensors for the detection of biomarkers has greatly influenced the outcome of the cancer diagnostics and therapy. Electrochemical detection is a highly promising technique for the early detection and monitoring of cancer since it has a high level of sensitivity, specificity, and rapid response time. We investigate various electrochemical techniques, such as voltammetry, amperometry, and impedance spectroscopy, with a focus on their fundamental principles, advantages, and limitations. The integration of nanomaterials, biomolecular recognition elements, and microfluidic systems has significantly enhanced the efficiency of electrochemical sensors, enabling the detection of cancer biomarkers at exceedingly low concentrations. Despite significant progress, challenges such as result reproducibility, standardisation of processes, and widespread implementation continue to exist. Future research should prioritise addressing these challenges to enable the seamless incorporation of electrochemical detection into routine clinical practice. This review emphasises the importance of electrochemical methods in cancer diagnostics, current trends and offers useful perspectives on their potential to revolutionise individualised treatment.

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Improving the supercapacitor efficiency of Ti_3AlC_2- by optimising the synthesis method

The excellent electrochemical characteristics of MXenes, a type of two-dimensional materials, have gained much attention in recent years, rendering them highly attractive for applications in supercapacitors1.This work investigates the synthesis of MXene through the utilization of a Fluoride Salt etching technique (LiF/HCl) with different durations of etching times2 and other parameters. The aim of this study is to examine the impact of varying these factors on the structural, morphological, and electrochemical characteristics of MXene, with the ultimate goal of enhancing its efficacy in supercapacitor applications. Choosing the right precursor, commonly referred to as the MAX phase, is a crucial step in the MXene synthesis process. Ti3AlC2, or titanium aluminum carbide, is the precursor utilized in this investigation. The Al layers in the MAX phase precursor are eliminated via the etching procedure3. By adjusting the etching time and other important parameters that affect the process during LiF/HCl treatment, different degrees of Al removal and surface functionalization can be achieved4, leading to variations in MXene's properties. Characterization techniques such as X-ray diffraction (XRD) , scanning electron microscopy (SEM), transmission electron microscopy (TEM), and Fourier-transform infrared spectroscopy (FTIR) are employed to analyze the structural and morphological changes induced by varying etching times. Electrochemical performance evaluation includes cyclic voltammetry (CV), galvanostatic charge-discharge (GCD) tests, and electrochemical impedance spectroscopy (EIS) to assess the specific capacitance, cycling stability, and charge transfer kinetics of MXene-based supercapacitors. The results reveal the optimal synthesis method that maximizes the surface area, porosity, conductivity, and ion diffusion kinetics of MXene, leading to enhanced supercapacitor performance. This study provides valuable insights into tailoring MXene properties through controlled etching, facilitating the design of high-performance supercapacitors with improved energy storage and electrochemical stability.

POS-26

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Optimized Pseudocapacitive Energy Storage Using NiCo2O4-Embedded Ti3C2 MXene Electrodes

MXenes have emerged as a promising class of next-generation storage systems, meeting the escalating demands in high-energy applications due to their impressive power density and enduring stability. Titanium Carbide (Ti_3C_2), among these MXenes, shows particular potential for supercapacitors, owing to its 2D structure, which boasts high electrical conductivity and mechanical resilience. Mixed metal oxides (TMOs) are also acknowledged electrode materials for supercapacitors, leveraging their diverse oxidation states for efficient charge transfer. Consequently, there's considerable importance in meticulously crafting MXene/TMO structures with adjustable shapes and improved electrochemical characteristics. To address this, a method was introduced to effectively integrate Nickel Cobaltite ($NiCo_2O_4$) into $Ti_3C_2T_x$ MXene via a straightforward hydrothermal process1. Structural and morphological analyses were conducted using X-ray diffraction (XRD), Energy-dispersive X-ray spectroscopy (EDX), and field emission scanning electron microscopy (FESEM). The electrochemical performance of the resulting composite electrode and supercapacitor prototype was assessed through techniques like cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), and galvanostatic charge-discharge (GCD). The enhanced capacitive behavior of the composite can be attributed to the cooperative effects between MXene and Nickel Cobaltite. Leveraging the synergy of these two-dimensional materials, the resultant devices exhibit exceptional electrochemical capabilities, including high volumetric capacitance and prolonged cycling stability2.

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Biowaste-derived activated carbon/polymer composites as an efficient electrode for supercapacitor applications

Bio-waste-derived activated carbon offers an exciting avenue in the area of sustainable and efficient supercapacitors, owing to their low cost, and reduced environmental impact associated with waste disposal. In this work, Polyaniline incorporated activated carbon (AC/PANI) composite was successfully developed and the effect of the polymer on the physical properties of the biowaste-derived activated carbon and its electrochemical performance in supercapacitor devices have been explored by synthesizing AC/PANI composite at different polymer ratios. In addition to the conducting property of PANI, the activated carbon provides a supporting skeleton for polyaniline to improve the surface area and porosity of the composite system and resolves the issue of cyclic stability of polyaniline.1,2 A superior specific capacitance of 529 F g-1 for the AC-PANI-3 electrode was achieved at a scan rate of 1 mV s-1 in a three-electrode system. By fabricating a two-electrode system, a practical application of the developed composite material was systematically evaluated. A prototype of a symmetric supercapacitor system was designed and achieved excellent capacitance retention. The synergistic effect of the electric double layer and pseudocapacitive properties of the individual activated carbon and PANI significantly enhance the energy storage capacity of the composite system. Therefore, the preferable capacitive performance of the AC-PANI composite is suggested to be a favourable candidate for the electrode material in supercapacitors.

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Quercetin Nanocrystal Loaded Alginate Hydrogel Patch for Wound Healing Application

Wound healing can often be delayed due to unfavourable physiological conditions. Current wound healing strategies have many limitations, making the development of novel therapeutic patches urgently necessary. We developed a hydrogel-based wound healing patch containing quercetin, a natural flavonoid found in fruits and vegetables, which has emerged as a promising candidate due to its multifaceted therapeutic properties. It boasts potent antioxidant activity by neutralizing harmful free radicals that contribute to tissue damage and inflammation. Quercetin also exhibits anti-inflammatory and antimicrobial effects. Despite its therapeutic potential, its poor aqueous solubility and bioavailability limit its effectiveness when administered conventionally. Hydrogel facilitates the sustained release of the drug, which is highly beneficial for the rapid repair of wounds by reducing oxidative stress. Quercetin nanocrystals sized 600-800 nm were synthesized, demonstrating the controlled release of quercetin when embedded in a hydrogel patch. This approach has been utilized for in-vivo wound repair in a rat model. This study demonstrates the feasibility of using a novel therapeutic hydrogel patch containing phytochemical-based nanocrystals for rapid wound healing applications.

POS-29

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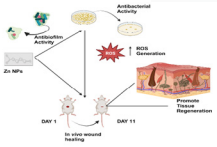
A great deal of research has been done on wound healing to ensure function preservation while achieving a quick recovery and little scarring. The antibacterial and antioxidant characteristics of nanoparticles (NPs) have made them attractive materials for applications related to wound healing. In order to hasten the healing of wounds, this study focuses on the creation and assessment of zinc nanoparticles (ZnNPs) that possess potent antioxidant and antibacterial properties (1). The nanoparticles are characterized using different analytical techniques. Cutaneous wounds were created on rats and randomized into 3 groups: a) nanoparticles treated; b) untreated, and c) silverex as positive control. The treatment was carried out for 11 days. DPPH test showed radical scavenging activity of the ZnNPs confirming anti-oxidant potential.
The nanoparticles showed cell viability in a dose dependent manner and found to be non-toxic. SEM images of nanoparticles incubated to E. coli monitoring biofilm showed disrupted cell membrane of bacteria showing antibiofilm properties (2). ZnNPs treatment rapidly reduces skin wounds within 11 days of treatment in the rat model and could be suitable for wound healing application. In addition, histopathological studies showed that nanoparticles could accelerate wound closure without formation of scar tissue. Overall, this study demonstrates the feasibility of using ZnNPs in the field of nanomedicine demonstrating multifunctional applications as anti-bacterial, anti-oxidant and wound healing.



Graphical abstract. Multifunctional applications of ZnNPs as an antioxidant, antibacterial and wound healing agent.

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The green synthesis of Zinc oxide nanoparticles (ZnO NPs) was successfully conducted using an extract of Camellia sinensis as a reducing agent. The synthesized ZnO NPs were calcined at varying temperatures to systematically analyze the impact of calcination temperature on their antibacterial activity. Comprehensive characterization techniques, including X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), ultraviolet-visible spectroscopy (UV-Vis), field-emission scanning electron microscopy (FE-SEM), energy-dispersive X-ray spectroscopy (EDX), and Brunauer-Emmett-Teller (BET) analysis, confirmed the formation and properties of the ZnO NPs. The antibacterial efficacy of these ZnO NPs was evaluated using the standard disc diffusion method against bacterial strains such as Staphylococcus aureus, Bacillus cereus, Klebsiella pneumoniae, and Escherichia coli. This green synthesis method using Camellia sinensis was found to be safe, non-toxic, and environmentally friendly, showcasing its potential for sustainable antibacterial applications.

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Development of Low-cost Sensors For Monitoring Odours in Ambient Air

The Internet of Things (IoT) has a crucial role in advancing various fields such as Industry 4.0, Big Data, and Machine-to-Machine technologies. All systems continuously gather information on various parameters such as temperature, speed, pressure, health data, environmental conditions, and consumption. Considering this, we've developed a novel fabrication method for H_2S gas sensor prototypes. These sensors are based on noble metal-functionalized on metal oxide semiconductor (MOS) chemiresistors. The fabrication process involved growing $CuCrO_2$ sensing thin film on SiO2/Si substrates using the RF sputtering method. Subsequently, Pd nanoparticles, known for their excellent gas-sensing catalyst properties, were functionalized onto the $CuCrO_2$ films using DC sputtering with varying sputtering times of 3, 6, 9, and 12 s. Nanorice morphology boosts gas absorption, capturing more target molecules. A 9s Pd sputtering time greatly improved H2S sensing over other gases. $CuCrO_2$ film with Pd showed the highest 72.3% response to 50 ppm H2S, detecting down to 0.5 ppm. These results were achieved at the optimal working temperature of 150 °C. After optimizing parameters, we transferred the technology to develop a sensor module for the prototype with IoT integration. The prototype sensor connects to NODEMCU-ESP8266 Wi-Fi, which links to a smartphone through a mobile hotspot.

Keywords: Metal oxides, Hydrogen sulphide, Gas sensors, Nanorice morphology, IoT.

POS-32

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Enhancement of H_2S Gas Sensing by Spillover Effect in Pd-Decorated Electrospun SnO_2/CuO Composite Nanofibers

H_2S, being the most noxious gas, has the potential to cause severe damage to health and death if exposed to higher concentrations. Semiconducting metal oxides (SMO) have played a fundamental role in detecting such lethal gases, being the sensing material in gas sensors. Strict instructions have been provided by OSHA to not be in an environment where more than 50 ppm of H_2S is present. Therefore, detecting H_2S gas at low concentrations is the priority of ongoing research. Our work demonstrated a Pd-decorated SnO2_CuO composite nanofiber, which is highly sensitive to 500 ppb of H_2S gas. The 1D composite nanofiber provides a high surface area for the H_2S gas adsorption. The relative response of SnO2/CuO composite nanofibers towards 500 ppb of H_2S gas is ~55% at 200 °C. The elevation in the relative response is due to the formation of metallic CuS from CuO, which provides more electron transfer for sensing. To increase the sensitivity, the SnO2/CuO composite nanofibers were sputtered with Pd for 9 s. The relative response boosted from ~55% to 60% with a faster response time of 27.39 s. The increase in sensitivity is observed as the Pd dissociates the H2S into SH and H free radicals, providing more gas interaction without any additional energy, which is widely known as the spillover effect. The Pd decorated SnO2/CuO composite nanofibers are selective towards the H_2S gas and are a stable material for industrial applications where detection of low concentration still stands as a challenging task.

POS-33

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WS2-decorated PdSe2-based Highly Sensitive and Selective Hydrogen Gas Sensor

The accurate detection of Hydrogen (H2) is essential in transportation, manufacturing, and storage due to its strong flammability. Therefore, there is a need for highly sensitive and selective H2 gas sensors. In this study, we have successfully fabricated a PdSe2/WS2 heterostructure, demonstrating outstanding characteristics as an H2 sensor. A thin film of PdSe2 is formed through a chemical vapor deposition by the direct selenization of Pd film that has been deposited using DC sputtering on a SiO2/Si substrate. The heterostructure is formed by drop-casting WS2 nanoparticles synthesized using the hydrothermal method onto the PdSe2 device. When the PdSe2 and PdSe2/WS2 devices were exposed to a 50-ppm gas at 100 ˚C, their H2 gas-sensing efficiency was evaluated. The results show a considerably improved response of 67.4% compared to pure PdSe2 (23.6%) due to the catalytic effect and the impact of n-type doping of WS2 NPs. The heterostructure exhibits superior selectivity towards H2 than other oxidizing and reducing gases. Also, the sensor shows a fast response (31.5 s) and recovery (136.6 s) time with a lower detection limit of 73 ppb towards H2. Further, density functional theory calculations showed that the PdSe2/WS2 device can adsorb H2 gas remarkably. This finding provides additional support for our experimental observations.

Keywords: Sputtering, Chemical vapor deposition, PdSe2/WS2 Heterostructure, H2 Sensing, Density functional theory

POS-34

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Ultra-trace Detection of Dopamine using Two-dimensional Cobalt Telluride

Dopamine is an essential neurotransmitter that plays a key function in various physiological processes of the brain. Deviant levels of dopamine indicate various neurological disorders like Parkinson's disease, Alzheimer's disease, or schizophrenia. To address the challenges associated with ultrasensitive dopamine sensing for regular health monitoring, here we have developed a sensor using two-dimensional Cobalt Telluride (2D-CoTe2). The 2D-CoTe2 coated glassy carbon electrode sensor shows a limit of detection (LoD) of 0.21 pM measured by Differential Pulse Voltammetry in 0.1 M phosphate buffer solution. The assessmentof selectivity, repeatability, and reproducibility has been conducted, to enquire about the efficiency of the sensor. The durability of the sensor has been verified for one month, demonstrating a minimal loss of 16 %. The interaction of the 2D-CoTe2 and dopamine has been investigated by chemical fingerprints using Fourier transform infrared spectroscopy, Raman spectroscopy and Raman imaging. Additionally, a flexible paper-based sensor using 2D-CoTe2 has been successfully fabricated and employed for real-time dopamine detection from artificial sweat, which has achieved a LoD of 0.22 pM.

Ultra-trace Detection of Dopamine using Two-dimensional Cobalt Telluride

POS-35

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Enhanced Field-Emission Characteristics of Laser Molecular Beam Epitaxy Grown GaN Nanostructures on Flexible Titanium Foil under Photo-Illumination

This study examines the cold field emission (CFE) characteristics of self-assembled GaN nanostructures, both in darkness and under ultraviolet (UV) light, synthesized on flexible titanium (Ti) metal foil using laser molecular beam epitaxy. When illuminated with UV light, the CFE current increased, reducing the turn-on field from 2.3 V/μm to 1 V/μm at a current density of 10 μA/cm^2 under 2.2 mW light irradiation. Additionally, the field-emission current density rose from 136 μA/cm^2 to as high as 844 μA/cm^2 at an electric field of 9 V/μm. This enhanced performance is attributed to the increased electron concentration in the conduction band and the decreased effective potential barrier height of GaN under UV illumination. These findings highlight the potential of GaN nanostructures as light-activated field-emission switches for device engineering and pulsed electron stream applications. In-depth discussion will be done on the growth mechanism, characteristics, and application of GaN nanostructures.

POS-36

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Bi-functional DES Supported DFNS Nano-structured Robust Catalyst for Efficient Fixation of CO2 into Cyclic Carbonates in Atmospheric Pressure

In the present research endeavour, a novel heterogeneous catalyst of deep eutectic solvent modified dendritic fibrous nano silica (DES@DFNS) was designed for the catalytic fixation of CO2 with styrene oxide. The prepared catalyst was well characterized using FE-SEM, SEM, XRD, BET and BJH, FT-IR respectively. The corresponding CO2 fixation was performed under atmospheric pressure, solvent and co-catalyst free condition. Remarkably, the CO2 fixation reaction showed excellent catalytic activity of 99% conversion, 96% of selectivity and high yield of 95% towards styrene carbonate at 120°C for 10 h under solvent-free, atmospheric pressure condition. We believed that, DES@DFNS catalyst showed existence of acid-base bi-functional nature in presence of base TBAI attributed excellent catalytic performance in the CO2 fixation reaction with styrene oxide synthesis of styrene carbonate. In addition, various reaction parameters effects were also tested and discussed in depth. To understand the scope of the catalytic activity, catalyst was tested with substituted epoxide and styrene to developed desired product. Catalyst has been reused up to successive six run without any appreciable loss in the catalytic activity. The slight degradation in the catalytic activity due distortion of the solid catalytic material. Besides the above, we have also tried to explain the plausible catalytic fixation of CO2 with various epoxide substrate was successfully performed. DES@DFNS catalyst can be reused up to six runs with slight distortion in the catalytic activity. The outcome of this methodology gave several advantages such as to avoid use of toxic solvents and hash oxidizing agents, fast recovery of the catalyst and systematic conversion of epoxides to desired cyclic carbonates. Also, the greener and eco-friendly, acid-base bifunctional catalyst, solvent-free condition, atmospheric pressure, high yield and reusability of catalyst considered as attractive key points in this current research endeavour.

Keywords: Greenhouse CO2 gas utilization; covalent immobilization; DES@DFNS catalyst; Fixation of CO2 into epoxides; Cyclic carbonates.

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POS-37

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Hydrogel-based sunlight-driven interfacial seawater desalination: state-of-the-art technique for water-sun-light-energy nexus

Sunlight-driven interfacial photothermal evaporation has been considered as a promising strategy for addressing global water crisis. Herein, we developed various types of hydrogel-based evaporator using nitrogen-doped carbon quantum dots-iron oxide hybrid nanocomposite (NCQD@ Fe304), mining waste, fibrous carbon derived from Saccharum spontaneum and match-sticks as the photothermal materials. Various hydrogels were used to generate vertically aligned porous channel so that it can float naturally. Water is transported to the evaporator interface through the porous network of the hydrogel matrix. Such a strategically designed hydrogel evaporator exhibits a very high broad-band light absorbance of 98%, a high evaporation rate of 2.65 kg.m-2h-1 , and an energy conversion efficiency of 98%, and outstanding salt-mitigation ability under the solar irradiation of one sun. Besides, these evaporators have been proven to be capable of restricting the evaporation of volatile organic contaminants (VOCs) like phenol, 4-nitrophenol, nitrobenzene, and various organic dyes like methylene blue, and methyl orange via adsorption and photocatalytic degradation to ensure the purity of the evaporated water. Such an innovatively designed evaporators offer a promising approach for the production of drinking water from wastewater and seawater.

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POS-38

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Compact STT/SHE-MTJ Model with Monte-Carlo Independent Thermal Noise

In light of the significance of magnetic tunnel junction (MTJ) devices in next-generation computing, there is a need for a compact STT/SHE-MTJ model to facilitate the simulation of hybrid MTJ/CMOS circuits. The existing SPICE-based compact MTJ model presented in the literature [4] and [5] incorporates noise using Monte-Carlo (MC) methods and also relies on commercial tools such as HSPICE and Cadence Virtuoso. However, when noise is integrated using this approach, it restricts incorporating other random variations during the MC analysis. Therefore, this model introduces the same noise in every simulation, resulting in an inability to effectively represent random noise variations within the MC analysis. This work presents a physics-based compact STT/SHE-MTJ model for hybrid MTJ/CMOS circuit simulation that accurately emulates the device physics and stochastic nature of the MTJ. This development aims to motivate researchers to develop and simulate hybrid CMOS/MTJ circuits and systems without the need for expensive EDA tool access. Moreover, this model integrates thermal noise without using the MC approach, i.e., the MC independent approach, which effectively captures the thermal noise as well as random fluctuations in other parameters within hybrid MTJ/CMOS circuits during the MC analysis. To demonstrate the functionality of this model, MC simulations are performed on the MTJ.

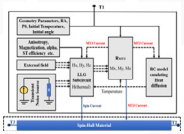

Fig. 1 NGSPICE simulation framework for STT/SHE-MTJ Model

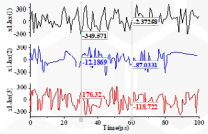

Fig. 2 MC response of noise variation at a x1(hx) node of MTJ model.

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Nano-Nest Composites: Revolutionizing Next-Generation Wastewater Remediation with Tin Oxide and Carbon Nanotubes

Tin oxide (SnO2) and carbon nanotube (CNT) nano-nest composites are at the forefront of advanced water treatment technologies, offering innovative solutions to tackle water purification challenges. This study explores their synergistic potential, leveraging the unique structure of SnO2/CNT nano-nests to significantly enhance both adsorption capabilities and photocatalytic activity. By effectively targeting organic pollutants and heavy metals present in water, these composites demonstrate exceptional efficacy in contaminant removal. Furthermore, their inherent high stability and reusability contribute to their sustainability as viable options for next-generation water treatment applications. This research underscores the transformative impact of nanostructured materials in improving water quality and advancing environmental sustainability goals. By harnessing the enhanced properties of SnO2/CNT nano-nest composites, this study not only addresses current water treatment challenges but also paves the way for future developments in efficient and eco-friendly water purification technologies.

Keywords: - Tin oxide, SnO2, carbon nanotube, CNT, nano-nest composites, water treatment, adsorption, photocatalysis, environmental sustainability

POS-40

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The Development Of A Biocidal Agent Coated Pu Facemask Filters With High Filtration Efficiency And Biocidal Activity

Emerging air born infectious diseases (EIDs) are a significant burden on global economies and public health. Antibacterial air filters are an essential to prevent EID transmission. Herein, bioprotective nanofibrous membranes with rechargeable antibacterial and antiviral activities that can effectively produce biocidal reactive oxygen species (ROS). A novel antibacterial complex 3,3′ -4,4′- benzophenone tetra carboxylic dianhydride/graphene oxide (BTD/GO) were loaded in polyurethane nanofibrous can produce photoactive air filters that can store the biocidal activity under light irradiation and dark condition, making the biocidal function "always online." The resulting membrane exhibit integrated properties of fast ROS production, ease of activity storing, long-term durability, robust breathability, interception of fine particles (>98%), and high bactericidal (>99.9999%), which serve as a scalable biocidal layer for protective equipment by providing contact killing against pathogens either in aerosol or in liquid forms. The successful synthesis of these fascinating materials may provide new insights into the development of antibacterial air filter in a sustainable, self-recharging, and structurally adaptive form.

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Indwelling medical device surfaces, like urinary catheters (UC) and central venous catheters (CVC), are susceptible to bacterial adherence that can result in colonization and biofilm formation. This can put patients' at risk for a variety of catheter-associated infections, including urinary tract infections and central line bloodstream infections. This work introduces a novel method for developing an antibacterial catheters by impregnating nanofibrous yarns with a bactericidal drug rifampicin (rif). At first, rifampicin-loaded poly(ε-caprolactone) (PCL) nanofibrous yarns with 30 wt% rifampicin shown significant antibacterial activity against Escherichia coli and Staphylococcus aureus. Then, using a custom made aluminum mold with inner and outer diameters of 4 and 6 mm, rifampicin-loaded nanofibrous yarns at a concentration of 0.1g were embedded to fabricate silicone catheters. Through scanning electron microscopy (SEM) morphological characterization showed well-aligned integration of nanoyarns inside the inner lumen of the catheter. Fourier-transform infrared spectroscopy (FTIR) and energy-dispersive X-ray spectroscopy (EDAX) validated the effective incorporation of rifampicin into the nanofibrous yarns. The resultant catheters showed superhydrophilic characteristics, which boded well for fouling mitigation. Significant zones of inhibition against S. aureus and E. coli, measuring 4 cm and 2 cm, respectively, were found by antimicrobial testing. Notably, the catheters' mechanical integrity was not affected by the yarn embedding. Moreover, rifampicin release was sustained for 90 days, indicating long-term antibacterial activity. Catheters embedded with PCL/rifampicin nanoyarn showed sustained antibacterial activity, antiadhesive qualities, and stability over a 90-day period, suggesting that they have a great potential for use in clinical settings.

POS-42

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Biomass-derived hydrogel-based sunlight-driven interfacial evaporator for seawater desalination: state-of-the-art technique for water-sunlight-energy nexus

Sunlight-driven interfacial photothermal evaporation (SDIE) has been emerged as a promising strategy for addressing global water crisis. Sunlight-assisted desalination is implemented to overcome the consumption of high energy in the recent desalination techniques, since it uses sustainable and abundant sunlight as the only energy input. SDIE has attracted significant research interest due to its simple implementation, cost-effectiveness, and high energy conversion efficiency. Among the various photothermal materials for solar evaporators, carbon-based photothermal materials stand out because of its better solar absorption capacity, easy preparation method, low-cost, tunable structure, and high abundancy on earth. To design the interfacial evaporator, the photothermal materials were integrated with hydrogel matrix. Hydrogel can easily absorb light, and can increase the photo-thermal conversion efficiency by lowering heat loss during heat transfer that results from heat localization at the air–water interface. Because of existence of interconnected pores, water can move from the bottom to the water-air interface effectively. Based on this concept, this presentation will disclose design of different hydrogel based evaporators using carbon fibre derived from sustainable sources and different functional hydrophilic biopolymers. Further to ensure the purity of the evaporated water the hydrogel is enriched with phototcatalytic nanoparticles in optimised amount. Such types of meticulously designed hydrogel ensures high evaporation rate, salt-mitigation, and restricts the evaporation of volatile organic contaminants during the evaporation process.

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Enhancing Seed Germination and Seedling Growth of Arka Rakshak F1 Tomato Using Solar-Assisted and Co-Precipitation Synthesized CuO Nanoparticles for Seed Priming

Nanoparticles (NPs) and their disposal through anthropogenic activities have become a new environmental concern. The impact of copper on plant metabolism remains insufficiently studied. In this research, Copper oxide nanoparticles (CuO NPs) were synthesized using solar-assisted and co-precipitation methods with copper acetate monohydrate as the precursor. Various analyses, including X-ray diffraction, particle size analysis, Scanning Electron Microscopy (SEM), and Fourier Transform Infrared Spectroscopy (FTIR), confirmed that the synthesized CuO NPs are within the nano size range. The impact of these synthesized nanoparticles on the germination and seedling growth of Arka Rakshak F1 (Lycopersicon esculentum) was tested at different concentrations: 50, 150, 300, 450, and 600 mg/L. At lower concentrations, the germination and seedling growth were almost unaffected, while significant inhibition was observed at the higher concentrations of 300, 450, and 600 mg/L for both the solar-assisted and co-precipitation methods compared to the control. Our results revealed that Cu2+ had a favourable effect on the early growth of tomato seedlings. However, long-term exposure to higher concentrations (300, 450, and 600 mg/L) resulted in oxidative damage and reduced morphology of the Arka Rakshak F1 tomato seedlings.

Keywords: Solar-assisted CuO NPs, Co-precipitation CuO NPs, Arka Rakshak F1,Seedling growth and Nano agriculture.

POS-44

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Harnessing solar light driven bismuth ferrite @ polyaniline nano composites for dye degradation

Water is the most essential component of life for all living organisms, and it is estimated that nearly 800 million people around the world still do not have access to safe drinking water of sufficient quality for domestic purposes. The synthetic dyes used in the textile industry pollute a large amount of water. Textile dyes do not bind tightly to the fabric and are discharged as effluent into the aquatic environment. As a result, the continuous discharge of wastewater from a large number of textile industries without prior treatment has significant negative consequences on the environment and human health. Therefore dye containing wastewater should be effectively treated using eco-friendly technologies to avoid negative effects on the environment, human health, and natural water resources. The continuously growing need for clean water has increased research looking for new and efficient ways to treat wastewater. Due to its magnetic properties, Bismuth ferrite, a photo-catalyst, has introduced a novel field of photo-catalysis where the photo-catalytic material could easily be separated from the aqueous solution after wastewater treatment. The studies of advanced materials in environmental remediation and degradation of pollutants is rapidly advancing because of their wide varieties of applications. BiFeO3 (BFO), a perovskite nanomaterial with a rhombohedral R3c space group, is currently receiving tremendous attention in photodegradation of dyes. Photocatalyses such as hydrogen generation from water splitting or degrading organic contaminant on photocatalysts under solar light is promising in solving current energy and environmental issues. BiFeO3 is considered as one of the most promising materials in the field of multiferroics with great potentials in photocatalysis due to their excellent properties of relatively small band gap, stable structures, and low cost.

Keywords: Bismuth ferrite, Multiferroics, Photocatalysis, Band gap

POS-45

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Graphite carbon nitride (g-C3N4/GCN) nanoparticles (NPs) derived from Aloe vera gel represent a ground-breaking method with important biological applications. Unlike traditional dangerous chemical-based procedures, this unique process makes use of the complex content of Aloe vera, which includes glucose, proteins, acemannan, and amino acids. These GCN NPs have outstanding optical, mechanical, and chemical properties, as demonstrated by X-ray diffractometry (XRD), Fourier transform infrared spectroscopy (FTIR), Scanning Electron Microscopy (SEM), Energy Dispersive X-Ray Spectroscopy (EDS), and RAMAN Spectroscopy. Their chemical inertness, nontoxicity, and high biocompatibility highlight their potential in a variety of applications. The antimicrobial activity of the synthesized GC_3N_4 was evaluated against various bacterial strains using standard microbiological assays. The results depicted concentration of GC_3N_4 NPs was increased (50, 70, 90 µg/ml) and increase in antimicrobial activities was due to the increase of H_2O_2 concentration from the surface of GC3N4. The results demonstrated that g-C_3N_4 synthesized using aloe vera gel exhibited significant antimicrobial properties. The study highlights the potential of using renewable natural resources for the synthesis of advanced materials with promising applications in antimicrobial treatments. This green synthesis approach not only provides an environmentally benign pathway for producing GC_3N_4 but also opens new avenues for the application of biogenic materials in nanotechnology

Keywords: Graphite Carbon Nitride Nanoparticles, Green Synthesis, Aloe Vera Gel, Characterization analysis and Anti-microbial activity.

POS-46

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This study investigated the UV absorption properties of cellulose acetate coating in combination with the amino acids' phenylalanine, tyrosine, and tryptophan which is derived from prawn shell on glass substrates. UV analysis was performed using UV-visible spectroscopy to measure the UV absorption spectra of cellulose acetate, individual amino acids, and composite coatings. It was found that cellulose acetate exhibited minimum UV absorption, while the amino acids showed distinct UV absorption peaks in the UV region due to their aromatic and conjugated structures. The composite coatings of cellulose acetate and the amino acids demonstrated enhanced UV absorption compared to cellulose acetate alone. These findings suggest that the incorporation of phenylalanine, tyrosine, and tryptophan can effectively improve the UV absorption properties of cellulose acetate coatings on glass, offering potential applications in UV protection. Further investigations could focus on optimizing the composition and concentration of amino acids to achieve the desired UV-blocking capabilities and exploring the long-term stability and durability of the composite coating.

POS-47

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Interaction of Nanoparticles with Probiotic Media: A Comparative Study of Bifidobacteria Growth in TGE and MRS Media

Probiotics, defined as living organisms that confer health benefits when consumed in adequate amounts, are widely used in drinks and yoghurts, with bifidobacteria being the most common strains. This study investigates the interaction of nanoparticles with optimized media for the growth of Bifidobacterium longum, specifically comparing Tryptone Glucose Yeast Extract (TGE) media with the commonly used, yet expensive, MRS media. TGE media, primarily composed of soybean meal and commercially available from Hi-media laboratory, was tested against synthetic media to observe B. longum growth comparable to that in MRS media. Bifidobacteria were cultivated in three different media broths, and growth curves were determined using the pour-plate method to obtain CFU/ml. Significant results were observed during the stationary phase at 50 and 55 hours. A 100% inoculum was added to all media, supplemented with 0.05% L-Cysteine, and incubated at 37°C for 24 to 48 hours. Based on the growth curve, stationary phase cells were selected for mass cultivation in TGE media. The TGE media demonstrated a comparable number of colonies to MRS media, proving effective for large-scale cultivation of B. longum. Future studies should scale up the experiment, freeze-dry the cultures, and assess the viability and curdling properties post-freeze-drying. This research presents the potential to replace the costly MRS media with the more economical TGE media for probiotic cultivation, highlighting the role of nanoparticles in optimizing probiotic media.

Keywords: Probiotics, Bifidobacterium longum, TGE media, MRS media, Nanoparticle interaction, Growth curve, Mass cultivation, Freeze-drying.

POS-48

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Clean and safe water is a basic human requirement for the multifaceted development of society and a thriving economy. Rapid population growth, expanding industrialization, urbanisation, and extensive agricultural practises have resulted in the generation of wastewater, which has rendered the water not only dirty or polluted, but also lethal. Every year, millions of people die because of diseases transmitted through the consumption of contaminated water. Although various methods for wastewater treatment have been investigated in recent decades, their use is limited by a few constraints, including the use of chemicals, the formation of disinfection by-products, time consumption, and cost. Nanotechnology, defined as the manipulation of matter at the molecular or atomic level to create new structures, devices, and systems with superior electronic, optical, magnetic, conductive, and mechanical properties, is emerging as a promising technology that has demonstrated remarkable feats in a variety of fields, including wastewater treatment. Nanomaterials have a high surface-to-volume ratio, high sensitivity and reactivity, high adsorption capacity, and ease of functionalization, making them ideal for wastewater treatment. We reviewed the techniques being developed for wastewater treatment using nanotechnology, including adsorption and biosorption, nanofiltration, photocatalysis, disinfection, and sensing technology. This extends talk, we will discuss the fate of nanomaterials in wastewater treatment, as well as the risks associated with
their use.

Keywords: Nanomaterials, Wastewater, Treatment and Management

POS-49

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Synergic integration of WO3-NPs with 2D-WS2 for Advanced Broadband Photodetection

Broadband photodetection, especially in the deep UV range, is challenging due to silicon's negligible optical absorption at 254 nm and the need for integration with high-bandgap materials.1 Monolithic integration of these materials on silicon is hindered by CMOS fabrication incompatibility. This study presents the first experimental and theoretical investigation of 2D/0D heterojunctions of WS2/WO3 on a silicon platform, revealing the charge transfer mechanisms.2 Transient photocarrier decay experiments show effective quenching of excited photocarriers in the WO3/WS2 heterojunction, enhancing carrier transport, supported by DFT simulations.3 The designed p-Si/WS2/WO3 heterojunction-based photodetector demonstrates exceptional photosensitivity with a broad spectral response from 254 nm to 940 nm. The device achieves a peak responsivity of 251 A/W and a specific detectivity of 1.89×1014 Jones, with rise and fall times of 0.64 s and 0.48 s, respectively, at 365 nm under a 2-volt bias. This work demonstrates broadband photodetection, including deep UV, using nanostructured WO3 on a silicon platform with WS2 as a charge transport mediator. This approach offers a promising pathway for developing low-cost, air-stable broadband photodetectors for optoelectronic applications.

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POS-50

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Unleashing the Bifunctional Activity of Iron Phthalocyanine-Reduced Graphene Oxide Hybrid for Water Electrolysis

The development of an efficient and highly durable bifunctional electrocatalyst for water-splitting reaction is crucial for practical applications to meet energy requirements. Herein, aminenaptholsulphanic acid trifunctional monomer infused iron phthalocyanine (FeSPc) to tune the properties and evaluated as bifunctional catalyst for waer electrolysis i.e., hydrogen evolution reaction (HER) and oxygen evolution reaction (OER). The designed catalyst is characterized using various spectroscopic and analytical techniques. The synthesised supramoleculeis physically treated with reduced grapheme oxide (rGO) and the resllting hybrid is coated on glassy carbon electrode (GCE) and evaluated for HER and OER bifunctional activity for water electrolysis. GCE/ FeSPc-rGO electrode exhibited a lower overpotential of 93mV and 350 mV at -10mA.cm-2 for HER and OER in 0.5M H2SO4and 1.0M KOH electrolyte respectively. Further, the fabricated Ni-foam/ FeSPc-rGO electrode manifested a lower overpotential of 330 mV at a current density of 10 mA.cm-2 in 1.0 M KOH electrolyte at a scan rate of 5 mV.s-1. The Tafel slope value for the designed electrode is 42mV.dec- 1 for both HER and OER indicating facile reaction kinetics and efficient hydrogenandoxygen evolution. Additionally, the electrocatalyst showed greater stability and durability for long-period performance by retaining its catalytic activity without any significant degradation of the structure. The fabricated bifunctinal catalyst has the ability to replace precious monofunctional benchmark catalysts like Pt/C and IrO2 and can overcome the complexity associated with the precious monofunctional benchmark catalysts.

Keywords: Supramoleculephthalocyanine; water splitting; hydrogen evolution reaction; oxygen evolution reaction; Tafel slope; stability.

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Atmospheric gases mostly in industrial region is contaminated with the presence of NO2, NH3, sulphur compounds and many other toxic pollutants. The effective way of detecting such gases is already explored with metal organic framework and conducting polymers. Carbon based nanomaterials especially graphene-based composites has significantly proved to be a prominent figure in gas sensing applications because of their chemical versatility and showing high response of 5.21 to 10 ppm NO2 with recovery time less than a minute. Metal chalcogenide nanocomposites like Molybdenum Sulphide (MoS2), Cadmium Sulphide (CdS), Indium Selenide (InSe) can have effective detection cycles of these toxic pollutants due to their structural significance. Dopants and defects incorporated on sheets of MoS2 have profound influence on transport properties through scattering mechanism and adsorption.

Graphene metal chalcogenide (G-InSe/ G-CdS/ G-MoS2) having their superior electronic properties will help them as a good gas sensor. Their potential for unique sensitivity can be improved with engineering defects and doping with elements like boron and nitrogen due to their enhanced charge carrier concentration. The improvement of active locations for sensing for performance stability of the material has yet to be addressed by calibrating the synthesis methods. The I-V curves studied have results of this prospective compound as an electrochemical sensor. Graphene metal chalcogenide is a promising compound which will provide fast response time and early detection of toxic pollutants.

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POS-52

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Physical and photoluminescence properties of Sr-doped SnO2 nanostructured thin films

In the current work, pure and Sr-doped SnO_2 thin films were grown on a glass substrate using the sol-gel spin coating approach. The polycrystalline tetragonal crystal structure of all the deposited films was demonstrated by X-ray diffraction analysis. The surface topography and surface roughness (R_{rms}) were estimated with the AFM analysis. The Fourier transform infrared spectroscopy (FTIR) study showed that all the films exhibit the Sn-O, Sn-O-Sn, Sn-OH, and O-H vibration peaks. The XPS spectra of Sr-doped SnO2 films revealed the presence of Sn, O, and Sr elements and their oxidation states. In the visible spectrum, the Sr-doped SnO2 films have shown optical transmittance of more than 76%. In the pure SnO2 film, the optical band gap energy (E_g) was determined to be 3.89 eV. However, the band gap energy decreases with Sr doping, with the lowest band gap of 3.78 eV achieved in the 5 at% Sr: SnO2 film. The photoluminescence (PL) analysis showed a robust green emission peak and low intensities of UV and blue emission bands in Sr-doped SnO2 films. Additionally, a high figure of merit (Φ) of $3.8\times10^{-3}\ \Omega^{-1}$ and a minimum sheet resistance (R_{sh}) of 32 Ω/Sq were observed in the 3 at% Sr: SnO2 film.

POS-53

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Strong Red Emission of Europium (III)-Activated $BaZrO_3$ Phosphors for Solid-State Lighting and Advanced Forensic Applications

In the present study, a combustion method was utilized to prepared the intense red emitting Eu^{3+} ions doped $BaZrO_3$ nanopowders. The obtained fluorescent powders were examined for their structural, surface morphology, luminescence, photocatalytic and forensic studies. The powder X-ray diffraction (PXRD) outcomes exhibit simple cubic phase. The scanning electron microscopy (SEM) micrographs revealed the surface morphology of the prepared powders. Further, Transmission electron microscope (TEM) micrographs exhibited particle size and it was found to be around 45 nm. The four significant photoluminescent emission peaks of Eu^{3+} ions located at $^5D_0 \rightarrow 7F_0$ (578 nm), $^5D_0 \rightarrow {}^7F_1$ (591 nm), 5D0$\rightarrow$ $^7F_2$ (601 nm), $^5D_0 \rightarrow F_3$ (612 nm) were observed under 393 nm excitation wavelength. The synthesized powders were studied for their excellent photocatalytic properties. The obtained results indicated that, the present powders can be successfully used as dyes in the treatment of polluted water. The obtained nanopowders were also evaluated for advanced forensic applications. The powders exhibited excellent visualization of latent fingerprints on several substrate surfaces without any background interference. The found all results demonstrated that, the designed nanopowders can be essentially utilized as dye removal in the polluted water, red component in white LED fabrication and advanced forensic applications.

Keywords: Fluorescent powder, luminescence, wLED, photocatalytic and latent fingerprint.
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POS-54

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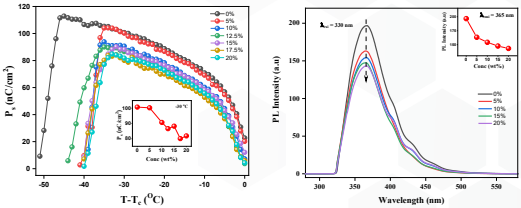
Impact of Graphene Quantum Dots on Photoluminescence, Dielectric, and Electro-Optic Properties of Liquid Crystal

We have investigated the effect of Graphene Quantum Dots (GQDs) on the dielectric, polarization, and fluorescence properties of MHPOOCBC, a ferroelectric liquid crystalline (FLC) system by varying GQD concentrations. Our findings reveal that the inclusion of GQD not only reduced the transition temperature but also resulted in a reduction in polarization, rotational viscosity, anchoring energy coefficients, and a faster response time, a feature attractive from an application point of view. On the other hand, GQDs bring out substantial differences in the magnitude of the dielectric relaxation frequency and the Δε associated with the Soft mode in the SmC* phase. The strength however is independent of temperature in both the pure compound as well as in the nanocomposite. Fluorescence spectrum analysis indicates that the peak wavelength remains largely unaffected, while photoluminescence (PL) intensity decreases with increasing GQD concentration. The PL spectra, analyzed using a Stern-Volmer plot, exhibit a non-linear, downward concave trend towards the X-axis, suggesting the presence of both static and dynamic quenching mechanisms.



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Perovskite solar cells based on methylammonium lead iodide (CH3NH3PbI3) and related materials have emerged as an exciting development for next generation photovoltaic technologies. Solar cells based on them have achieved impressive energy conversion efficiencies, but their stability is still limited. Understanding degradation mechanisms in such materials is key to developing strategies to increase their lifetime. The present work reports on the nanoscale characterization of perovskite thin films with respect to their stability and degradation mechanisms. We investigated the local conductance and surface potential variation of perovskite films at the nanoscale using conducting atomic force microscopy (CAFM) and Kelvin probe force microscopy (KPFM). CAFM measurements revealed that the current is larger at grain boundaries. CPD differences between GBs and grains is almost same which suggest the ability of charge carriers capture is almost same in grains and GBs. We investigated the effect of sunlight exposure on the nano-scale conductance and surface potential of perovskite thin films towards better understanding of photo-induced degradation mechanisms.

POS-56

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Influence of defined in vitro priming conditions on enhancing the therapeutic potential of human mesenchymal stem cell-derived exosomes

Mesenchymal stem cells (MSCs) are renowned for their immunomodulatory and tissue regenerative properties. Despite their potential, clinical applications of MSCs face stringent regulations due to the unpredictable risks of transplanting culture-expanded live cells. MSC-derived exosomes, ranging from 30 to 200 nm in size and containing miRNA, proteins, and other bioactive molecules, have emerged as promising alternatives that offer the therapeutic benefits of MSCs without associated risks.

However, the impact of in vitro priming conditions on modulating the therapeutic potential of human MSC-derived exosomes, including changes in the quality and quantity of payloads such as miRNA, proteins, and other bioactive molecules, remains unclear. This study aims to address this critical gap by investigating how specific priming conditions influence the exosomes' efficacy. By systematically varying the priming environment, we seek to elucidate how these conditions affect the molecular composition and functional capabilities of the exosomes. Exosomes have been successfully isolated from human MSCs primed under various conditions including different glucose conditions, oxygen tension. The isolated exosomes were characterized by Fe-SEM, TEM, DLS, and NTA analyses, revealing a size range of 173.83 nm ± 84.5 nm. These exosomes were investigated for their influence on the proliferation, differentiation and functionality of MSCs, HSCs and endothelial cells were investigated.

The study results showed that exosomes from MSCs significantly upregulate proliferation marker genes in all the investigated cells and influenced the differentiation and functionality. This suggests that developing suitable in vitro priming systems can harness the full potential of exosomes for therapeutics and regenerative medicine.

Key words: Exosomes, immunomodulation, HSC expansion, in vitro priming , MSCs , HSCs,

POS-57

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Influence of support textural property on CO2 to methane activity of Ni/SiO2 catalysts

Nanoparticle-based catalysts have significant advantages over conventional bulk-phase catalysts due to their higher surface area and greater exposure to the reactants. Support materials in catalysis play a pivotal role by providing the foundation for dispersion, influencing catalytic efficiency via textural properties and interactions between reaction-intermediates and active sites. Therefore, selection of suitable support materials is a crucial aspect of designing catalysts. Catalytic hydrogenation of anthropogenic carbon dioxide is one of the many pathways to mitigate greenhouse gas emissions and fight against climate change. However, compared to the existing lab-based technologies, the thermochemical route has the potential to be readily translated to industry-level due to its ease of scalability.

Here, we elucidated the role of the physicochemical textural properties of inert support on catalytic activity by impregnating nickel nanoparticles on ordered mesoporous silica (SBA-15 and MCM-41) and non-mesoporous silica (nMPS). The differences in the nature of catalysts, degree of distribution, and nanoparticle encapsulation were studied by isotherm analysis and spectroscopic experiments. Operando studies were used to understand the variance in reaction pathway attributed to the textural properties. The Ni/SBA-15 catalyst followed dissociative CO pathway, while MCM-41 and nMPS counter-parts favoured associative formate mechanism, resulting in a difference in conversion and selectivity.

POS-58

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Nanoscale photonics explores novel realms of light-matter interaction with broad implications for diverse technological applications. Intense nanosecond laser pulses interacting with metallic surfaces create high-density plasma, driving interest in their use as compact astrophysical sources for studying rapid reaction dynamics, nano-scale imaging, and lithography. Our previous work optimized laser coupling with solid metallic targets to investigate the expansion behaviour of laser-produced silver plasma in ambient liquid, employing space-resolved optical emission spectroscopy. This method also facilitated controlled synthesis of silver nanoparticles through plasma-initiated processes via laser ablation [1]. Additionally, we developed green nano-hybrid materials in-situ via laser ablation for chemical sensing and produced low-toxic, highly luminescent graphene quantum dots (GQDs) for bio-sensing and imaging. Systematic studies on their linear and nonlinear optical responses, along with antibacterial properties, have been documented [2-4]. Furthermore, we designed graphene-metal nanocomposites using liquid-phase laser ablation and explored the nonlinear optical responses and sensing capabilities of various metal-organic frameworks and transition metal dichalcogenides (TMDCs) like MoS_2 and WS_2, characterized by a hexagonal arrangement of metal atoms (M) between layers of chalcogen atoms (X) in the MX_2 stoichiometry. Complemented by rigorous experimental investigations from controlled synthesis to structural and optical property analyses, our research integrates high-level Ab initio quantum mechanical and molecular dynamics simulations. These efforts provide critical insights for evaluating properties against technological demands, guiding the development of advanced photo-generated nanomaterials for future applications.

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POS-59

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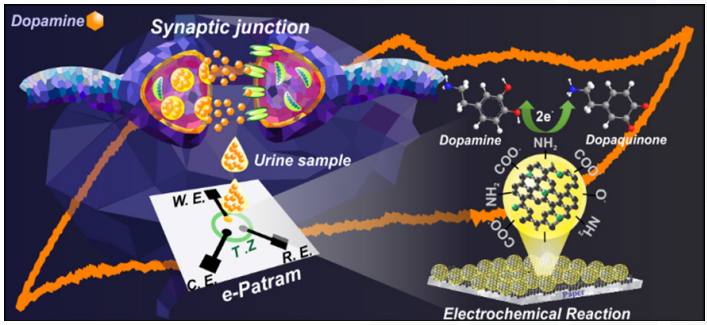
Engineering Paper into an Advanced Ultrasensitive Electrochemical Point-of-Care Testing Device for Neurotransmitter Detection in Urine

Dopamine (DA) plays a key role in regulating bodily functions such as motor skills and memory. Fluctuations in DA levels could indicate neurodegenerative diseases like Parkinson's and Alzheimer's, making it crucial to monitor these levels for early detection. We introduced an innovative method, the e-Patram, a paper-based POCT sensor designed to quickly detect DA in urine—a non-invasive, easily obtained sample. The challenge in urine testing lies in the similar redox potentials of DA, ascorbic acid, and uric acid. We overcame this by modifying the e-Patram electrodes with N-CQDs, improving their selectivity for DA even amidst high concentrations of interfering substances. This adjustment enabled the detection of DA at levels as low as 48 pM, a record low for paper-based electrochemical sensors. The successful application of this sensor in testing human urine showcases its potential to significantly impact healthcare by enabling regular monitoring of neurological health.



POS-60

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Fabrication Of Biocomposite Alginate Hydrogels Loaded With Eggshell-Derived Bioceramic Nanohydroxyapatite To Augment In Vitro Osteogenesis And Plant Growth

Hydroxyapatite (HAP) is the portion of the bone which majorly contributes to the inorganic content of the bone matrix. It confers rigidity and hardness to the bone and any low hydroxyapatite content in the bone can compromise the quality of the bone matrix, decrease bone strength and increased fragility of bones. Hydroxyapatite can be naturally derived from many sources including plant, animal and microbial sources by simple methods. Chicken eggshells are an important natural source of hydroxyapatite which are nonedible and are considered as a solid waste. Such waste adds up to the load on the environment and poses great challenge in solid waste management. Deriving hydroxyapatite from such abundant waste sources and utilizing it for potential applications would pay way not only for sustainable usage of natural resources but also enable reuse of such solid wastes thereby reducing considerable load on the environment. This study explores the use of eggshell-derived bioceramic (nanohydroxyapatite) for medical (osteogenic property) and agricultural applications. Biocomposite hydrogels formed from biopolymer Sodium alginate containing the matrix nanohydroxyapatite were used for the controlled release of target drugs (natural bone growth promoters like phytoestrogens) to enhance in vitro osteoblastic proliferation. These hydrogels were introduced to osteoblast cultures in varying concentrations to assess the influence on matrix mineralization by Alizarin red staining ,Vonkossa staining and by morphological studies. Additionally, the potential of nanohydroxyapatite as a source of phosphorus in agriculture was tested by studying the impact on growth and seed germination (Trigonella foenum- graecum and Raphanus sativus). This study is expected to provide a basic understanding of the usage of bioceramics in biocomposite hydrogels for dual applications. This can also help in sustainable utilization of biowastes providing an eco/environment-friendly approach to reduce the load on the environment.

Keywords:
Hydroxyapatite, Osteoblasts, Alginate, Trigonella foenum-graecum and Raphanus sativus.
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POS-61

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'Janus' is a Greek word derived from the mythological God having two faces. Several researchers have attempted to develop Janus textiles, where a single fabric could offer two different characteristics on each side. However, this research work focused on preparing a bi-layered nanofilm based textile material suitable for making surgical gloves. A bi-layered textile material was developed by electrospinning technique, wherein one side of the 'Janus' glove material was made of Polyvinyl Alcohol (PVA) nano-film (hydrophilic layer), which facilitated breathability and thermo-control properties. The glove material's other side (hydrophobic layer) was developed using Polyurethane and polyvinyl chloride (PU+PVC) in combination with Betulin, which served as an antimicrobial agent. The hydrophilicity and hydrophobicity of either side of the developed glove material were confirmed by contact angle analysis, which showed acute and obtuse meniscus formations for (PVA) and (PU+PVC) nanofilms. The antimicrobial activity of incorporated Betulin in the (PU+PVC) hydrophobic layer was confirmed by the AATCC-100-2019 test method. Physical properties like tensile strength of each nano-film, water absorbency, and quick drying ability of the resultant textile bilayer were also analysed. Moreover, the morphology of the developed bi-layered material was assessed by FTIR and SEM characterization.

POS-62

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Graphene-Doped Hydrogels Promoting Ionic Conductivity In Gel Valve-Regulated Lead Acid Battery

In this study, the impact of graphene-doped poly(vinyl alcohol) hydrogels on gel valve-regulated lead acid batteries was examined. The gel formulations were made by adding various amounts of graphene into the gel system comprising poly(vinyl alcohol) and sulphuric acid. Gel formulations were subjected to ionic conductivity study and Fourier transform infrared spectroscopy (FTIR) to understand ionic mobility and material interaction, respectively. Cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS) and potentiodynamic polarization (PDP) were utilized to find the optimized amount of graphene in gel formulations. Galvanostatic charge-discharge (GCD) techniques were employed on a battery comprising an optimized gel electrolyte. Battery exhibited a discharge capacity of 12.82 mAh at a current density of 15 mA cm−2. After 500 prolonged cycles, the battery displayed a discharge capacity of 87 % at 25 mA cm−2 current density indicating that graphene-doped hydrogels can be a promising gel electrolyte for lead acid batteries.

POS-63

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In recent years, graphene-based membranes are extensively explored for desalination process to fulfil the pure water scarcity. Still, there is a noticeable gap in the research on a technique that simultaneously deposits a membrane and also generates pores in the flake of membrane. In this work, we demonstrated a one-step and scalable protocol i.e., a conventional atmospheric plasma spraying (APS) to fabricate a graphene nanoplatelets (GNP) membrane for water desalination application. Various characterization tools: FE-SEM, Raman, and TEM etc., were utilized to evaluate the deposition of GNPs flakes and induced sub-nanometer pores in the large area GNP membrane. Plasma-sprayed GNP membrane showed impressive desalination performance in terms of water flux, salt rejection, and permeability around ~67 Lm-2h-1, ~99 %, and ~115 Lm-2h-1bar-1 respectively at 0.6 bar of transmembrane pressure (TMP). This performance of the GNP membrane was attributed to the critical role of graphene in terms of its structures, including induced pores within graphene sheets and its functions. Our deposited GNP membrane is cost-effective and showed the applicability of conventional plasma spraying in the design of nanomaterials-based membranes for various water purification protocols.

Keywords: Graphene nanoplatelets, Plasma spray, Sub-nanometer pore, Desalination, Salt rejection rate.

POS-64

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Large-scale production of high-quality ultrathin layers (1–3 nm) of molybdenum disulfide (MoS_2) with absolute (≈100%) 1T-phase is still in its infancy. Therefore, it is extremely crucial to have a technique for the mass production of ultrathin 1T-MoS_2 layers. Here, a direct, single-step, and ultra-fast technique that produces high-quality ultrathin layers of 1T-MoS_2 with a production rate as high as 58 g h^{-1} without the usage of any intercalates or solvents is demonstrated. The exfoliated ultrathin 1T-MoS_2 layers exhibited ≈100% 1T-phase with a large specific surface area (67 m^2 g^{-1}), higher electrical conductivity (140 S m^{-1}), high thermal stability (up to 500 °C) and hydrophilicity (water contact angle (WCA): ≈23.4^0). The ultrathin 1T-MoS_2 layers showed a higher specific capacitance of 420 F g^{-1}; perhaps an ideal candidate for the electrodes of supercapacitors. Moreover, the ultrathin 1T-MoS_2 layer exhibited better mechanical flexibility and retained its original performance on bending between 0 and 180^0 angles. Further, an initial trial is done on other transition metal dichalcogenides (TMDs) i.e., tungsten disulfide (WS_2), and observe similar results. The work sheds light on the simultaneous exfoliation and phase transformation of TMDs in large quantities, and detailed proofs-of-concept demonstrate its application in next-generation energy storage devices.

Key Words: exfoliation, molybdenum disulfide, phase transformation, scale-up, tran-sition metal dichalcogenides.

POS-65

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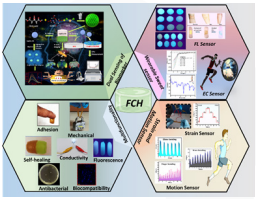
Wearable conductive CuCD@FCH nanoprobe for dual detection of biomarker in sweat and human motion detection

Hydrothermally prepared copper-doped carbon dots (CuCDs) were used for the fluorescence and electrochemical detection of biomarker like calcium and glycine. The fluorescence intensity of CuCD is diminished after the addition of Ca2+ biomarker due the quenching process. Ca@CuCD nanoconjugate serve as an excellent platform for the recognition of glycine. The feeble emission of Ca@CuCD increases substantially in the presence of glycine due to aggregation-induced emission. At the same time, there was a 5-fold increase in the current response of the Ca@ Cu-CD modified electrode as compared to the control. The exceptional combination of fluorescence and conducting properties, along with Ca-glycine interaction, establishes our probe as a dual sensor for the detection of glycine in real serum samples. The limit of detection for this nonenzymatic fluorescence and electrochemical sensing are 17.2 and 4.1 nM, respectively. Furthermore, an extensive evaluation of the toxicity and bioimaging properties in fruit fly Drosophila melanogaster shows that the Ca@Cu-CD probe is not cytotoxic and can be applied for ex vivo imaging of glycine. For real life detection of Ca2+ ion in human sweat, a fluorescent conductive hydrogel (FCH) has been fabricated by crosslinking PVA and agar in presence of CuCD. The developed FCH synergistically addresses "four birds-in-one-stone", i.e. Ca2+recognition, ionic conductance (4.2 Sm-1), fluorescence and stretchability (160%). The hydrogel patch sensor can monitor Ca2+ level in sweat in both fluorescence and electrical mode. At the same time because of excellent skin adhesiveness and flexibility FCH sensor can be attached to any joint to monitor strain induced by body motion in both electrical and fluorescence mode. This work provides a strategy to design multifunctional material to address prospective applications in wearable sensors.

Keywords: Fluorescence sensor, Electrochemical sensor, Wearable patch, Hydrogel, Strain, Motion, imaging



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The study of dielectric properties of green synthesized Ag_2S nanoparticles

The Ag_2S nanoparticles have been synthesized using Jara lemon extract by a facile, convenient, environment friendly green synthesis method. The different characterizations such as XRD, HRTEM, FESEM, and UV-Vis absorption spectrum confirm the good quality of synthesized Ag_2S NPs. The XRD pattern confirms the well crystallinity of the sample and there are no impurity peaks. The temperature and frequency dependant dielectric properties have been studied to investigate the electric behaviour of Ag_2S NPs. A relaxation peak observed in loss tangent vs. frequency plot and it shifted towards higher frequency with increasing temperature. The variation of AC conductivity with frequency reveals that at lower frequency region obeys Jonsher's Power Law (JPL) and Super-linear Power Law (SPL) at higher frequency region. The Nyquist plot of the sample gives two semi-circular arches, which suggests both the grain and grain boundary effect in the Ag_2S NPs. These grain resistance (), as well as grain boundary resistance () decreases with increasing temperature, which suggests the negative temperature coefficient of resistance (NTCR) behaviour like a semiconductor. The activation energy (E_a) has been estimated from the temperature dependent AC conductivity measurement.

Keywords: Silver sulfide; Green synthesis; Nyquist plot; HRTEM; Negative temperature coefficient of resistance (NTCR);

POS-67

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Acmella oleracea driven synthesis of nano Bi_2O_3 for remediation of drug and bacterial water pollutants

The current study reports the biosynthesis of nano Bi203 using combustion technique fuelled by Acmella oleracea plant extract. The prepared compound was analysed through X-ray diffraction which indicated a mixture of monoclinic α-phase and tetragonal β-phase, scanning electron microscopy showed the coexistence of spherical and flaky nanostructures, ultra violet spectroscopy quantified a band gap of 2.5 eV and Infrared spectroscopy exhibited absorption bands attributed different vibrational modes of nano Bi203. The prepared nanoparticles were employed in photo catalytically degrading cardiac protective drug pollutants in water sources and was capable of adsorbing pathogenic gram-negative bacterium Escherichia coli bacterial cells proved by adsorption isotherm studies. The antibacterial properties were also indicated by zone inhibition. This work facilitates the practicable application of nano Bi203 in environmental remediation.

Keywords: Nano Bi203., Photocatalytic, cardio protective drugs, antibacterial, Acmella oleracea. Bacterial adhesion

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Microarchitecture Engineering Of β-Ga_2O_3 Heterostructures On Arbitrary Substrates For Deep Uv Photodetectors

The ultrawide-bandgap oxide semiconductor β-Ga2O3 with a direct bandgap (~4.5-4.9 eV) is of paramount interest for the design of nanoscale high-power electronics, sensing and memory-based applications. The β-Ga2O3 thin-films are synthesized using expensive vacuum-based techniques, which require high-maintenance, sophisticated vacuum equipment and high temperature that hinder the large-scale commercial production [1]. The current low-cost solution-based techniques has seen a limited success in achieving continuous β-Ga2O3 films, which typically show less packing density, that prevents them to cater large-area applications [2]. The present work for the first time, to the best of our knowledge, presents a simple robust cost-effective reliable electrophoretic deposition (EPD) approach to obtain large area (~2cm×2cm) continuous β-Ga2O3 polycrystalline films on transparent conductive fluorine-doped tin oxide (FTO), technologically feasible silicon, flexible aluminum foil and indium tin oxide coated polyethylene terephthalate (ITO-PET) substrates. The application of a constant DC voltage, as low as 20V enables the deposition of β-Ga2O3 films on arbitrary substrates, and any further increase in DC voltage (upto 120V) helps to achieve a higher packing density. The controlled assembly of β-Ga2O3 microstructures on different micro-patterned geometries demonstrate conformal deposition, that can potentially help to reduce the gate leakage currents and increases the electric breakdown field, for nanoscale high-power oxide-based transistor and switching applications [3,4]. The β-Ga2O3 films deposited on FTO, aluminum foil, and silicon enables the formation of metal-semiconductor-metal and isotype heterojunctions respectively. The deep ultraviolet (UV) sensing capabilities of the β-Ga2O3 based heterostructures on FTO, silicon and aluminum reveal a dark current of less than 12 nA, with detectivity of 3.0×107 Jones, 4.8×107 Jones, and 3.6×107 Jones respectively. The simple one-step economically viable EPD technique with an ultra-fast deposition rate of 1.5μm/min offers itself as a high throughput method for the development of large area continuous β-Ga2O3 films on myriad substrates; facilitates the commercialization of heterojunction based deep UV photodetectors.

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POS-69

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Nano-surface Engineered Cathodes for High performance Sodium-ion Batteries

High voltage cathode materials are vital to develop high energy Na-ion batteries (SIBs) for practical applications. Ni-Mn based O3-layered transition metal oxides are promising cathodes for SIBs owing to its high capacity, energy density and facile synthesis [1]. However, the cathodes have capacity fading and cycling stability issues due to multiple-phase transitions. Additionally, capacity degradation occurs due to oxidative electrolyte decomposition above 4V, leading to HF formation in acidic electrolytes with NaPF6 salt [2]. Different strategies to mitigate surface deterioration in cathodes involve reducing the exposed area of the active material and coating the cathode surface with inert nanomaterials. Surface coatings provide protective layers, enhance conductivity, and can react with residual alkali and HF to suppress oxygen loss and metal dissolution [3]. Metal oxides such as Al_2O_3, MgO, ZrO_2, SnO_2, ZnO, and TiO_2 are commonly used for surface coating modifications in layered cathodes. Sun et al. applied an AlF3 coating on O3-$Na[Ni_{0.65}Co_{0.08}Mn_{0.27}]O_2$ using a dry ball-mill method, enhancing battery performance. The coated cathode achieved 147 mAh g^{-1} capacity with 92% retention at 0.2 C [4]. Reducing the surface area of the active material minimizes its exposure to reactive species in the electrolyte and atmosphere, thereby decreasing detrimental side reactions and capacity degradation. In addition, coating the cathode with inert nanomaterials creates a protective barrier that shields the active material from direct contact with the electrolyte, enhancing its structural stability and Cycling stability.

In this work, a surface-modified O3-type $NaNi_{0.45}Cu_{0.05}Mn_{0.4}Ti_{0.102}$ cathode was synthesized by coating with B_2O_3 using a dry ball-milling method. Moreover, the presence of B_2O_3 not only execution as a protective layer but also act as a dopant agent. Then, integrating of Li+ ensures that the Jahn Teller distortion and Na+/vacancy ordering is suppressed. Thus, strong B-O and Li-O bond can shorten the TM-O slab and as a consequence, enlargement of the Na-O slab and thereby increase the d-spacing which responsible for improving the diffusion. Significantly, B2O3 coating minimized parasitic reactions with the electrolyte and facilitated Na+ migration. Hence, material achieved a high specific capacity of ~180 mAh g^{-1} which demonstre superior rate capability and retaining 97% capacity after 50 cycles. Notably, the impact of B_2O_3 on charge storage mechanisms, as assessed through electrochemical performances and Operando-XRD will be presented.

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Application of Zinc oxide quantum dot to improve the invigoration of a sub-standard quality of black gram (VBN8)

Nanoparticles, ranging from 1 to 100 nanometres in diameter, remain relatively unexplored in agriculture, especially metal oxide nanoparticles (MONPs). Zinc oxide nanoparticles (ZnO NPs), synthesized via the Sol gel method, were investigated for their effects on the germination of blackgram (VBN8), which initially showed a 74% germination rate. Seeds were primed with ZnO NPs for 180 minutes at concentrations ranging from 10 to 1000 ppm. Significant enhancement in germination percentage to 93% was observed with priming at 500 ppm. This improvement extended to other seed parameters like root and shoot length, vigour indices, germination rate, and biochemical markers such as dehydrogenase and catalase. However, higher concentrations of ZnO NPs showed adverse effects on germination and seedling vigour. Toxicity analysis (MTT Assay) indicated slight toxicity at higher ZnO NP concentrations, emphasizing the dose-dependent nature of their effects in agricultural applications.

Key words: Nanoparticles, biosafety, invigoration, enzyme, toxicity and priming

POS-71

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Morphology-Tuned Pt_3Ge Accelerates Water Dissociation to Industrial-Standard Hydrogen Production over a wide pH Range

The discovery of novel materials for industrial-standard hydrogen production is the present need considering the global energy infrastructure. A novel electrocatalyst, Pt3Ge, which is engineered with a desired crystallographic facet (202), accelerates hydrogen production by water electrolysis, and records industrially desired operational stability compared to the commercial catalyst platinum is introduced. Pt3Ge-(202) exhibits low overpotential of 21.7 mV (24.6 mV for Pt/C) and 92 mV for 10 and 200 mA cm−2 current density, respectively in 0.5 M H2SO4. It also exhibits remarkable stability of 15,000 accelerated degradation tests cycles (5000 for Pt/C) and exceptional durability of 500 h (@10 mA cm−2) in acidic media. Pt3Ge-(202) also displays low overpotential of 96 mV for 10 mA cm−2 current density in the alkaline medium, rationalizing its hydrogen production ability over a wide pH range required commercial operations. Long-term durability (>75 h in alkaline media) is achieved with the industrial level current density (>500 mA cm−2) using flow reactor. The driving force behind high performance of Pt3Ge-(202) has been envisaged by mapping the reaction mechanism, active-sites, and charge-transfer kinetics via controlled electrochemical experiments, ex situ X-ray photoelectron spectroscopy, in situ infrared spectroscopy, and in situ X-ray absorption spectroscopy supported by first principles calculations.

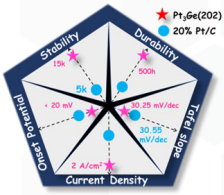

Fig. 1. Ordered catalyst Pt3Ge(202) achieved better performance than state-of-the-art catalyst 20% Pt/C for different parameters.

Keywords: Hydrogen production, electrochemistry, intermetallics, water electrolysis.

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POS-72

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Polyvinylpyrrolidone capped electrospun ch3nh3pbcl3 perovskite film as The electron transport layer in perovskite solar cell application

The inherent moisture instability of hybrid lead halide perovskites necessitates polymer additive research to improve their moisture stability. Polymer engineering on solar cell absorber layers enhances chemical stability and device performance. This work reports electrospinning of pure and PVP-capped methylammonium lead chloride (CH3NH3PbCl3) perovskite film. A structural investigation utilizing XRD demonstrates that PVP capping reduces average crystallite size from 66.05 to 39.69 nm. The microscopic study shows that PVP-added CH3NH3PbCl3 perovskite film contains smaller particles than pure film. The surface coverage and uniformity of the film is much more in the presence of PVP. Energy dispersive X-ray examination shows that the pure film contains ~16% more oxygen, indicating that PVP reduces moisture's impact on perovskite film, which is the prime objective of this work. Moreover, the optical properties have been analyzed using diffuse reflectance mode of UV–Vis-NIR spectroscope. Finally, the use of CH3NH3PbCl3 as the electron transport layer has been demonstrated in Glass/FTO/CH3NH3PbCl3/CH3NH3SnI3/Spiro-OMeTAD/Au structured perovskite solar cell usin the SCAPS-1D simulator. The above-mentioned cell exhibits 21.65%, 72.21%, 32.44mA/cm2 and 0.924V of PCE, fill-factor, Jsc, Voc, respectively.

POS-73

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Hydroxyapatite Nanocomposite for Enhanced Implant Performance: Bactericidal characterization in selecting nanomaterial incorporation

Introduction:
Hydroxyapatite (HA) is a widely used biomaterial due to its biocompatibility, similar to natural bone. However, brittleness and low mechanical strength limit its application in implants. This study investigates the incorporation of nanomaterials (Silver (Ag), Carbon Nanotube (CNT), and Nanodiamond (ND)) into HA to improve its mechanical strength while maintaining biocompatibility.

Methodology:
- Nanocomposite samples: CNT/HA, Ag/HA, and ND/HA.
- The percentage dosage of nanocomposite incorporation in the following order 10mg, 20mg, 40mg, 80mg, and 160 mg.
- Bacterial strains: Gram-negative (Pseudomonas aeruginosa MCC2080) and Gram-positive (Streptococcus mutans ATCC25175).
- Bacterial suspension: Standardized turbidity (McFarland 0.5) diluted to 10^5 CFU/mL.
- Antibacterial activity: Broth microdilution according to CLSI guidelines.

Results:
- Ag/HA exhibited antibacterial activity due to the inherent properties of silver nanoparticles.
- CNT and ND did not show significant bactericidal effects compared to Ag incorporation.

Conclusion:
This study highlights the importance of specific nanomaterial selection for achieving desired functionalities in HA implants. Silver nanoparticles offer promising potential for enhanced antibacterial properties, while other nanomaterials might require further investigation for their impact on implant performance.

POS-74

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UiO-66 Based Supra-MOF Assembly for Quick Analysis of Edible Oils from Custom Designed Opto-Electronic Device

Supramolecular chemistry adopted by the hybrid systems of metal ions and organic linkers of metal-organic frameworks (MOFs) offers not only the molecular level porous architecture but also an approach for assembly-within-assembly: Supra-MOF, for creating simpler yet multifunctional host-guest based smart material couples. In this work, Supra-MOF approach is smoothly translated to a well-known UiO-66 MOF compound to form luminescent CQD@UiO-66 (CQD: carbon quantum dots) and used as a main probe in custom-designed 3D printed opto-electronic device. The device mainly explored on the basis of quenching of fluorescence ability of Iodine for the purpose of identifying the quality of edible oil samples from different commercially available brands. The photodiode based signal output from the device was used to identify the changes in the incident fluorescent light of aqueous dispersion of CQD@UiO-66 affected by the rejected iodine from the oil portion. The application of MOF based compound in a proof-of-concept opto-electronic device sheds light on the impact of temperature (heating) with the time on edible oil saturation/unsaturation levels using a quick and newly developed method of determining iodine value (Iv) of oil samples.

Keywords: MOFs, Porous Material, Host-guest chemistry, Opto-electronic device, sensing

POS-75

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Synthesis and characterization (4-chlorophenyl)(6,7-diamino-1-phenylindolizin-3-yl)methanone for Anti-cancer and Anti-fungal Activity

We have successfully synthesized a series of substituted indolizine derivatives, a chemical reaction carried in between the quaternary substituted bromide salt with substituted alkynes which are electron deficient in presence of sodium carbonate or potassium carbonate in dimethyl formamide as solvent. The synthesized compounds have been characterized by spectroscopic analysis like IR, 1H-NMR and 13C-NMR respectively. Series of compounds 4a, 4b, 4c, 4d and 4e have been screened for anticancer activity against adrianycin as positive control. The present research article plays a vital role on the effective synthesis of substituted indolizine derivatives which were eco-friendly in nature. The products were obtained successfully through intermediates. In which some of the selected exhibited anti-cancer properties at 10µg/mL, 20µg/mL, µg/mL and 80 µg/mL.

POS-76

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Nano roads and its pores concept in road transport system for rainwater Harvesting and to conserve underground water table

In day today life, one of the essential need for daily life is food, water & shelter. Due to the development of science & technology, advanced invention & development towards the technology becomes the part of their life. One of the thing is transport system, which helps in moving from one place to another with the help of road, railways & air transport. On the other hand, humans are claiming war with mother nature with scientific development. Every monsoon season our country faces the major problems in metropolitan cities due to flood. To prevent this Silicondioxide nanoparticle which can be incorporated into composition mixture of road making. Silicondioxide (E551) possess no toxicity, it was used in pharmaceutical & food industry. It enhances absorption of rain water up to 40% ,by reaching to the ground by its pores absorption & it won't react with water & other substances , by this we can conclude that it was non – toxic and it will be helpful in dry areas to preserve underground water table like hot regions. In a hour of rain, it will helps in absorption of rainwater to penetrate to water table. In future , it will helpful in maintaining water table & eco-system of surrounding areas, by preventing the water scarcity problem in future.

POS-77

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Plant-mediated Zinc Oxide nanoparticle synthesis, characterization, and its application on Vigna mungo seeds (Black gram) to mitigate drought stress

Globally nanotechnology has been believed as a novel technology owing to its potential application, particularly in the field of agriculture. On the other hand, input and resource management in agriculture face several hurdles due to uncontrollable climatic conditions. Pulses are grown in rainfed conditions accompanied by drought stresses limiting the yield and quality of crops are more prevalent. Previous studies identified that applying ZnO nanoparticles on crops could tackle drought stress in rainfed conditions. This study focused on tracking the drought-responding genes in Black gram and stimulation of germination due to ZnO nanoparticles under induced drought conditions using polyethylene glycol (PEG). The ZnO nanoparticles can be synthesized using plant extract of Carrisa edulis seeds, a widely used reducing agent in the green synthesis process. The formation of nanoparticles is confirmed by characterization with XRD, UV-visible spectrophotometer absorbance, FTIR, SEM-EDAX, and TEM analysis. Subsequently, the in-vitro experiment will be designed with a completely randomized block design (CRBD). The germination parameters such as germination percentage, germination speed, root length, shoot length, fresh weight, dry weight, and seed imbibition rate will be analyzed during the initial research work. According to the results obtained from the preliminary study, the field trials will be conducted for real-time application in the Vigna mungo (Black gram) fields with ZnO nanoparticles to mitigate drought stress.

Keywords: Polyethylene Glycol, Black gram, Drought Stress, Zinc Oxide, Germination.

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POS-78

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Innovative skincare soap loaded with encapsulated nanoparticles of natural antioxidants from fruit peel

This study explores the formulation and efficacy of a novel skincare soap infused with nanoparticles of antioxidants. Traditional skincare products often face limitations in delivering active ingredients effectively due to the barrier properties of the skin. Nanoparticles, owing to their small size and large surface area, offer enhanced penetration and bioavailability of active compounds. In this research, antioxidants from different fruit peel were extracted and encapsulated within biocompatible solid lipid nanoparticles and incorporated into soap formulated with virgin coconut oil. Virgin coconut oil is renowned for its moisturizing properties and rich content of beneficial fatty acids, making it an ideal base for skincare products. The prepared soap was evaluated for its physical properties, stability, and antioxidant activity. Our results demonstrated that the nanoparticle-loaded soap exhibited superior antioxidant activity and moisturizing properties compared to conventional soap. Furthermore, the stability tests indicated that the encapsulated antioxidants retained their efficacy over an extended period. The soap also showed good foaming ability, skin compatibility, and user acceptability in preliminary trials. These findings suggest that skincare soap loaded with antioxidant nanoparticles could provide enhanced skin protection against oxidative stress and other factors causing skin damage, offering a promising avenue for advanced skincare solutions.

POS-79

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Fabrication of Bi-layered Skin Tissue Equivalents by Combining Electrospinning & 3D Bioprinting Techniques

Tissue engineering has evolved as a promising strategy to effectively promote the regeneration of various tissues. Nanofibrous scaffold fabricated using electrospinning resembles the structural architecture of the native extracellular matrix components & also promotes enhanced cellular adhesion and proliferation. However, fabricating complex constructs resembling the native tissue architecture using this conventional strategy remains a huge challenge. 3D bioprinting, on the other hand enables the fabrication of complex 3D structures while precisely positioning cells in multiple layers of the tissue construct. In this study, a hybrid construct was developed by combining electrospinning and 3D bioprinting strategies. Herein, PHBV, (poly-3-hydroxybutyrate-co-3-hydroxyvalerate), a synthetic biodegradable polyester has been employed to develop nanofibrous support matrix onto which cell laden gellan gum/gelatin bioink was printed. The electrospun scaffold possessed adequate mechanical strength, high water retention capacity and the developed bioink possessed shear thinning behaviour & yield stress indicating enhanced printability. The cytocompatibility of the developed scaffolds were evaluated using human dermal fibroblast (HDF) and human keratinocyte (HaCaT) cells indicated enhanced proliferation. In addition, the co-culture of fibroblast and keratinocytes on these hybrid constructs indicated enhanced viability and proliferation. This hybrid skin constructs holds potential as scaffold for enhanced regeneration and also serve as a suitable drug testing platform.

POS-80

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Combining 3D Printing & Electrospinning to Fabricate Biomimetic Conduits to Treat Critical-Sized Peripheral Nerve Defects

Critical-sized nerve defects do not effectively regenerate without surgical intervention including use of nerve guide conduits (NGCs). Various tissue engineering strategies have been explored to make NGCs that precisely recapitulate the structures and properties of native nerve tissues. However, the majority of these NGCs are tubular in nature and lack surface cues to promote nutrient transport, cell attachment and tissue infiltration. In this study, we developed a spiral NGC macrostructure to address nutrient transport issues and surface-functionalized nanofibers to enhance cellular activities. Biocompatible polymeric nanofibers were electrospun onto a 3D printed thermoplastic (TP) polymer sheet. Spiral NGCs were constructed using both aligned and randomly oriented nanofibers, and 3D printing used 25, 35, and 50% TP infill densities. Anisotropic nanofiber cues showed good adhesion, viability, proliferation, alignment, and neurogenic gene expression for all infills when evaluated with rat Schwann cells (RSC 96). The spiral conduits with 25% and 35% infill densities exhibited comparable Young's modulus values to Neurotube® and ultimate tensile strength values equivalent to acellular cadaveric human nerves. A critical-sized (10mm) sciatic nerve defect in Wistar rats was treated with the developed NGCs to assess its efficacy over a 4-month period. The groups treated with NGCs and autografts showed comparable muscle innervation and axon healing, as assessed through gait parameters, functional recovery analysis, and histological observations. Thus, the developed NGC presented in this study holds potential for development as a treatment for large-gap nerve defects.

POS-81

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Effect of Co:Fe composition on the structural and magnetic properties of $CoFe_2O_4$ nanoparticles

In this research work, we have studied the effect of Co:Fe composition on the structural and magnetic properties of $CoFe_2O_4$ (CFO) nanoparticles prepared via solvothermal technique. Here, we have varied the Co: Fe ratio in the precursor solution such as 1:1, 1:2 and 1:3. The XRD analysis confirmed the formation of the cubic spinel phase of CFO without any secondary phases. The Raman spectroscopic analysis also exhibited the characteristic peaks of the cubic spinel structure of CFO. Furthermore, the Raman bands between 200 – 240 cm^{-1} correspond to the formation of Fe_2O_3, which is the most common secondary phase reported during the preparation of spinel ferrites. This impurity peak is observed to be diminished for the 1:2 composition, confirming its better purity when compared with other samples. The SEM analysis exhibited the formation of well-defined and uniformly distributed spherical grains. The average grain size is observed to increase from 85 nm to 125 nm as the composition increases from 1:1 to 1:3. The magnetic studies (M-H loop) at room temperature confirmed that the saturation magnetization (M_s) is optimum for the 1:2 composition. Hence, the 1:2 composition of CFO can be employed for the synthesis of magneto-plasmonic nanoparticles for SERS-based sensing applications.

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Fabrication of Magnesium-Doped Nano Hydroxyapatite and Nano Hydroxyapatite Biomimetic Scaffolds for Bone Tissue Engineering

Bone tissue engineering has emerged as a promising alternative strategy for addressing the limitations of traditional bone grafting methods, which are often associated with drawbacks such as limited availability, rejection and disease transmission. Nano hydroxyapatite (nHA)-based ceramic materials has shown excellent biocompatibility, bioactivity, and osteoconductivity, making it an ideal material for bone tissue engineering applications. In this study we have developed nHA and magnesium-doped nHA (Mg-nHA) based ceramic scaffolds, as bone graft substitute. The nano-sized structure of nHA helps to enhance protein adsorption, promote cellular interactions and tissue integration.

The ceramic materials were commercially obtained and fabricated via traditional mould cast method using PVA and HPMC as binding agent followed by sintering at 1200 °C for 4 h. The structural composition and mechanical properties of the scaffolds were characterized using FT-IR, XRD, XPS and universal testing machine. In vitro studies using MG63 cell line and BMSC's revealed increased proliferation and better cell extensions for 14 days on the surface the scaffolds. nHA and Mg-nHA based ceramic scaffolds have shown excellent, biocompatibility and mechanical properties, which can be tailored to make scaffolds for both load-bearing and non-load-bearing bone defects especially in clinical conditions such as osteoporosis, bone fractures, and implant revisions.

POS-83

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3D Printing of Bone Constructs Using Composite Ceramic Paste Reinforced with Bentonite for Load Bearing Bone Defects

The field of bone tissue engineering majorly focuses on fabricating implantable substitutes for treating load bearing critical sized defects. In recent years, 3D printing has emerged as a promising technique for fabricating intricate and complex structures with personalized features. Here, we present an approach for fabricating 3D ceramic scaffolds using bentonite nanoclay and micron sized hydroxyapatite along with a binder using extrusion bioprinting. The surface morphology and trans axial projections of the scaffolds were assessed using SEM and micro-CT respectively. Characterization techniques such as TGA, FTIR, XRD were performed for analysing the thermal stability, chemical composition and crystalline nature of the fabricated constructs respectively. Compressive strength of the constructs was evaluated using uniaxial tensile testing machine (UTM) which showed excellent mechanical properties similar to human bone. In vitro efficacy studies performed using MG63 cell lines revealed increased cell proliferation indicating enhanced cytocompatibility. This novel strategy was framed with the goal of establishing the efficacy of incorporating bentonite into ceramic scaffolds for the fabrication of complex bony designs toward the treatment of critical sized bone defects where the natural fracture healing mechanism is impeded.

POS-84

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Nanoengineered Bioinks for 3D Bioprinting of Gradient Subchondral-to- Chondral Construct for Osteochondral Tissue Repair

The repair and regeneration of osteochondral tissue require intricate gradient reconstruction containing both chondral as well as subchondral tissues. Short term effectiveness of conventional methods and limited availability of cells and grafts for treating the defects demand the need for tissue engineered constructs. Three-dimensional (3D) bioprinting is used to fabricate scaffolds with high levels of intricacy and complexity to mimic the exact environment of extracellular matrix for repair and regeneration. Here, we aim to fabricate a bilayer composite hydrogel bioink for 3D printing of osteochondral constructs using alginate semi-interpenetrating network with nanohydroxyapatite in the subchondral bone region, which favours the calcification of bone region. For the chondral region zein nanoparticle with core shell carboxymethyl cellulose, is used to mimic the tissue transition from bone like matrix to chondral tissue. Viscoelastic property of hydrogel was evaluated for finding the storage and loss modulus with varying amplitude and frequency. Compressive strength of 190 kPa was obtained for the subchondral construct. Effect on different loading time, size, charge, protein secondary structure evaluation, crystalline nature and thermal stability, etc of nanoparticle were evaluated by SEM, zeta sizer, CD spectra, XRD, DSC respectively. Nanoparticles incorporated semi-interpenetrating alginate hydrogel network specifically for the cartilage opens additional option for encapsulation of drugs or growth factors into the bioprinted chondral tissue construct. Bilayer construct with subchondral region followed by chondral region was fabricated using Cellink BioX6 3D bioprinter. Micro CT was used to track the presence of nanohydroxyapatite in the bone region. The developed gradient composite bilayer scaffolds with controlled microenvironment for the bone and cartilage offers various advantages in treating osteochondral defects.

POS-85

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Hydroxyl functionalized Boron Nitride Nanotubes-Gelapin composites for Cardiac Tissue Engineering

Cardiovascular diseases (CVDs) account for 31.8% of all deaths globally. Cardiac tissue engineering is a strategy for the treatment of end-stage cardiac diseases. Despite advances in regenerative strategies, achieving electromechanical coupling with the native organ remains a challenge in cardiac tissue engineering. Herein, we have employed hydroxyl functionalized boron nitride nanotubes (BNNTs) incorporated genipin crosslinked gelatin (Gelapin) hydrogel films as a stimuli-responsive scaffold for cardiac regeneration. Various physiochemical characterizations such as SEM, FTIR, mechanical strength and protein adsorption were carried out on the fabricated scaffolds. In vitro studies such as cell viability, proliferation and adhesion were performed using rat cardiomyoblasts (H9c2) and neonatal rat ventricular cardiomyocytes (NRVCMs) on these scaffolds. The gene expression levels of actinin alpha 2 (Actn2), myosin heavy chain 6 (MYH6) and GATA4 were found to be significantly increased in the composite scaffolds when compared to the control scaffolds. The expressions of cardiac markers connexin-43 (CX43), troponin T and cytoskeletal protein F-actin in NRVCMs were visualized using immunofluorescence and were found to be higher in the composite scaffolds after 14 days in culture. These results indicate that the construct can be a potential candidate for myocardial engineering as it integrates topographical and chemical cues. Further studies on its potential to integrate with the native organ is underway.

Keywords: BNNTs, genipin, cardiomyocytes

POS-86

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Inquisition into the Synthesis, Structure and Transport Properties of Supervalent Cation Substituted Double-Perovskite-Type Solid Electrolyte for All-Solid-State Sodium Ion Batteries

The highly sought-after Lithium Ion Battery (LIB) market has exalted the reparations on Lithium. The finite lithium reserves and its economic stifle has pushed us to seek an alternative energy storage system. Na-ion batteries (NIBs) have emerged as a feasible solution for LIBs owing to the illimitable sodium reserve spread across the globe and reasonable performance to LIBs. Despite many positive and negative electrodes for NIBs being developed, the safety concerns and narrow electrochemical window of the commonly employed organic liquid electrolyte experience safety concerns like leakage, flammability and a slender electrochemical window identical to that of LIBs. In the interest of the same, an all-solid-state sodium battery (ASSSB) will be a practical solution to deal with the safety and performance aspects allowing the use of sodium metal anode leading to higher energy density [1].
This investigation consolidates the two different supervalent cation substituted Sodium ion conductor with double perovskite-oxide type structure [2]. The concerned compounds were synthesized via solid-state reaction route. The structural characterization, morphological analysis and phase identification were carried out by Raman spectroscopy, Scanning Electron Microscopy, Powder X-ray diffraction respectively. The sodium ion conductivity was examined using Impedance Spectroscopy and the electrochemical stability window using Linear Sweep voltammetry. In this work, a detailed investigation has been conducted to explore the structural and microstructural characteristics and to compare the Na+ transport with the substitution of two different dopants on the double-perovskite solid state NIB electrolyte. This work points towards the development of higher energy density all-solid state sodium metal batteries for a sustainable future.

Keywords: solid electrolyte, double perovskite, solid-state sodium battery, ionic conductivity, impedance spectroscopy, electrochemical stability, sodium metal anode.

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Fabrication Of Manganese Doped Polyaniline Electrodes As High-Performance Supercapacitors With Superior Energy Density And Prolonged Shelf Life

The rising energy ultimatum has urged a paradigm shift from conventional to non- conventional, green and clean energy sources to indulge the supply and demand. Energy storage devices such as supercapacitors and batteries have the potential in catering current energy crisis to a greater stretch. Supercapacitors on this regard have paved its way as an excellent energy storage device by serving with superior performance, enhanced cycle life, environmental compatibility and cost – effectiveness. Amongst the existing supercapacitor electrode materials, the conductive polymer, mainly polyaniline doped with transition metals have gained much attention because of its remarkable supercapacitive performance. Thus, doping on polyaniline with transition metals is a best strategy in overcoming the cyclic instability which is a major challenge faced by polyaniline supercapacitors. Herein, manganese doped polyaniline was synthesized via In-situ oxidative polymerization method in HCl medium. Electrochemical studies uncovered an areal capacitance of 776 mF/cm2 at a current density of 1 mA/cm2, gravimetric capacitance of 995 F/g at 1 A/g, 99% coulombic efficiency, and a capacitive retention of 86.5% was observed after 20,000 cycles at a current density of 35 mA/cm2 by the fabricated coin cell device. The shelf life performance of the coin cell was analyzed after 400 days and underwent a long run for one lakh cycles which revealed a capacitive retention of 71% at 1 mA/cm2 and a stable coulombic efficiency of 96% throughout the cycling. From the performance analysis, the manganese-doped PANI claims to serve as an excellent electrode for supercapacitor applications.

Keywords : Transition metals, Manganese doped polyaniline, Supercapacitors, Coin cell device, Energy density, Shelf life.

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Synthesis and characterisation of RGO decorated NiO nanoflowers for supercapacitor applications

The fabrication of Nickel oxide (NiO) nanoflowers adorned with reduced graphene oxide (RGO) was conducted to utilise the cost-efficient hydrothermal technique, followed by calcination to produce composite materials. Three composites, namely NRGO1, NRGO2, and NRGO3, were synthesised with varying NiO: RGO mass ratios. Diverse analytical methods such as FE-SEM, XRD, UV-visible, and Raman spectroscopy were employed to analyse the morphological and structural characteristics, phase purity, optical properties, chemical bonds, and functional groups of the specimens. The electrochemical properties of NiO and RGO-modified NiO (NRGO) were assessed through techniques including cyclic voltammetry, galvanostatic charge-discharge testing, and electrochemical impedance analysis. The results indicated that the incorporated RGO improves NiO's reversibility when utilised as an electrode material, attributed to the creation of a continuous framework and an increase in active sites for redox reactions due to its distinct configuration. The specific capacitance of the NRGO3 composite reached 395.84 Fg-1 in a 6M KOH electrolyte at a scan rate of 10mv/s, representing the highest value among the various samples, hence indicating its suitability as an electrode material for applications in energy storage.

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Development of chitosan nanoformulations for targeting the latent HIV reservoirs

Combined Antiretroviral Therapy (cART) is a treatment to decrease the HIV viral load efficiently by employing a combination of drugs. These drugs require a platform to target these drugs specifically to the HIV-infected cells for better bioavailability. The present study focuses on the 'shock and kill' strategy by encapsulating the antiretrovirals and latency-reversing agent (LRA) into the chitosan nanoparticles that were surface-modified to conjugate specific antibodies such as CD2 and lymphocyte function-associated antigen-1 (LFA-1) for targeted delivery. This nanoformulation targets both acutely and latently infected cells. The nanocarrier has been characterized using scanning electron microscopy, differential scanning calorimetry, FTIR, particle size and zeta potential to confirm the presence of drug inside the nanoparticle and the conjugated antibodies on the surface of the chitosan nanoparticles. The effect of this nanocarrier on cell viability has been evaluated in uninfected cell lines such as Jurkat, U937, THP-1, HCMEC/d3, and Caco2. The internalization of the nanoparticles has been quantified using flow cytometry and confocal microscopy. The cell entry mechanism in Jurkat T-cells and U937 monocytic cells suggested that the formulated nanoparticles enter the cells majorly via the clathrin-mediated pathway. The cell viability assay was also performed in PMA-activated HIV-infected cell lines TZM-bl and HLM-1. The percentage of cell viability was found to decrease significantly when compared with the free drugs thereby lowering the concentration of p24 antigen. These studies suggest that the formulated nanoparticles are a suitable therapeutic regimen to target and annihilate free HIV-infected cells and those in the reservoirs.

POS-90

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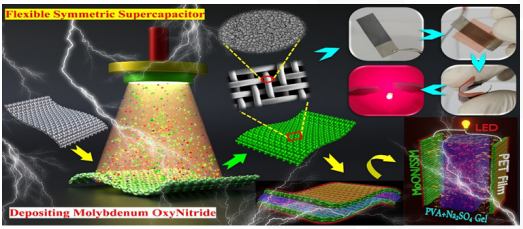
Pseudocapacitive Storage in Molybdenum Oxynitride Nanostructures Reactively Sputtered on Stainless-Steel Mesh towards an All-Solid-State Flexible Supercapacitor

Exploiting pseudocapacitance in rationally engineered nanomaterials offers greater energy storage capacities at faster rates. The present research reports a high-performance Molybdenum Oxynitride (MoON) nanostructured material deposited directly over stainless-steel mesh (SSM) via reactive magnetron sputtering technique for flexible symmetric supercapacitor (FSSC) application. The MoON/SSM flexible electrode manifests remarkable Na+-ion pseudocapacitive kinetics, delivering exceptional ~881.83 F.g-1 capacitance, thanks to the synergistically coupled interfaces and junctions between nanostructures of Mo_2N, MoO_2, and MoO_3 co-existing phases, resulting in enhanced specific surface area, increased electroactive sites, improved ionic and electronic conductivity. Employing 3D Bode plots, b-value, and Dunn's analysis, a comprehensive insight into the charge-storage mechanism has been presented, revealing the superiority of surface-controlled capacitive and pseudocapacitive kinetics. Utilizing PVA-Na2SO4 gel electrolyte, the assembled all-solid-state FSSC (MoON/SSM‖MoON/SSM) exhibits impressive cell capacitance of 30.7 $mF.cm^{-2}$ (438.59 F.g-1) at 0.125 $mA.cm^{-2}$. Moreover, the FSSC device outputs superior energy density of 4.26 $\mu Wh.cm^{-2}$ (60.92 Wh.kg-1) and high power density of 2.5 $mW.cm^{-2}$ (35.71 kW.kg-1). The device manifests remarkable flexibility and excellent electrochemical cyclability of ~91.94% over 10,000 continuous charge-discharge cycles. These intriguing pseudocapacitive performances combined with lightweight, cost-effective, industry-feasible, and environmentally sustainable attributes make the present MoON-based FSSC a potential candidate for energy-storage applications in flexible electronics



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POS-91

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Development And Characterization Of A Novel Non-Immunogenic Nanofibrous Mesh For Encapsulation Of Bioartificial Pancreas

Type 1 Diabetes mellitus (T1DM) is an autoimmune disease leading to the destruction of beta cells by one's immune system. Administration of insulin exogenously is the conventional treatment strategy for T1DM. The major limitation of this method is the occurrence of hypoglycaemic episodes, which can lead to serious complications. Artificial pancreas is an alternate treatment strategy incorporating continuous glucose monitoring. Though better than recurrent insulin injections, it is inferior to the physiological situations in terms of sensing frequency. Bioartificial pancreas is an upcoming treatment strategy that incorporates insulin-producing cells in a conducible microenvironment. One of the key factors in the success of bioartificial pancreas is immuno-isolation. This study aims to fabricate a nano-mesh composed of polyethersulphone for this purpose. The synthesized fibres were observed to have high porosity and did not hinder the transport of glucose across the membrane indicating their ability to provide a semipermeable environment. Upon culture of macrophages on the scaffold, no activation was observed morphologically when compared to LPS-stimulated cells, indicating their non-immunogenicity. Encapsulation of a pancreas-on-a-chip construct in this mesh can offer a suitable strategy for the long-term survival of beta cells and sustained glucose-sensitive insulin secretion.

POS-92

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Development of a dual-targeted dual drug-loaded theranostic nanocarrier for the treatment and management of cerebral stroke

The study on cerebral ischemia has gained importance in the research community due to its high clinical prevalence worldwide and is suspected to be one of the prominent pathology post-COVID infection but remains a challenge for physicians due to critical complications in timely treatment and diagnosis. The incorporation of nanotechnological interventions could potentially mitigate these challenges by aiding strategical localization and preferentially accumulating in disease sites circumventing the blood-brain barrier through targeting peptides, reducing post-ischemic impairment with a neuroprotectant and enhancing specificity and sensitivity of diagnosis. Flavonoids are found to possess diverse pharmacological properties and therapeutic implications that at regulated concentrations are potent antioxidants. The present work focuses on investigating the therapeutic potential of the neuroprotectant rutin in a nano-liposomal formulation for the treatment and management of cerebral ischemia.

Quercetin-Gadolinium complex (QGd), an MRI contrast agent developed in the lab was co-encapsulated with rutin in a PEGylated liposomal nanocarrier with thrombus and blood-brain barrier targeting peptides. The nanocarrier with the size of 200 nm was characterized by SEM and dynamic light scattering for surface morphology, hydrodynamic size, and surface charge. Functional groups and thermal properties were studied to confirm drug encapsulation while phantom agar assay showed magnetic contrast properties of QGd in the free and co-encapsulated form. Drug release studies elucidated initial burst release followed by a sustained release. The system showed no significant in vitro cytotoxicity as assessed in neuronal and endothelial cell models. Cell internalization studies analyzed using confocal microscopy revealed enhanced uptake of peptide-tagged systems when compared to unmodified versions. Cell entry mechanism was assessed by flow cytometry with known pathway inhibitors revealing receptor-mediated endocytosis through a clathrin-dependent pathway as the dominant mechanism. An in vitro hypoxia model was created with CoCl2 and therapeutic efficacy was assessed for the system. Peptide-tagged versions showed significantly higher therapeutic implications and improved cell morphology. The peptide-tagged liposome showed no significant hemotoxicity and displayed thrombus targetability indicating its promise in the treatment and management of cerebral ischemia.

POS-93

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Reduced graphene oxide incorporated p-AgO/n-CeO S-scheme heterostructures with improved photocatalysis and its electrochemical and sensing application

For the synthesis of reduced graphene oxide incorporated p-AgO/n-CeO (RGAC) with effective quantity and quality, a hydrothermal method is employed. This technique also enhances the morphological, physical, and structural characteristics of the nanocomposite. The RGNC nanocomposite catalysts were characterized in terms of their morphologies, microstructures, compositions, specific surface areas, photogenerated electron-hole pair separation/transfer, and photocatalytic activity. The nanocomposite shows potential for application in the treatment of industrial wastewater. The synthesized RGAC material demonstrated photocatalytic activity by degrading Methyl Orange dye under sunlight. RGAC heterojunctions exhibited significantly better photocatalytic performance than pure AgO and CeO. Graphene serves as an efficient co-catalyst, accelerating the transfer of charges in semiconductor photocatalysts. This improvement is attributed to several factors, including the fast transfer of charge carriers, the larger surface area, and the distinct band structure of graphene. The RGAC nanocomposite demonstrates exceptional cyclic stability and energy density when employed in electrochemical applications. Additionally, its application in sensing technologies has proven effective in the detection of ascorbic acid. These characteristics confirm that the RGAC nanocomposite is an environmentally safe, facile, and highly efficient material, supporting its potential for sustainable development.

Keywords: Ascorbic acid, Methyl Orange, Photocatalytic degradation, p-n junction, S-Scheme mechanism.

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Fabrication of Wearable Supercapacitors Through Layer-by-Layer Approach

This work reports the fabrication of conducting textile electrodes through a layer-by-layer (LBL) approach and its application as an efficient current collector in supercapacitors. The highly conducting gold (Au) fabric was realized by coating the alternating layers of tris(2-aminoethyl) amine (TREN) and Au nanoparticles capped with tetraoctylammonium bromide (TOABr) ligands [1]. The optimized conditions offer Au fabric with less than 0.12 Ω/□ resistance in just 2LBL. Coating a thin layer of PDMS, besides enhancing the hydrophobicity of the surface, improved its sustainability towards washing and sonication tests. To fabricate flexible and wearable supercapacitors, upon the Au-fabric, polyaniline (PANI) was electrodeposited as an active material [2]. In the three-electrode configuration, the maximum areal capacitance of 1575 mF/cm2. In a symmetric two-electrode configuration, the device offered a maximum areal capacitance of 660 mF/cm^2 with a high areal energy and power densities of 58.64 μWh/cm2 and 22860 μW/cm2, respectively. This LBL method offers a significant advantage over various existing techniques in terms of simple room-temperature fabrication with just 2LBL, excellent conductivity with high durability, adaptability to various substrates, and ease of scalability.

Keywords: Conducting electrode, wearable, layer-by-layer, flexible electrode, supercapacitor

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POS-95

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Efficient Dye Mitigation Adapting Eco-Conscious Ag-Ag_2S Nanoparticles

The textile industry generates substantial, hazardous dye wastewater, posing severe risks to human health and the environment. This study examines the synthesis and catalytic efficiency of Ag and Ag-Ag_2S alloy nanoparticles in degrading p-nitrophenol dye. It compares green synthesis methods with chemical synthesis techniques. The structural and morphological examination verified the presence of both Ag and Ag-Ag_2S phases. Nanoparticles synthesized via green methods varied in size from 3 nm to 47 nm, whereas those synthesized chemically ranged from 11 nm to 102 nm. Green-synthesized nanoparticles exhibited superior catalytic performance, achieving a degradation efficiency of 78.55% for Ag in 16 minutes and 83.22% for Ag-Ag_2S in 17 minutes, compared to 48.85% and 54.6% for chemically synthesized Ag and Ag-Ag_2S in 18 and 30 minutes, respectively. The enhanced efficiency of green-synthesized nanoparticles is attributed to their smaller size, spherical shape, and higher surface area-to-volume ratio, facilitating better adsorption and electron transfer during dye degradation. The green synthesis method is cost-effective, environmentally friendly, and robust, making it a promising approach for producing efficient catalysts for environmental remediation.

POS-96

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Development of a carbon nanotube-modified electrochemical sensor for thedetection of glycated hemoglobin using boronic acid derivatives in a point-of-care device

The development of a carbon nanotube interfaced electrochemical sensor for glycated hemoglobin (HbA1c) offers a promising tool for diabetes management. This sensor capitalizes on the superior properties of carbon materials, such as high surface area, electrical conductivity, and biocompatibility, to detect HbA1c levels efficiently. In this study, an electrochemical sensor for the detection of HbA1c levels was attempted using a glassy carbon electrode (GCE) modified with multiwalled carbon nanotubes (MWCNTs) and boronic acid derivatives. The present electrochemical detection method monitors the increase in the conductance of the system upon addition of HbA1c, allowing for precise quantification in blood samples. Specific capture of HbA1c on the electrode surface was facilitated through a Cerberus molecule synthesised in lab. Potassium ferricyanide was used as redox mediator. The performance of the sensing electrode was analysed using differential pulse voltammetry (DPV) and cyclic voltammetry (CV). The sensor exhibited a linear range of 1.5 mg/dL to 200 mg/dL of HbA1c with a response time of less than 1 min.The sensor has a detection limit of 120 mg/dL and remained unaffected by common interferents in blood.

POS-97

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Cell line engineering is a typical process which is used in the production of biotherapeutics. It is considered a promising approach over conventional drug therapy to improve the efficacy and safety. The advancement in biotherapeutics made huge impact on cancer treatment, especially in the context of breast cancer. The global mortality rate for breast cancer was about 12.7 per 100,000 women in 2022. The available biotherapeutics such as trastuzumab and pertuzumab are expensive which makes them inaccessible to many affected individuals. The aim of this study is to produce the monoclonal antibody pertuzumab in Chinese hamster ovarian (CHO) cell line, and study its ErbB2-binding and biological activities. In this work we have synthesized the gene of interest and cloned it in two different vectors pCH01.0 and pcDNA3.1+. Minimum inhibitory concentration of two different antibiotics (Kanamycin and ampicillin) was determined in E. coli strain (DH5alpha). Using the selected antibiotic concentration the transformants were screened in antibiotic plates. The plasmid was isolated and pooled together for transfection and pure plasmid with a transfection efficiency of 53% was achieved. The transfection of CHOK1 and CHO DHFR- cells with this plasmid for synthesis of the protein of interest is underway.

POS-98

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Electrospinning is a novel and useful technique applied over the last few years in the areas of food processing and medicine due to its versatility and low cost in the development of nanofibers from natural and synthetic biopolymers. Polyvinly alcohol based anthocyanin (PVA+Anthocyanin) solution was prepared to develop spoilage indicator. The electrospinning parameters such as flow rate were varied at three levels: 0.5, 1.0 and 1.5 mL h-1, voltage was varied at three levels: 15, 20 and 25 kV. The other processing parameters such as needle to collector distance (15 cm) and dimension of the syringe needle (0.80 mm ×38 mm) and speed of the plate were kept constant for all the treatment combinations. Different properties physical, mechanical and biodegradable properties were analyzed. It was noticed that the treatment with a flow rate of 1.0 mL.h-1 and a voltage of 20 kV had the highest desirability value of 0.825. The developed biodegradable spoilage indicator strip is then attached to the individual fig fruit throughout its shelf-life and physico-chemical properties of fig fruits were correlated with colour change occurring in spoilage indicator. It was found that the spoilage indicator has changed its colour from light pink to purple on the 3rd day and then to a yellowish green on the 6th day of storage. Hence this could be an effective solution to monitor the spoilage of fruits, throughout its shelf-life.

POS-99

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Development of Novel Nanocarriers with Multi-modal Action against Lung Cancer

A novel PVI (poly 1-vinyl imidazole) polyplex was formed with anti-VEGF si-RNA and characterized using gel retardation assay and heparin displacement assay. The 2D in vitro studies were carried out using the A549 (human lung cancer) cell line and LL2/ LLC (mouse lung cancer) cell line. The polyplex exhibited superior internalization that was confirmed using cy3-tagged anti-VEGF si-RNA. The gene silencing efficacy of the polyplex was evaluated by migration assay (scratch and boyden chamber assay). The VEGF gene silencing efficacy of the polyplex was higher than the free si-RNA which was confirmed by western blot and RT-PCR studies. A 3D in vitro model using matrigel was developed to mimic the tumor microenvironment. The parameters like centrifugation speed, cell line, and time were optimized to obtain compactly packed large spheroids. The spheroid characteristics were analyzed using Live / Dead assay and its hypoxic core region was confirmed. The internalization of si-RNA into the tumor spheroid was investigated using fluorescent-tagged si-RNA and it showed better internalization after 4 h of treatment when compared to its counterparts. The silencing efficacy of the polyplex in 3D in vitro tumor spheroid model was confirmed by western blot and RT-PCR. A significant reduction of VEGF was observed in the polyplex-treated spheroids when compared to the control. Muc1 peptide-tagged chitosan nanoparticle prepared for immune alteration and it was characterized using SEM, dynamic light scattering, and FTIR analysis. The therapeutic efficacy of the polyplex and the peptide-tagged chitosan nanoparticle was evaluated in immune–competent C57BL/6 mice. The tumor was implanted orthotopically into the left lung of the mice and the tumor engraftment was confirmed by micro-CT images. After the engraftment, the animals were treated with polyplex and a combination of the polyplex and peptide-tagged chitosan nanoparticles. On day 17, the animals were sacrificed and the lung and spleen were excised for analysis and staining. The inflammatory markers were analyzed using ELISA and the VEGF silencing was investigated using western blot. A significant reduction was observed in the polyplex and chitosan treated groups when compared to the diseased control and individual treatment groups. This suggest that the nano geno-immunotherapy could be a more potent strategy to treat lung cancer.

POS-100

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Enhanced Catalytic Performance and Triboelectric Energy Harvesting with Silver-Cobalt Bimetallic Nanoparticles

Bimetallic nanoparticles (BNPs) are of great significance due to their unique properties and synergistic effects, leading to diverse applications. In this study, silver-cobalt bimetallic nanoparticles (AgCo BNPs) are synthesized using a simple wet chemical route. These BNPs achieve 99.97% reduction of 4-nitrophenol dye within 9 minutes. Recognizing the potential of metal nanoparticles to significantly boost the efficiency of triboelectric nanogenerators (TENGs), the synthesized AgCo BNPs are incorporated into a polymer matrix to analyze their impact on triboelectric performance. The TENG device with 8 ml of BNPs demonstrates superior performance, generating an output voltage of 270.52 V and a current of 5.24 μA. The synergistic properties of AgCo BNPs highlight their promising applications in both water treatment and energy harvesting, showcasing their multifunctional capabilities and potential for advancing sustainable technologies.

Keywords: Bimetallic nanoparticles, janus structure, catalytic activity, energy harvesting

POS-101

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Presence of discrete energy states, tunable band gap and enhanced fluorescent properties makes elemental quantum dots (QDs) a promising candidate compared to its one dimensional or two dimensional counterparts. Herein we describe a solvothermal assisted sol-gel method to synthesize Se quantum dots. Competing interests of oriented attachment based crystal growth with simultaneous rapid hydrolysis and condensation of silica network forces the QD to be entrapped within the voids of the matrix. Morphological and crystalline characterization revealed that Se quantum dots (average size 3-8 nm) have trigonal crystal structure. The aggregation based crystal growth of the nanocomposite results in the formation of planar defects (dislocations, stacking faults, twins and grain boundaries) in the material. Under ultraviolet excitation, quantum dots exhibits an excitation wavelength-dependent solid-state blue emission. Stable solid-state fluorescence obtained from Se QDs are explored for quantitative determination of the dye curcumin.

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POS-102

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Unveiling Stimuli-Driven Phase Shifts In Supra-Mof Zif-7

The synthesis of Supramolecular Metal-Organic Frameworks (Supra-MOFs) is a rapidly expanding field with significant implications for materials science. This research explores the complex synthesis dynamics of Supra-MOF ZIF-7, detailing the transformation from a gel to a crystalline structure. It is found that the gelation process precedes the crystallization of ZIF-7, with temperature being a crucial factor in accelerating this transition. Furthermore, the effects of various synthesis parameters, including different metal ions, dopants, and solvents, on the phase change of ZIF-7 have been thoroughly examined. The inclusion of various metal ions and dopants modifies the gelation kinetics and stability of the intermediate phases, thereby influencing the quality and properties of the final crystals. The choice of solvent significantly affects the morphology and size of ZIF-7 crystals, providing a flexible method for adjusting the framework's properties. This controlled synthesis approach not only clarifies the fundamental mechanisms of Supra-MOF transformation but also creates opportunities for incorporating guest molecules into ZIF-7 structures, offering an improved strategy for customizing MOF properties for specific applications.

POS-103

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Engineering Trimer Ag@SiO_2 Nanospheres Clusters for Double Resonance SERS Substrate on a Single Chip Using FDTD Method

The study investigates the plasmonic properties of trimer Ag@SiO_2 core-shell nanospheres for sensor based on surface enhanced Raman Spectroscopy (SERS) technique using finite-difference time-domain (FDTD) simulations. The research focuses on investigating local electric field enhancement in various geometric configurations under longitudinal and transverse polarization. In this work, the SERS characteristics of a series of transformation of Ag@SiO2 core-shell nanospheres trimer are numerically investigated for the first time and correlated with the plasmon modes using plasmon hybridization theory. The D3h symmetry with R2 = 30 nm shows degenerative behaviour. When the base size is further reduced to R2 = 15 nm, wave splitting occurs under different polarization. Peaks at two different wavelength arises at 445 and 440 nm and SERS enhancement is of the order 106 making it suitable for a highly sensitive sensor. Further reduction of base size to R2 = 0 nm, i.e. monomer, peak splitting does not happen, and peaks are coincided. This investigation shows that nanocluster with R2 = 15 nm, exhibits double resonance peak. Thus, a single substrate that exhibits double resonance SERS characteristics is proposed in this work.

POS-104

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In aqueous phase exfoliation, molecular surfactants play a crucial role in reducing the surface tension of water and creating repulsive potential barriers between exfoliated nanosheets against re-aggregation. Conventional surfactant molecules do not contribute to the property enhancement of stabilized graphene nanosheets. Introducing surfactant-like properties to nanomaterials, such as amphiphilic nanomaterials, helps to stabilize and improve the synergetic properties of the stabilized graphene nanosheets. This study introduced a new type of inorganic surfactant i.e. vermiculite clay nanosheets for effective exfoliation and stabilization of few-layer graphene nanosheets in water. Raman and X-ray photoelectron spectroscopy studies suggest that exfoliated graphene nanosheets are high quality, and free of basal plane defect and oxidation. The gas impermeability of graphene and the thermal insulation nature of vermiculite nanosheets have been utilized for protective coating applications. The vermiculite nanosheet-stabilized aqueous graphene dispersion was directly coated on Cu foil and PU foam and demonstrated long-term (120 h) oxidation performance at mid-temperature (200°C) and fire-retardant coating applications, respectively. After heat treatment, compared to Cu foil, 84% enhancement in hardness value was observed for coated Cu foil. This research finds a new way to stabilize 2D materials in water using clay nanosheets and their applications in high-temperature protective coatings.

Keywords: graphene, vermiculite, amphiphilic nanomaterials, liquid phase exfoliation, protective coatings

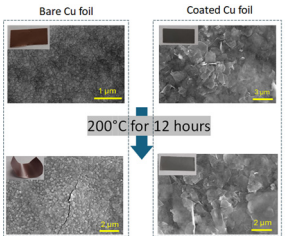

Figure: Before and after SEM image of uncoated and coated Cu foil at 200°C for 12 hours

POS-105

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Photon-Assisted Thermal Control of Graphene Nanosheets Networks for Enhanced Electrical Conductivity

Two-dimensional nanosheets hold enormous promise for advanced electronic applications due to their exceptional electronic and electrical properties. While graphene is the most extensively studied material, optimising its electrical conductivity and electronic grade quality is always challenging due to device size requirements. Although various methods of exfoliation and growth techniques are available for graphene networks but the controlling the junction resistance between nanosheets remains to be challenging to develop solution processed graphene networks for thin film device applications. This study explores photon-assisted thermal control and morphology driven electrical conductivity as a technique to enhance conductance of graphene nanosheet networks. By utilizing different photon sources of variable wavelength regions on self-assembled graphene nanosheet films with/without thermal energy. We found balance between heating from photons and resistive heating effectively reduces the intersheet resistance and improves graphene network conductivity. The experiments show that photon-assisted annealing greatly improves the electrical conductivity of graphene nanosheets by aligning in plane. After 10 min of annealing, the ID/IG ratio of photon-assisted films decreased by 65% compared to thermal annealing and resistance is decreased from 40 kΩ to 5 kΩ. Furthermore, we analyse the impact of photon energy and exposure duration on the thermal effects and resultant electrical properties. The improved photon-assisted thermal treatment is a practical and scalable way to improve the performance of graphene-based electronic devices. This method not only advances the practical application of graphene nanosheets in flexible electronics, sensors, and conductive films but also offers insights into the broader field of photonic thermal management in nanomaterials. Photon-assisted methods can improve nanoscale materials' electrical properties for next-generation technological advances in electronics.

Keywords: Photon, Thermal, 2D Nanosheets, Graphene, Electrical conductivity.

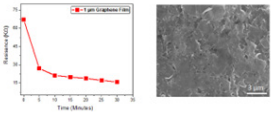

Figure. A) Resistance of graphene film as function of focused solar irradiation time, and B) corresponding SEM image after 30 minutes of irradiation.

POS-106

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Influence of decoration of au nanoparticles on reduced graphene oxide for acetone detection

Developing an affordable, realistic, highly sensitive room-temperature-operable acetone sensor is crucial in industries and medical fields. Acetone, one of the exhaled volatile organic compounds, is a key indicator of blood sugar. Hence, the acetone sensors can efficiently detect Type 1 diabetes or diabetes ketosis. The present study focuses on synthesising reduced graphene oxide (RGO) and Au decorated RGO (AuRGO) and their acetone sensing characteristics. X-ray diffraction analysis and Raman spectra obtain structural details while scanning and transmission electron microscopic images are used to carry out a morphological analysis. The compositional study is carried out via X-ray photoelectron spectroscopy to quantitatively determine the rate of reduction of graphene oxide (GO) into RGO and confirm the decoration of zero-valent Au nanoparticles. Acetone sensing performance of the prepared samples is investigated, and it is observed that decoration of Au nanoparticles has resulted in enhanced response (1.87%) compared to RGO (0.65%) with good selectivity, repeatability and long-term stability.

Keywords: Acetone sensing; Au nanoparticles, Reduced graphene oxide; Enhanced response

POS-107

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Activated carbon from coconut shell coated with nanoparticles: A low cost model for removal of toxic heavy metals from water

The removal of heavy metals from contaminated water sources remains a critical environmental concern due to their toxic effects on ecosystems and human health. The present work is aimed to investigate the application of activated carbon from coconut shell charcoal coated with green-synthesized nanoparticle of Moringa seed (NCAC) as an effective adsorbent for heavy metal ions. The synthesis of NCAC involves the utilization of environmentally friendly methods for nanoparticle synthesis from moringa seeds. The activated charcoal was produced from the coconut shell. The synthesized nanoparticles were coated onto activated charcoal, enhancing its surface properties and adsorption capabilities. Batch adsorption experiments are conducted to evaluate the performance of NCAC under various parameters including pH, initial metal concentration, contact time, and temperature. Characterization techniques such as SEM, TEM, and XRD are employed to analyze the morphology, structure, and surface area of NCAC. Our results demonstrate that NCAC exhibits promising adsorption efficiency and selectivity towards heavy metal ions, outperforming conventional activated carbon adsorbents. A household model was prepared to assess the efficacy of the heavy metal absorption process. The study highlights the potential of green-synthesized NCAC as a sustainable solution for mitigating heavy metal contamination in water, offering insights into the development of eco-friendly adsorption technologies and adds to sustainable water treatment technologies.

Activated carbon from coconut shell coated with nanoparticles: A low cost model for removal of toxic heavy metals from water

POS-108

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Engineering the Cerium Oxide Nanoparticles with Enhanced Hydrophobicity

The synthesis and designing of monodisperse nanomaterials with distinctive physical and chemical properties provide novel opportunities for utilizing them for a wide variety of applications. In general, the structures and surface characteristics of the nanomaterials have a major influence on their physicochemical properties. It is feasible to carefully modify the properties of the nanomaterials by tuning the reaction parameters. Here, we provide a simple and effective wet chemical method for the controlled synthesis of functionalized cerium oxide nanostructures by varying the reaction parameters such as capping agents, the concentration of the precursor. The synthesized CeO2 nanoparticles (NPs) are characterized using XRD, Raman spectroscopy, FESEM, TEM, and FTIR to study the crystal structure, morphology, and functional groups. The CeO2 NPs were found to be spherical and have a diameter of 23 nm ± 2 nm. They are highly crystalline in nature and belong to a cubic crystal system. We investigated surface wettability for various functionalized CeO2 NPs by contact angle measurements. The capping agent plays a critical role in imparting hydrophobicity to the NPs. The functionalization of CeO2 resulted in maximum enhancement in the contact angle of 107°. This work provides valuable insights into the influence of surface functionalization of nanoparticles on hydrophobicity applications.

Key words: Hydrophobic, metal oxide, morphology

POS-109

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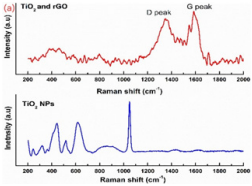
Titanium dioxide (TiO2) nanoparticles enhance energy storage, charge and discharge rates in supercapacitors for efficient and rapid energy delivery due to their tunable electrochemical properties. In this paper, we report the effect of carbon doping of TiO2 nanoparticles as an electrode for supercapacitors. TiO2 nanoparticles was synthesized using sol-gel method and rGO/TiO2 nanocomposites was synthesized using hydrothermal method. rGO concentration was varied from 1 to 5 wt% in TiO2 nanoparticles. The structural and optoelectronic properties were studied using Raman, UV-Vis spectrophotometer and CV measurements. In Raman spectra TiO2 NPs exhibit active mode of anatase phase at vibrational modes Eg1, B1g, B1g+A1g, and Eg2 located at 244, 360, 516, and 614 cm-1. In rGO/TiO2 nanocomposites two prominent peaks of carbon were observed in the Raman spectra at 1341cm-1 and 1599cm-1 which corresponds to D peak G peak of Carbon (as shown in Fig.1(a)). The UV-Vis absorption spectra of TiO2 nanoparticles shows the absorption edges at 346 nm and the absorption edges shift 264 nm with the addition of rGO. With the increase in wt% of rGO in TiO2 from 1-5 wt% the absorption edge shift from 264 nm to 314 nm. The red shift of nanocomposites with the increase in rGO percentage in TiO2 clearly shows the narrowing of the bandgap. As we increase the rGO wt% in TiO2 specific capacitance drastically increase from 10.37 Fg-1 to 1005.55 Fg-1 which is around two order change in magnitude (as shown in Fig.1(b&c)). This shows that the conductivity increases with the addition of carbon in TiO2 nanoparticles. The outcome from these studies shows that rGO/TiO2 nanocomposites hold the potential in the advancement of energy storage technologies, which is demand of today's electronic world aiming to yield electrodes with improved energy storage properties and prolonged cycling stability.



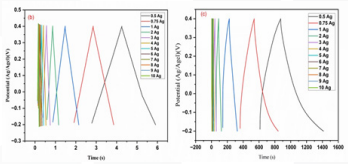


Figure 1a: Raman Spectroscopy of TiO2 and rGO/TiO2 ,
b&c: Galvanostatic Charge-Discharge curves TiO2 and rGO/ TiO2

POS-110

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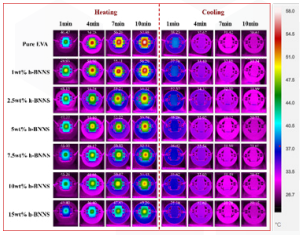
h-BN Nanosheets Infiltrated Polymer Composite Films for Thermal Management Applications

Thermally conductive and electrically insulating nanofillers are ideal materials in a polymer for the synthesis of thermal interface materials to dissipate the heat from the electronic devices. However, the practical application of existing thermal compounds is limited by the insufficient heat transfer pathways and usage of high-filler loading. The consequences of high filler loading and pump out in thermal grease affect the reliability of thermal interface materials for heat management. Thermals films and thermal pads of varying thickness are reliable due to their re-usability. To improve the distribution and orientation of the fillers, here we have used a spray coating followed by hot pressing method using exfoliated hexagonal boron nitride nanosheets (h-BNNS). Here, during hot pressing the spray-coated h-BNNS gradually infiltrated to the EVA matrix and formed the resultant BNNS-EVA composite film. The aspect ratio of h-BNNS is ~130 is used as filler in the ethylene vinyl acetate matrix. The thermal management application for the thermal film was demonstrated with the help of a 10 W LED bulb. It was found that the thermal compound film with the addition of 15 wt.% h-BNNS shows surface temperature reduction by ~9°C compared to the pure EVA matrix. This work provides a simple, easily deployable, scalable, and high heat-spreading thermal compound composite that may be used for next-generation heat dissipation in flexible consumer electronics devices.



Keywords: Infiltration, thermal management, thermal interface material, electronic cooling, Boron nitride.

POS-111

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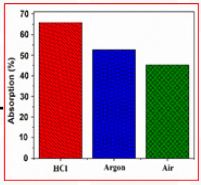
Facile synthesis of a Reusable MoS2 Aerogel for Efficient HCl Gas Absorption

Solid rocket motors (SRMs)[1], commonly employed as main boosters for rockets, utilize ammonium perchlorate as the oxidizer and aluminum powder as the fuel. The combustion of composite propellants primarily generates exhaust products such as hydrochloric acid (HCl), carbon monoxide (CO), aluminum oxide, and hydrogen (H2). Approximately 95% of the ammonium perchlorate is converted to HCl, constituting nearly 20% of the combustion product by weight, which significantly contributes to air pollution. To mitigate these challenges, various nanomaterial-based aerogels, including graphene oxide (GO)[2], have been developed. In response to this issue, our group has developed a reusable MoS2 aerogel specifically designed for HCl gas absorption, with an absorption capacity of around 65%. The fabrication process is straightforward and cost-effective, enhancing the material's practicality. The aerogel's effectiveness in absorbing HCl gas makes it highly valuable, offering a promising solution to mitigate air pollution. Moreover, the samples exhibit exceptional recoverability, underscoring their suitability for HCl gas absorption applications. This work lays the groundwork for the advancement and mass production of innovative nanomaterial-based aerogels, presenting versatile solutions for a broad spectrum of contemporary applications.

Reusable MoS2 aerogel

Lightweight placed on a flower



Reusab Excellent HCl gas absorption ability le MoS2 aerogel

References:
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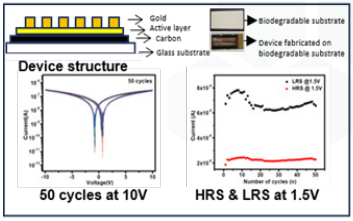
WO_3 bio-nanocomposite for fabrication of effective memristor device

Memristors play a vital role in the field of electronic devices and memory storage. These devices find attractive applications in storing information efficiently and therefore will be part of next-generation computing technologies. Researchers across the globe are exploring various materials for their optimum storage performances. In this regard, we have generated novel materials integrating organic-inorganic composite materials for the development of effective memristors, exploiting the distinct advantages of both components.

In this work, we present the wet chemical synthesis of shape selective WO3 nanosheets having orthorhombic crystal structure. The material was extensively characterized by XRD, Raman Spectroscopy, FESEM, UV-DRS, and FTIR to study their unique electrical and physical properties. The nano WO3 bioconjugate was synthesized and utilized as the active material for the resistive switching device. The resistive switching device was fabricated on a biodegradable substrate with gold and carbon as top and bottom electrodes, respectively. The switching characteristics revealed the promise of this device behaving as an efficient memristor. The device exhibited a wide memristive operating range from 1-10V with a set/reset voltage of 4.9/-4.8V. The device exhibited an on/ off ratio of >101 at -5V to +5V sweep. The high resistance state (HRS) and Low resistance state (LRS) were calculated at 1.5V delineating the formation of non-volatile memory in both on and off states.

Keywords: metal oxide, bio-nanomaterial composite, resistive switching.



HRS- High resistance state

LRS- Low resistance state

POS-113

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Brewing Up the Value: Enhancing Green Synthesis of Metal Oxide Nanoparticles Using Tea and Coffee Waste and Their Applications

The expansion of the world tea and coffee market has caused a significant increase in their production and consumption, consequently generating millions of tons of tea and coffee residues. In recent years, green synthesis of nanoparticles coated with different plant components has emerged as a sustainable approach with multifaceted applications. Green nanoparticles can be synthesized in an environment-friendly way, while retaining all the advantages of traditional nanoparticles and more. In this study, we aimed to utilize the enormous waste generated by tea and coffee industries to synthesize green nanoparticles with potentially diverse applications. Spectroscopic and microscopic techniques like XRD, FTIR, UV-vis spectroscopy, and AFM were used for sample characterization.

The photocatalytic degradation of methylene blue dye in aqueous solution (94% in 2 hours) demonstrated the potential of these green nanoparticles as sustainable and eco-friendly alternatives to environmental remediation. Furthermore, the nanoparticles efficiently scavenged DPPH free radicals, showing their ability in mitigating free radical-mediated oxidative stress. Disk diffusion assays demonstrated their antimicrobial activity against a few common pathogenic bacterial strains, presenting alternatives to conventional antibiotics. Thus, the green nanoparticles synthesized by sustainable utilization of tea and coffee waste have demonstrated immense potential in environmental and biomedical applications.

POS-114

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In traditional designs, sensory systems are separated from memory and computing units. Converting and transmitting data from analog sensing domains to digital storage leads to inefficient power usage and increased delay. In this study, we present an all-in-one memristor that can detect gamma radiation while also functioning as a data storage device, selector, and artificial synapse. The problem of sneak-path currents in crossbar arrays complicates the large-scale integration of oxide-based memristors for artificial neural networks. Resistive switching in AlFeO3 is studied using different electrode materials (Ag, Au, Cr, Si and FTO), embedding metal (Ag, Au) nanocrystals to engineer a class of tunable memories in which forming free, multilevel, and bipolar resistive switching coexist with bidirectional threshold switching, capable of functioning as selector, memory, artificial synapse and dosimeter. Stoichiometric alterations induced by deposition temperature elicit a transition from bipolar to threshold switching within a single device. The concentration of electric field induced by the embedded metal nanocrystals influences the composition and stability of the filament. The devices emulate critical neural functions and demonstrates interconversion dynamics between short-term and long-term plasticity.

Keywords: resistive switching, threshold switching, memristors, dosimeter, artificial synapses.

POS-115

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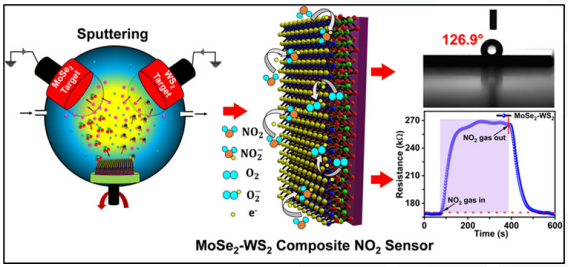
Vertically Aligned MoSe2-WS2 Nanoworms Heterojunction towards Room Temperature NO2 Gas Sensors

Gas sensing devices have gained substantial attention by using semiconducting heterojunctions composed of two-dimensional (2D) transition metal dichalcogenide (TMDs) materials, offering increased sensitivity, stability, selectivity, and full recoverability. However, a deeper understanding of the sensing behavior of these heterojunctions is necessary. In this investigation, the focus centers on the fabrication of p-n heterojunction consisting of hexagonal molybdenum diselenide-tungsten disulfide ($MoSe_2$-WS_2) for room-temperature (RT, 27°C) NO_2 (Nitrogen dioxide) gas detection. A catalyst-free magnetron sputtering technique has been employed to fabricate the composite thin film of vertically aligned hydrophobic $MoSe_2$-WS_2 nanoworms on the n-type silicon substrate. The resulting sensor exhibited exceptional sensitivity (59.63%), quick response (68.90 s), and full recovery (65.68 s) towards 50 ppb NO2 even at RT, highlighting its strong affinity for NO2 molecules. The reliability of the as-fabricated $MoSe_2$-WS_2 composite thin film sensor has been confirmed by its high selectivity (59.63%) and long-term stability (> 60 days) towards 50 ppb NO2 at RT. The remarkable sensing capabilities of this innovative TMDs composite hold promising potential for future low-power and room-temperature NO_2 gas sensors.



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Colorimetric Indicator Solution from Sappan Heartwood (Caesalpinia sappan L.) Extract for Milk Quality Monitoring

This study presents a pioneering approach to monitoring milk freshness utilizing a cost-effective and user-friendly colorimetric indicator derived from Caesalpinia sappan L. To our knowledge, this is the first instance of utilizing a Caesalpinia sappan L. solution for real-time updates of milk freshness via colorimetric detection without the utilization of a substrate. The indicator undergoes distinct color changes, transitioning from orange-red to orange to sharp yellow, in response to changes in the pH from pH 7 to pH 2 corresponding to various stages of milk spoilage. Digital images of the indicator solution treated with milk samples were analyzed using RGB indices, with the red chromatic shift serving as a reliable parameter for quantifying color changes and assessing milk spoilage. The colorimetric changes are attributed to the presence of brazelin in Caesalpinia sappan L. This innovative method offers the advantages of simplicity, accessibility, and accuracy, requiring neither specialized equipment nor trained analysts, thus making it suitable for use in resource-limited settings. This breakthrough in milk freshness monitoring has significant implications for food safety practices and holds promise for broader applications in diverse settings

POS-117

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Magic of Iron in $NiCoS_2$ for HER Performance: Quest for Iron Effect

Increasing demand for ecofriendly energy is an urgent requirement to solve biggest global threats like climate change and global warming. The electrochemical water splitting is a novel approach to get 99.99% clean and green hydrogen, oxygen, which is sustainable and easy to carry out. Herein, we have synthesized iron incorporated $NiCoS_2$ for the hydrogen evolution reaction (HER). The electrocatalyst composition varied by using different Fe3+ concentration to analyze the effect of iron incorporation into $NiCoS_2$. Under optimized deposition conditions, $NiCoFeS_2$ exhibits higher activity than compared other Fe concentrations. The NiCoFeS2 catalyst requires a very low overpotential of 90 mV at 10 mA cm−2 current density, exhibit Tafel slope of 90 mV dec−1. The high electrochemical active surface area (ECSA) of 11.5505 cm-2, roughness 162.6831 and Turn over frequency of 7.83s-1 makes the catalyst is promising for HER process.

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Cellulose Nanomaterials from Coconut Midrib with Antibacterial and Electromagnetic Interference (EMI) Shielding Applications

Cellulose nanomaterials can play an important role in achieving sustainable development goals related to energy, health, food, and water. Cellulose nanomaterials derived from agricultural by-products not only reduce environmental pollution, but also help generate additional income for farmers. Nanocellulose that could be obtained from coconut midrib is an example. In this study, nanocellulose was synthesized from coconut midrib using an optimized acid hydrolysis procedure, and structural as well as chemical characterization of the materials were performed. Cellulose nanopaper (CN) derived from coconut midrib cellulose nanomaterials is hydrophilic, which significantly limits its practical applications. To overcome this, a facile approach is to impregnate it with chitosan (CS), followed by in situ polymerization of polypyrrole (PPy). The results we obtained indicate that the CN/CS/PPy composite exhibits excellent water resistance. The functionalized cellulose nanopaper shows good conductivity and shielding effectiveness of 21.92 dB at 10 GHz. In addition, the functionalized cellulose nanopaper exhibits good antibacterial activity towards Staphylococcus aureus and Escherichia coli, with the bacterial reductions of 93.47 and 82.79%, respectively. This work provides a simple and efficient method for synthesis of coconut midrib nanofibrils and a versatile approach to functionalize cellulose nanopaper from it for achieving multifunctional properties.

POS-119

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Ion-imprinted carbon dots derived from paper precursors for the detection of metal ions

We are reporting a three-step modification strategy for carbon dots (CD) based on ion-imprinting technology by utilizing paper precursors. The proposed ion-imprinting strategy analyses the fluorescence response to each of those steps. The metal ion-bound CDs were synthesized by soaking paper precursors in a solution of metals. The tethered metal ions are removed using a precipitation method with suitable eluting solvents. Removal of metal ions creates vacancies of these metal ions on the CD surface, affecting the fluorescence characteristics. The fluorescence response after reinstating the metal ions with the addition of the specific metal solution determines the efficacy of the technique. We showcase the efficacy of the proposed ion-imprinting strategy by recording the selective and sensitive fluorescence enhancement for Cadmium ions with a limit of detection (LOD) of 520 nM. The Cadmium ions form coordinate bonds with the oxygen-containing functionalities of CDs, leading to the development of a novel, inexpensive sensor. This report on the metal detection strategy employing ion-imprinted CDs derived from paper precursors is the first of its kind.

POS-120

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Doxorubicin loaded thermostable nanoarchaeosomes: a next-generation drug carrier for breast cancer therapeutics

Breast cancer has a poor prognosis due to the toxic side effects associated with high doses of chemotherapy. Liposomal drug encapsulation has resulted in clinical success in enhancing chemotherapy tolerability. However, the formulation faces severe limitations with a lack of colloidal stability, reduced drug efficiency, and difficulties in storage conditions. Nanoarchaeosomes (NA) are a new generation of highly stable nanovesicles composed of the natural ether lipids extracted from archaea. In our study, we synthesized and characterized the NA, and evaluated their colloidal stability, drug release potential, and anticancer efficacy. Transmission electron microscopy images have shown that the NA prepared from the hyperthermophilic archaeon Aeropyrum pernix K1 was in the size range of 61 ± 3 nm. The dynamic light scattering result has confirmed that the NA was stable at acidic pH (pH 4) and high temperature (70 °C). The NA exhibited excellent colloidal stability for 50 days with storage conditions at room temperature. The cell viability results have shown that the pure NA did not induce cytotoxicity in NIH 3T3 fibroblast cells and is biocompatible. Then NA were loaded with doxorubicin (NAD), and FTIR and UV-vis spectroscopy results confirmed high drug loading efficiency of 97 ± 1% with sustained drug release for 48 h. The in vitro cytotoxicity studies in MCF-7 breast cancer cell lines showed that NAD induced cytotoxicity at less than 10 nM concentration. Fluorescence-activated cell sorting (FACS) results confirmed that NAD induced late apoptosis in nearly 92% of MCF-7 cells and necrosis in the remaining cells with cell cycle arrest at the G0/G1 phase. Our results confirmed that the NA could be a potential next-generation carrier with excellent stability, high drug loading efficiency, sustained drug release ability, and increased therapeutic efficacy, thus reducing the side effects of conventional drugs.

POS-121

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Eco-Friendly and Economical Copper-Enhanced Carbon Nanospheres: A Reusable Catalyst for Nitro-to-Amine Reduction

We propose the synthesis of thiol-functionalized copper-deposited porous carbon derived from Oil palm Leaves. The synthesis involves the chemical-free pyrolysis of Oil palm Leaves in a nitrogen atmosphere at 1000°C to produce porous carbon nanospheres. The resulting porous carbon material was further functionalized with thiol groups to facilitate the uniform deposition of copper nanoparticles and serve as an efficient support. This catalyst demonstrated excellent performance in reducing nitroarenes to their corresponding aromatic amines with a low metal loading of only 4 mol% in the presence of $NaBH_4$ as a reducing agent and EtOH/ water as green solvents. The products were identified using NMR spectroscopy. The catalyst was isolated from the reaction mixture and reused without any significant loss in the activity. The successful incorporation of approximately 8.6% Cu during the deposition process and the reusability of the catalyst highlights the potential of the porous carbon-supported copper catalyst synthesized at 1000°C for a sustainable and efficient heterogeneous catalyst for the reduction of nitroarenes.

Acknowledgment
We would like to acknowledge DST-INSPIRE for financial support.

POS-122

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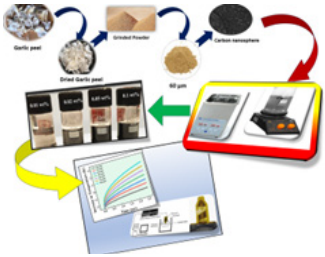
Low-Cost Heat Transfer Nanofluids for Future Automobile Industry: An Innovative Waste-to-Wealth Approach

This study explores the synthesis of biomass-based carbon nanospheres (CNS) from lignocellulosic-rich Allium sativum and their application in nanofluids (NFs) for enhanced heat transfer. This low-cost approach, coupled with its environmental friendliness, makes it particularly advantageous for automobile industry. By enhancing cooling efficiency at a reduced cost, this technology has the potential to not only improve vehicle efficiency but also contribute to national efforts towards sustainable development and resource utilisation. The thermal conductivity of CNS nanofluids depends on both particle size and concentration of nanoparticles. As the size of the particle decreased, the thermal conductivity increased by 52% to 122% at 30°C -80°C for particle sizes ranging from 120 nm to 28 nm, respectively. The rheological behaviour of CNS nanofluids was studied over a temperature range from 30°C to 90°C. The results show that the viscosity of CNS nanofluids increased linearly with increasing CNS concentration from 0.01 to 0.1 wt.%. Comparison studies conducted between the experimental values and theoretical values using suitable mathematical models for thermophysical quantities found a reasonable match.



Cost-effective nanofluid: waste to-wealth approach

Acknowledgements: We acknowledge Dr. Suryasarathi Bose from IISc Bengaluru and Pradeep G Siddheshwar from Christ University, Bengaluru, for their invaluable contributions to the characterizations and insightful inputs provided during the study. We thank the Centre for Research Projects, CHRIST (Deemed to be University) for providing the financial support with the seed money grant SMSS-2214.

POS-123

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Investigating Temperature-Dependent Porosity Modulation in Biomass-Derived Carbon Nanoparticles: Implications for Optimized Water Treatment Efficiency

Water pollution caused by the industrial sector is a major issue that impedes the achievement of SDGs. Water effluent containing dye poses a significant challenge to clean before discharge into the surrounding ecosystem. Inadequately treated and discharged dye wastewater is hazardous to aquatic and human life. As a result, it must be handled properly to avoid any negative consequences after disposal. In this case, we're using bio-waste derived carbon nanospheres to remove the dye and purify water. This study investigates how varying temperatures can be used to tailor the porosity of carbon nanoparticles derived from biomass. The primary aim is to enhance the efficiency of water treatment processes. The process involves adjusting the temperature during the synthesis of these nanoparticles, which controls their pore size and distribution. This optimized porosity significantly improves the adsorption capacity and effectiveness of the nanoparticles in removing contaminants from water. The findings demonstrate a promising approach to developing more efficient and sustainable water treatment technologies using biomass-derived materials. The utility of CNS increases efficiency as they are non-toxic compared to other metallic nanoparticles that have been utilized to date. This novel approach would be highly efficient, low energy consuming, and cost-effective, thereby can be applied on a large scale.

Acknowledgments: We thank the Centre for Research Projects, CHRIST (Deemed to be University) for providing the financial support with the seed money grant SMSS-2214.
Investigating Temperature-Dependent Porosity Modulation in Biomass-Derived Carbon Nanoparticles: Implications for Optimized Water Treatment Efficiency

POS-124

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Acid Functionalized Arachis Hypogaea skin-based Carbon Nanosphere as efficacious material for Enhanced Energy Storage

The study explores surface acid functionalization in porous carbon derived from Arachis Hypogea inner skin, thereby investigating its potential to enhance energy storage. The porous carbon was obtained by the pyrolysis at an elevated temperature of 800oCunder nitrogen gas yielded materials characterized using FTIR, XRD, Raman Spectroscopy, FE-SEM, EDS, and BET techniques. Various aqueous electrolytes and concentrations were tested, showing a maximum capacitive contribution of 98% in 3M KOH solution. In a three-electrode setup, specific capacitances reached 60 Fg-1 and 273 Fg-1 for porous carbon from AH via pyrolysis (AH8) and acid-functionalized porous carbon (FAH8), respectively, at 0.25 Ag-1 in 3M KOH electrolyte. FAH8 exhibited an energy density of 22.5 Wh kg-1 and a higher power density of 125 W kg-1. In a CR2032-type symmetric device, FAH8 achieved a maximum capacitance of 98 Fg-1 at 0.25 Ag-1, demonstrating exceptional cycle stability with 98.5% efficiency after 7500 cycles and 97.4% capacitance retention. Additionally, the FAH8 symmetric aqueous supercapacitor showed an energy density of 23.17 Wh kg-1 and a higher power density of 325.0 W kg-1. These results indicate that acid functionalization of porous carbon nanoparticles can increase specific capacitance fourfold, making them highly suitable for high-performance energy storage devices.
Keywords: supercapacitor, energy density, power density, current density, Arachis Hypogea

Acknowledgments

We thank the Centre for Research Projects, CHRIST (Deemed to be University) for providing the Seed Money with grant No.SMS-2214.

Acid Functionalized Arachis Hypogaea skin-based Carbon Nanosphere as efficacious material for Enhanced Energy Storage

POS-125

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A novel polymer matrix nanocomposite was developed using cost-effective, porous carbon nanospheres (CNSs) derived from Tectona grandis (Tg) sawdust through a one-step pyrolysis process at 1000°C. The resultant CNSs exhibited high carbon purity (97.25%) and low oxygen content (2.75%). These CNSs were incorporated into commercial-grade epoxy resin at three weight fractions: 0.05%, 0.1%, and 0.3%. Tensile testing was conducted to evaluate the mechanical performance of the nanocomposites, focusing on tensile strength and percentage elongation at break. The 0.1 wt% Tg1000/Epoxy composite demonstrated an optimal balance of enhanced tensile strength and improved ductility compared to the neat epoxy resin. This enhancement is attributed to the uniform dispersion of CNSs within the epoxy matrix, facilitating effective load transfer and crack deflection mechanisms. The superior mechanical properties of the 0.1 wt% Tg1000/Epoxy composite suggest its potential for various advanced applications where enhanced performance is essential. This study highlights the promise of using bio-waste-derived carbon nanomaterials to create high-performance, sustainable polymer nanocomposites, offering a cost-effective and environmentally friendly solution for advanced material development.

POS-126

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Biomass Derived, Low Cost Carbon Nanomaterial Supported Cobalt Boride as Bifunctional Electrocatalyst for Efficient Hydrogen and Oxygen Evolution Reaction

Biomass derived low cost carbon-based nanomaterial was synthesized as a bifunctional electrocatalyst for hydrogen evolution reaction and oxygen evolution reaction. Morus nigra bark derived carbon nanospheres (CNS) was synthesized by pyrolysis at 1000oC. Without further activation processes, cobalt boride was incorporated on CNS through simple chemical reduction method. The ratio of carbon to metal was optimized as 2:1 to minimize metal content while maintaining an effective catalytic activity. Electrocatalytic performance of the catalyst was evaluated via electrochemical techniques like linear sweep voltammetry, cyclic voltammetry, electrochemical impedance spectroscopy. The optimized catalyst exhibited overpotentials of 173mV and 340mV to reach the benchmark current density of 10 mA/cm2 for HER and OER respectively in alkaline medium. This work provides noble metal free, low cost, sustainable catalyst for HER suggesting biomass-derived carbon-based catalysts as a viable and competitive alternative to conventional HER and OER catalysts, paving the way for future research and industrial applications in hydrogen production.

Acknowledgments: We thank the Centre for Research Projects, CHRIST (Deemed to be University) for providing the financial support with the seed money grant SMSS-2214.

POS-127

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Integrating Biomass-Derived Carbon Nanospheres into Polysulfone Membranes for Superior Permeability and Antifouling Performance

Polymeric membranes incorporated with green synthesized carbon nanospheres (CNSs) are encouraging strategies for water remediation. In this work, novel biomass-derived carbon nanospheres were prepared successfully from mulberry leaves through pyrolysis technique and further subjected to acid functionalization. Polysulfone (PSF) membranes containing 0.1–0.6 wt% of synthesized functionalized carbon nanospheres (FCNS) were prepared with phase inversion method. The effect of incorporation of FCNSs with reactive oxygen functionality on the morphology and performance was investigated through pure water flux and antifouling performance. The performance of the PSF/FCNSs membranes were investigated using a cross-flow filtration system. The highest pure water flux and flux recovery ratio (FRR) were achieved with the membrane blended with an amount of 0.2 wt% CNSs (M-2), reaching 632.5 L m-2 h-1 and 93.54% respectively. The water contact angle gradually declined from 77.49° to 65.4° when the FCNSs content varied from 0.0 to 0.2 wt%. The performance of membranes is further hampered by hydrophilicity and fouling problems. Overall, the biomass derived carbon nanospheres opened a novel path to enhance the hydrophilicity, permeability and antifouling property of the PSF membranes, which pave a new avenue for membrane modification.

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POS-128

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Development of a non-invasive electrochemical-based sweat sensor for detecting 17β Estradiol

In the modern generation of nanotechnology, there is a need for developing non-invasive point-of-care devices for analyzing 17β estradiol which is crucial for women's reproductive health. Functionalized POSS (Polyhedral Oligomeric Silsesquioxane) hybrid material ideal choice for developing high-performance biosensors in the field of advanced materials, since POSS exhibits the required properties. This work concentrated on utilizing functionalized POSS-based nanomaterials as an interface detecting a 17β Estradiol. The integral part POSS material provides charge transfer and reliability of biosensors. Combining Functional groups and a nano scaled building blocks of POSS properties creates a synergistic effect including sensitivity and detection limits. Flexibility and biocompatibility of POSS-based interfacing material suitable for wearable biosensors. POSS material is synthesized by utilizing hydrolysis condensation reaction technique. The physicochemical characteristics of the synthesized material were analyzed topographically and structurally using a scanning electron microscope (SEM) and X-ray diffraction spectroscopy (XRD). Functional groups present in the synthesized material are investigated using FT-IR analysis. Electrochemical behaviors of the synthesized material are examined such as cyclic voltammetry (CV), differential pulse voltammetry (DPV) and electrochemical impedance spectroscopy (EIS). Stunningly our synthesized material displays synergistic properties such as sensitivity and detection limits. It helps prevent electrode fouling and provides more active sites for the attachment of biomolecules. The addition of unique functional groups in the POSS material to the electrode surface facilitates rapid and efficient electron transport, which is essential for accurate sensing of 17β Estradiol.

POS-129

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Development of $SrCaSiO_4:Tb^{3+}$ downshifting nanophosphor for increasing the power conversion efficiency of DSSCs.

The key to increased efficiency of dye-sensitized solar cells lies in inorganic downshifting layers doped with rare earth elements. This study uses $SrCaSiO_4:Tb^{3+}$, a highly effective luminescent downshifting nanophosphor, for the first time. It absorbs UV photons and transforms them into visible and near-infrared photons, which improves DSSC light harvesting. The DSSC uses the green downshifting nano phosphor $SrCaSiO_4:Tb^{3+}$ as a photoelectrode. The hydrothermal synthesis and high-temperature calcination processes are used to create the $SrCaSiO_4:Tb^{3+}$ downshifting nano phosphor. The luminescent properties and temperature stability of the synthesised $SrCaSiO_4:Tb^{3+}$were investigated using PLE, PL, and temperature-dependent PL. The structural and morphological studies were investigated using X-ray diffraction (XRD) and scanning electron microscopy (SEM). Surprisingly, $SrCaSiO_4:Tb^{3+}$ exhibits strong green emission at 543 nm and UV absorption at 230 nm. In addition to improving the stability of the I3- /I- electrolyte system, this distinctive emission of the $SrCaSiO_4:Tb^{3+}$ phosphor helps to prevent thermalization losses on the DSSC. Using this nano phosphor as a nanocomposite in addition to the conventional photoelectrode material, which is commercially available TiO_2 photoelectrode nanoparticles, the DSSC photoelectrode makes use of this absorption and emission property of $SrCaSiO_4:Tb^{3+}$. The photoelectrode was equipped with the nanocomposite $TiO_2/SrCaSiO_4:Tb^{3+}$. Using varying ratios of $SrCaSiO_4:Tb^{3+}$, the nanocomposite $TiO_2/SrCaSiO_4:Tb^{3+}$ was applied to the DSSC photoelectrode. Cyclic Voltammetry (CV) and Electrochemical Impedance Spectroscopy (EIS) were used to analyze the electrochemical behaviour of TiO_2 and $TiO_2/SrCaSiO_4:Tb^{3+}$. Following the addition of $SrCaSiO_4:Tb^{3+}$ downshifting phosphor, an enhanced current response was seen. Consequently, the device incorporating the $TiO_2/SrCaSiO_4:Tb^{3+}$ nanocomposite exhibits enhanced light harvesting, increased dye absorption, and efficiency.
Development of $SrCaSiO_4:Tb^{3+}$ downshifting nanophosphor for increasing the power conversion efficiency of DSSCs

POS-130

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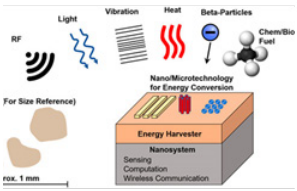
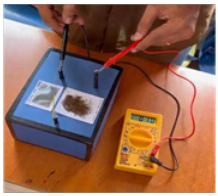
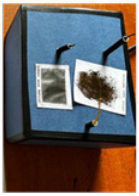
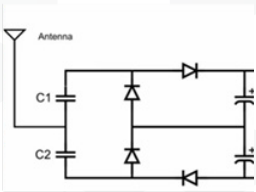
Design and Development of a Nano Antenna for Energy Harvesting in IoT-Based Nanotechnology Systems Using Chemical Decomposition Methods and AI-ML Techniques for Telecommunications

This research article presents the development of nano antennas for energy harvesting. With the increasing prevalence of wirelessly interconnected devices, the Internet of Things (IoT) is becoming a significant part of modern society. These devices, which often operate autonomously, are continually scaling down to millimeter and even smaller dimensions, creating substantial challenges for powering them. To address this, various energy harvesting approaches have been developed, including radio-frequency, optical, mechanical, thermal, nuclear, chemical, and biological modalities. This article provides a comprehensive survey of these methods, discussing their potential to scale down to small dimensions within the context of current technologies and future nanoscience advancements. As the number of untethered, wirelessly interconnected devices grows, the IoT has seen widespread adoption. These autonomous devices, which range from millimeter to sub-millimeter sizes, present significant power supply challenges. In this article, we conduct a thorough survey of current energy harvesting methods, covering modalities such as radio-frequency, optical, mechanical, thermal, nuclear, chemical, and biological sources. These methods enable the generation of electrical power for micro- and nano-systems. We explore the potential for scaling these energy conversion techniques to smaller dimensions, taking into account existing technologies and future developments in nanoscience. Additionally, the article provides an outlook on necessary advancements to overcome the challenges of powering small-scale devices and systems. A nano antenna is a novel solar collection device that utilizes rectifying antennas. Energy harvesting for nano antennas refers to the process of capturing and converting ambient energy into usable electrical energy using miniature antenna structures at the nanoscale. Nano antennas are designed to resonate at specific frequencies and efficiently collect electromagnetic waves or other forms of energy from the environment. This harvested energy can then be utilized to power low-power electronic devices, sensors, or wireless communication systems, especially in IoT (Internet of Things) applications. The fabrication of nano antennas has been accomplished through various techniques, including Electron Beam Lithography (EBL), Focused Ion Beam lithography (FIB), and Nanoimprinting Lithography (NIL). EBL and FIB lithography are expensive, time-consuming, and have low throughput. As an alternative, nanoimprinting lithography has been employed for nano antenna fabrication. It is a cost-effective, time-efficient, and high-throughput technique. In contrast to serial beam-based lithography, which employs photons, electrons, or ions to define nano patterns, NIL employs a hard mold that contains the desired surface topographic features. The mould is pressed onto a thin polymer film under controlled temperature and pressure, resulting in a thickness contrast. Resolutions as fine as 10 nm were demonstrated more than a decade ago. UV-NIL is a promising variation where a transparent mold is pressed at room temperature into a liquid precursor that is subsequently cured using UV radiation. Soft nano-imprinting techniques, utilizing polymeric flexible stamps replicated from a single master mold, have also been developed to reduce mold fabrication costs and enable large-area patterning at lower pressures.









POS-131

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The Fig. gives the experimental work carried out & the results observed in the multimeter. The working principle of a nano antenna relies on the interaction between light and its physical structure, typically composed of metallic nanoparticles arranged in a specific pattern. When light interacts with the nano antenna, it can excite the electrons within the metallic nanoparticles, resulting in surface plasmon resonance. This resonance causes the nanoparticles to oscillate, generating a localized electromagnetic field that can interact with nearby materials such as molecules or other nanoparticles. The design of a nano antenna can be optimized to enhance desired properties, such as the intensity and directionality of the electromagnetic field. Consequently, nano antennas find utility in various applications, including sensing, imaging, and data communication. The working principle is centered on the ability of metallic nanoparticles to interact with light and produce a localized electromagnetic field, which can be exploited for diverse applications. However, material selection in nano antenna fabrication presents challenges, particularly with gold (Au) and silver (Ag), as they exhibit skin effect at higher frequencies. This effect impacts the efficiency of nano antennas by reducing the effective cross-sectional area of the wire and increasing resistance. To address this issue, alternative materials like graphene and carbon nanotubes (CNT) are being explored. These materials do not display skin effect at higher frequencies, making them promising candidates for nano antenna fabrication. In this paper, we delve into the details of nano antennas based on CNT and graphene, exploring their potential advantages and applications. The design and development of a nano antenna using chemical decomposition methods in IoT-based nanotechnology systems for energy harvesting in the telecommunications sector can be approached using AI (Artificial Intelligence) and ML (Machine Learning) techniques. By applying an AI-ML approach, the design and development of a nano antenna for energy harvesting in IoT-based nanotechnology systems can be enhanced, leading to improved efficiency, cost-effectiveness, and better alignment with the specific requirements of the telecommunications sector. The circuit used for testing is shown in Fig. above. To conclude, the increasing global demand for energy cannot be met solely by non-renewable sources, highlighting the need to maximize energy extraction from renewable sources. Solar energy is a prominent renewable source, but current photovoltaic devices still face challenges in achieving optimal conversion efficiency. In this context, we explore the potential of a new device called the nano antenna, which converts heat energy into electrical energy and significantly enhances solar cell efficiency. This technology holds great promise for space applications, with space agencies such as NASA and ISRO utilizing solar cells as power sources in space shuttles. Nano antennas offer a compelling solution due to their efficient fabrication process using Nanoimprinting lithography, requiring minimal material compared to solar cells while delivering higher efficiency. Additionally, nano antennas find application in plasmonic electronic circuits, converting dissipated heat energy from electrical connections and electronic components into electrical energy. This functionality contributes to lower operating temperatures for such devices.

Keywords - Photovoltaic devices, Infrared, Communications, Nano antennas, Lithography, Chemical, etc.

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Development of nano-robots for medical applications in humans to cure cancer diseases using nanotechnology

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The main objective of the nanorobotic project is to design a miniaturized Magnetic Nano-Robot (MNR) for detecting cancerous cells using simulation tools such as Nano-Hive, incorporating biomolecules like carbon nanotubes (CNTs), lipids, pH/O2/Ferro Magnetic Nano Particles encapsulated in silk proteins. The MNR aims to detect affected cells via bio-sensors, release targeted cancer drugs to the tumor, and disinfect the area. The project involves testing the fabricated MNR prototype across various stages, including laboratory, animal, and human trials at institutions like IISc, NCBS, and SCH. Following successful trials, the goal is to apply for a patent, publish findings, secure grants, develop a start-up, and eventually release the product to the market. To achieve these goals, the research follows ten critical measures: determining the nanorobot's mode of entry into the human body; developing a propulsion system for the nanorobot; ensuring the ability to hold a set location while working; determining the operational use of the system; finding a suitable power source for the nanorobot; accurately locating the infected cell in two scenarios (moving with and against the fluid flow); identifying methods for removing compounds targeted by the nanorobot; establishing procedures for drug removal from the body; continually observing the body and updating on the cancer cell's destruction; and ultimately rendering the infected cell inactive or extracting it from the human body. Problem statement of the project is to design a miniaturized MNR to detect the cancerous cell using simulation tools like nano-hive with the help of biomolecules (CNTs, lipids, pH/O2/Ferro Magnetic Nano Particles encapsulated silk proteins) and detect the affected cell using bio-sensors, release the cancer drug to the tumour and disinfect it along with the testing of fabricated MNR prototype model (lab, animal, human) in the IISc lab/NCBS/SCH. The work aims to design and develop a nano-robot for medical applications in humans to cure cancer disease. It should be remembered that we are only using the program solution in this paragraph. The nanorobot's design includes a C-nanotube shell, a biomolecular nanomotor for propulsion, and peptide limbs for orientation. DNA and proteins, as well as genomes, make up biological components. As a result, it can be quickly separated from the body, has sensors, molecular sorting rotors, fins and propellers, a total of 6 degrees of freedom (6-DOF), and sensing capabilities to identify target areas and obstacles as the main component of a medical nanorobot. The designed nanorobots will use

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chemical nanosensors as embedded nanoelectronics which can be programmed to detect different levels of cancerous cells. A nano-chip consisting of all the embedded electronics that will be used for data transmission, communications, and interactions will be designed using the simulation tool. The surgical nanorobot for cancer treatment will be made up of ASIC circuitry, which is a set of integrated circuit blocks. The design can solve features for typical medical applications such as cancer treatment by offering an asynchronous interface for antenna, sensor, and a logic nanoprocessor that can deliberate actuator and ultrasound contact activation when required. The design takes into account the key variables used for nanorobot architecture and control activation, as well as the necessary technology history for advanced manufacturing hardware for molecular machines. As a general rule, the number of nanodevices used to insert a nanorobot should be equal to the hardware size in terms of inside-body use. We use smart intelligent sensors for actuators, such as electromagnetic, piezoelectric, electrostatic, and electrothermal sensors. The most effective and safe way to guarantee energy for as long as the nanorobot requires it is to use CMOS for active telemetry and power supply, and this concept will be used in the design process. Various sensors can be built into the surgical bot to relay data for a person's health care and to connect with doctors. It's worth noting that only software implementation is covered in this paragraph. Nanorobot fabrication in software using NanoHive simulator tools: it can be thought of fabricating the simulated nanorobot in the fab lab in any part of the country after discussion with the company representatives. Nanoscale electronics, sensors, technologies, components, micro- and nanoelectromechanical structures, bio-electronic interfaces, and embedded small-scale systems will all be part of the evolved nanorobot in the future, which can be developed to cure cancer disease, and the simulated nanorobot will be fabricated and tested. The following software needs to be procured for designing the nanorobot to use it for cancer therapy cure: NanoHive Nanospace Simulator Tool Beta Version 2.0. The methodology for killing the virus is explained next. Several different treatment techniques are under consideration in our research project. In one treatment, the cell absorbs nanoparticles, which are then heated up by infrared light to destroy the cell. The power from the bloodstream concept is used here for the work, using all three possibilities for the power flow mechanisms in our research project. In the first example, the microrobot's outer casing will have electrodes that would fuse with electrolytes in the blood to form a battery. The second method of extracting energy from the bloodstream is to use a fuel cell or literally to burn blood chemicals. This is analogous to a battery, but instead of getting electricity from current flowing through electrodes, we'd get it by triggering chemical reactions to occur at a regulated pace and extracting power from them. The body obtains its own strength in a similar manner by absorbing fuel chemicals from the bloodstream. The figure shown encompasses the fabrication process of nanorobots and utilizes AI and ML approaches for training purposes and the development of the project's flow chart, detailing the methodology and concepts used for the virus's destruction.

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To decipher 3d bioprinting solutions for the repair and regeneration of peripheral nerve injuries

Background & Objective:
Tissue engineering techniques for peripheral nerve injuries aim to improve nerve regeneration and functional recovery. Strategies for engineering nerve tissue include creating a 3D environment for the cells in order to restore the functional matrix. This study focuses on developing a scaffold using 3D bioprinting to facilitate peripheral nerve regeneration. The study aims to optimize the combination of alginate/methylcellulose gels in order to formulate a bio-ink for 3D bioprinting to be utilized for peripheral nerve regeneration applications.
Methodology:
Alginate and alginate/methylcellulose hydrogels were prepared and then subjected to physico-chemical and rheological analysis. Schwann cells were then cultured and seeded on the hydrogels. The cytocompatibility was assessed using MTT and Live/Dead assays. Hydrogels were then 3D bio-printed using a 3D bioprinter. Bio-ink was prepared by incorporating Schwann cells into Alginate/methylcellulose hydrogel which was then printed and cultured and cytocompatibility assay was performed.
Results & discussion:
The specific concentration of alginate and alginate/methylcellulose gels was optimized which depicted structural integrity and swelling and degradation capacity. Schwann cells seeded on hydrogels demonstrated good cytocompatibility. 3D-printed hydrogels depicted good shape fidelity post-printing. 3D-printed Schwann cells incorporated bio-ink also proved to be highly cytocompatible.
Conclusion:
The study successfully developed a 3D-printed biocompatible scaffold using sodium alginate and methylcellulose. Physicochemical and cytocompatibility characterization indicated suitable properties for cell growth. Schwann cell seeding and incorporation exhibited high viability, highlighting scaffold biocompatibility.

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Delivery of Specific MicroRNAs trough Nano Particles for the targeted site for Neurodegenerative Disorder

Nanotechnology, s concepts for the benefit of human beings health and well being in the area of Nanomedicine. In this imaginary abstract we need to aim to provide the overview of the area where nano particles are act as vehicle for targeted cite delivery of specific MicroRNAs for the neurodegenerative disorders. There will be two difficulties in Neuropharmacology: drugs are passed through the blood barriers and then it's internalized by targeted cells. Nano particles will increase the drugs bioavailability and pharmacokinetics, especially improving safety and efficiency psychotropic drugs.

In the region of multidimensional translational approaches, this special class of non-coding RNAs (22-25 nucleotides long) took a giant leap in exploiting the industry for their diagnostic and therapeutic applications. Small size, multiple target regulation, therapeutic modalities and exogenous activity were the central attractions that drive the global healthcare market resulting in the formation of 'miRNA mimics' and 'antagomiRs'.

Hypothesis: To explores nanotechnology-based approaches using miRNAs highlighting vectors such as nanoparticles, gold and magnetic nanoparticles, dendrimer-based nanoparticles, polymeric nanoparticles) to treat neurodegenerative disorders.

Need: Facilitated by high-throughput genomics and bioinformatics in conjunction with traditional molecular biology techniques and animal models, Nanotechnology research is now positioned to make the transition from laboratories to clinics to deliver profound benefits to public health.

POS-134

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Investigating the therapeutic potential of mesenchymal stem cell derived nanosomes in corneal tissue regeneration

Corneal blindness is a condition affecting millions of people worldwide and its treatment is impacted by the limited availability and quality of donor cornea tissues. Mesenchymal stem cell (MSC) derived nanosized extracellular vesicles (EVs), known as nanosomes, have shown great promise in the treatment of various clinical disorders, and were used in this study to demonstrate their regenerative and therapeutic potential in healing corneal wounds. These nanosomes isolated by ultracentrifugation and purified by Iodixanol density gradient separation were evaluated by nanoparticle tracking analysis and electron microscopy for size estimation, and western blot for protein profile as per MISEV2018- guidelines. They showed a narrow size distribution (70-150 nm) and appeared as typical cup-shaped vesicles in transmission electron microscopy. They displayed characteristic MSC-derived EV-markers CD9, CD63, CD81, TSG101, Flotillin, and Alix. Their therapeutic potential was established by in-vitro functional assays using human corneal epithelial (HCE) cells and in vivo studies performed in New Zealand white rabbits. The nanosomes showed significant activity in terms of anti-inflammation, anti-fibrosis, neurogenesis and anti-angiogenesis. Thus, MSCs-derived nanosomes stimulate reepithelization and support transparent regeneration of diseased cornea, observed both in vitro and in vivo. They are promising candidates for the clinical translation towards the treatment of various corneal disorders such as neurotropic keratitis, inflammation, and keratoconus to restore vision.

Investigating the therapeutic potential of mesenchymal stem cell derived nanosomes in corneal tissue regeneration

POS-135

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Bioactive Corneal Lenticules with Stem Cell-Derived Nanovesicles for Tissue Regeneration

The pursuit of a universal recipe for tissue-specific bioinks stands as a formidable challenge, as developing a formulation accommodating diverse cells and functionalities proves to be a monumental task. Despite advancements in bioprinting of tissue substitutes, a complete replication of extracellular matrix with optimal bioactivities remains a limitation. Nanosized extracellular vesicles emerge as promising bioactive cargo molecules. These can be loaded with growth factors like NGF and HGF, to support corneal regeneration. This study investigates a bioink, composed of collagen and hyaluronic acid derivatives, to harness the regenerative potential of human mesenchymal stem cell-derived nanovesicles in a digital light processing bioprinted corneal lenticule. The lenticule showed cornea mimetic properties, with light transmittance exceeding 85% and a compressive modulus comparable to that of a native cornea. MSC-derived nanovesicles, with diameter 70 to 150 nm were uniformly distributed in the lenticule. They exhibited an average release rate of 22% over 120-days, showcasing their potential as a sustained drug-delivery platform. By demonstrating 98% biocompatibility with human corneal stromal cells, the lenticules proved to conserve nanovesicles activity. This research highlights the prospective avenues of bioactive nanovesicles in bioprinted lenticules for corneal regeneration which can be extended to vascular and complex tissue regeneration.

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Nanotherapeutics loaded hydrogel constructs for tissue regeneration

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Tissue mimetic hydrogels have gathered plenty of attention in tissue engineering, owing to their programmable nature. The therapeutic potential of hydrogels can be enhanced by incorporating a carefully selected nanovesicle with respect to source, precursor, and method of synthesis or isolation. Liposomes are among the most versatile and clinically successful nanovesicles that can be engineered to carry cargo of interest to act as nanotherapeutics.
We utilized our proprietary biopolymeric hydrogels as matrix for delivering liposomes for tissue regeneration. The liposomes were synthesized through solvent evaporation-extrusion method and characterized for hydrodynamic diameter (~160 nm) and surface charge (~30 mV) using nanoparticle tracking analysis. Liposomes were uniformly distributed in the hydrogel as observed through fluorescent microscopy, and were released in a controlled manner from the liposome-hydrogel construct over an extended period. The constructs demonstrated adhesion strength of 60 kPa and biocompatibility with human cell lines when assessed in vitro.
The outcomes of the study demonstrated potential of the liposomes-hydrogel construct approach for developing an efficient, targeted and minimally invasive therapeutic tool for tissue regeneration.

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Gold nanoparticle-liquid crystal composites: The importance of excess ligand removal

Gold nanoparticles (GNPs) have garnered significant attention in the pursuit of advanced liquid crystal electro-optical material design. Recent literature replicates the addition of a substantial amount of liquid crystal (LC) in GNP synthesis, leading to properties that closely mimic those of liquid crystals themselves. However, it is pivotal to develop a competent synthesis method to open up new insights regarding liquid crystal nanocomposites. Hence, this work elaborates on the remarkable synthesis of gold nanoparticles using a refined Brust-Schiffrin method where an amine-functionalized liquid crystal was introduced as a stabilizer. The purification process, which involved washing off uncoordinated excess ligands, led to the formation of gold nanoparticles embedded in a liquid crystal -matrix. Thermogravimetric analysis (TGA) revealed that even a minimal removal of 5% of ligands induced significant changes in the composite, altering its mesogenic and optical properties and resulting in the emergence of Fano resonances in the Au-LC-nanocomposites.

Keywords: GNP, LC, nano-soft composites, Fano-resonance

POS-138

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Elucidating the photo-assisted performance of Nickle Cobalt Oxide Nanowires based supercapacitors

With the growing demand for energy storage from renewable energy sources, photo-rechargeable supercapacitors offer a viable alternative for directly converting and storing solar energy. This will take over the traditional energy solution which uses a solar cell to convert solar energy and store it in rechargeable batteries. In the present work, we synthesized binder-free NiCO2O4 nanowires that grow on Ni foam and analysed their crystal structure and morphologies using XPS and TEM. The UV Vis spectrometer's observed band gap is in the visible region, making it an ideal candidate for both solar energy conversion and storage. The NiCO2O4 nanowires demonstrated a 48% increase in areal capacitance at a current density of 5 mA/cm2 (715 to 1060 mF/cm2) under illumination with light. Additionally, there is also a 33% increase in energy density under light conditions (35 to 52 mAh/cm2) and a high powder density of 1500 mA/cm2. A typical asymmetric device was prepared utilizing activated carbon as anode and NiCO2O4 nanowires as photocathode material for practical use. The device achieved an excellent performance, with a capacitance retention of 94% after 10,000 cycles under dark conditions and 88% after 1,000 cycles upon light illumination. This study brings new prospects for the direct storage of ample solar energy.

POS-139

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A controlled release dispenser to deliver the pheromone of cabbage diamond back moth Plutella xylostella

The oligophagous diamondback moth (DBM), Plutella xylostella (Lepidoptera: Plutellidae), attacks cruciferous crops globally. Using insecticides to control this pest is harmful on longrun, thus leveraging its behavior is a more sustainable method. The sex pheromone of P. xylostella consists of (Z)-11-Hexadecenal, (Z)-11-Hexadecenyl Acetate, and (Z)-11-Hexadecen-1-ol in a ratio of 10:10:1. Commercial pheromone lures in rubber/silicone septa dispensers need frequent replacement, increasing cost. Novel nanoporous materials are effective in releasing volatile signaling chemicals. P. xylostella pheromone was loaded in mesoporous silica (SBA-15) dispensers with well-organized pore channels. The pheromone in the nanomatrix dissipated slower than the pheromone alone, according to thermal gravity analysis (TGA). Pheromone-infused nanomatrix composite caused a strong electrophysiological reaction in male moth antennae. The field experiments showed that the pheromone-loaded nanomatrix trapped more insects than rubber septa for a longer time.

POS-140

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Development of Nano route based Synthetic RBC's using Nanoparticles & Nanotechnology – Prototype

This paper gives a brief abstracted overview on the final year project work that was carried out by the student under the guidance of the supervisors. Blood transfusion plays a critical role in modern healthcare, but the availability of safe and compatible blood for transfusion is often limited. Synthetic red blood cells (RBCs) have emerged as a potential solution to address this challenge. This abstract provides an overview of the development of synthetic RBCs as a promising alternative to natural RBCs. In addition, steps taken toward the development of artificial blood technology and some of their promises and hurdles will be highlighted. Synthetic RBCs are designed to mimic the structure and function of natural RBCs, allowing for effective oxygen transport and circulation within the body. They are typically composed of biocompatible materials that offer enhanced stability, extended shelf life, and compatibility with various blood types, minimizing the risk of adverse reactions during transfusion. On the membranes of these cells are proteins that the body recognizes as its own. For this reason, a person can use only blood that is compatible with her type. Currently, artificial blood products are only designed to replace the function of red blood cells. It might even be better to call the products being developed now, oxygen carriers instead of artificial blood. Oxygen and carbon dioxide throughout the body. They are also responsible for the typing phenomena. On the membranes of these cells are proteins that the body recognizes as its own. For this reason, a person can use only blood that is compatible with her type. Currently, artificial blood products are only designed to replace the function of red blood cells. It might even be better to call the products being developed now, oxygen carriers instead of artificial blood. Despite the advancements in science and technology, challenges remain in the development of synthetic RBCs. Achieving long-term stability, optimal oxygen-carrying capacity, and efficient removal from circulation after use are areas of active research. Additionally, regulatory approval and large-scale manufacturing processes need to be established to facilitate clinical translation and widespread availability. In this project we Develop Nano route based Synthetic RBC's using Perfluorocarbon (PFC's) we also have designed an embedded system to verify the flow rate and volume of the RBC's. The development of synthetic red blood cells (RBCs) using perfluorocarbon (PFC) compounds has been an area of active research. PFCs are synthetic compounds that have a high affinity for oxygen and can serve as oxygen carriers in blood substitutes. The main objective of our project, developed under the guidance of our project guide, is to create nanoroute-based synthetic red blood cells (RBCs) that fulfill several critical criteria. First, these synthetic RBCs will have the ability to carry oxygen efficiently, similar to natural RBCs. Additionally, they will be designed to integrate seamlessly with human blood, showing no significant differences when combined. These synthetic cells will also react to pathogens, mimicking the natural immune response of human RBCs. Our focus will be on targeting blood group O+ to ensure broad compatibility. Furthermore, we aim to significantly increase the shelf life of these synthetic RBCs, making blood storage simpler and more efficient. Lastly, the design will enhance the reusability of the synthetic RBCs, ensuring they remain functional over extended periods. The application of perfluorocarbon (PFC) compounds in synthetic red blood cells (RBCs) offers significant advantages, including high oxygen solubility, low toxicity, and excellent biocompatibility. PFC-based synthetic RBCs can function as artificial oxygen carriers, effectively delivering oxygen to tissues and organs in scenarios where traditional blood transfusions are challenging or unavailable. Additionally, synthetic RBCs developed using nanoroute approaches open up exciting possibilities in personalized medicine and research. By incorporating drug molecules and functionalizing the surface of synthetic RBCs, these cells can be engineered to deliver drugs specifically to target tissues or organs, thereby enhancing therapeutic efficacy and minimizing side effects. Moreover, synthetic RBCs can serve as valuable platforms for studying blood-related diseases, drug interactions, and oxygen transport mechanisms, offering new avenues for medical research and treatment.

POS-141

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The rapidly evolving science of nanotechnology has the potential to completely transform a wide range of sectors, including pest control. Recently, the use of nanomaterials and their formulations has found efficient substitutes for traditional pest control approaches. There has been a lot of progress in manipulating nanomaterials and making nanoformulations of different insecticides. This is because many traditional insecticides are made of ingredients that dissolve easily in water and need a way to be applied in field. Nanopesticides have many advantages over bulk chemicals, such as higher effectiveness, controlled release, higher photodegradability, less pollution, and lower toxicity to things that aren't intended to be affected. The nanoformulation of certain natural insecticides, such as neem oil, has the advantage of preventing early degradation, among other advantages. Researchers have proposed numerous formulation forms, including nanoemulsions, nanocapsules, and inorganic nanoparticles like metals and their oxides, as well as nanoclays. These products have potential to enhance the effectiveness of currently available pesticide active components. Nanoscale molecular diagnostics could facilitate early detection, diagnosis, and management of plant diseases and pathogens in the future. Using nanoporous materials as a carrier for highly volatile compounds like semiochemicals with regulated spatiotemporal release rates can effectively decrease insecticide use.

Keywords: Nanomaterials; semiochemicals; controlled release; Nanopesticid es

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Coke-free Propane Dehydrogenation over Ultra-stable BCN Catalyst

Non-oxidative propane dehydrogenation (PDH) is one of the most important on-purpose techniques for bridging the supply-demand gap of propylene. Pt and Cr-based catalysts are the commercial catalysts for PDH process. However, the high cost of Pt, environmental impact of Cr, and rapid catalyst deactivation which requires frequent regeneration resulting in CO2 emissions are some of the major challenges. Here we showcase a metal-free borocarbonitride (BCN) catalyst that exhibits exceptional catalytic activity and stability. The as-synthesized catalyst achieved a propane conversion of 17.8% with 94% propylene selectivity at 600 ◘C. Time-on-stream (TOS) stability test at 600 ◘C shows that BCN retains its initial activity even after 400 h in a single run. The stable nature of active sites and insignificant coke formation rates are believed to be the reasons for such performance. Based on experimental characterizations and DFT calculations, we propose that quinone functional groups are the active site and catalyst regeneration happens via the release of a hydrogen molecule.

POS-143

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MXene-graphene oxide composite coating for corrosion prevention

Corrosion is a pervasive problem that can cause significant damage to metal surfaces, leading to reduced durability and increased maintenance costs. Therefore, finding effective ways to prevent or slow down corrosion is crucial in many industries. One promising solution to corrosion is the use of graphene reinforced MXene nanohybrid coatings. It represents a new class of coating material with improved functionality which will be in high demand because of its extraordinary mechanical, electrical, and anti-corrosive properties. In this study, we investigated the layer-by-layer electrophoretic deposition (EPD) of Ti3C2TX MXene and graphene oxide (GO)-MXene nanohybrid (GMX) onto copper substrate and evaluated its corrosion resistance. MXene was derived from MAX phase synthesized by both pressureless sintering as well as flash sintering. The stable colloidal suspension of GMX nanohybrid was prepared by dispersion of 1 wt% Ti3C2TX MXene and 0.1 wt% GO in NMP and water, respectively. The EPD process was optimized to achieve uniform deposition of the GMX nanohybrid coating. The effects of various deposition parameters, such as deposition time, voltage, and suspension concentration were systematically investigated to determine the optimal conditions for uniform coating formation with desired thickness. The SEM analysis reveals a homogeneous distribution of GO and MXene within the nanohybrid coating, indicating good compatibility between the two materials. The XRD analysis confirms the increase in d-spacing of the GMX sheets to 9.73 Å from 8.75 Å for neat GO sheets, which suggests that interlamellar insertion of MXene nanosheets into GO sheets has occurred. The FTIR analysis confirms the formation of Ti-O-C bond between MXene and graphene nanosheet via nucleophilic substitution reaction. The Tafel measurements exhibited excellent corrosion inhibition efficiency of 99.99% for the layer-by-layer coating of GO and MXene compared to inhibition efficiency of 99.64% for GMX coated copper. These findings provide insights into the coating, highlighting their potential in corrosion protection.

POS-144

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Novel Strategies For Developing Effective Therapeutic Regimen Against Triple Negative Breast Cancer

Background: Breast cancer is the most prominent disease in women worldwide, which is considered a major threat to global health.

Purpose: Mitoxantrone hydrochloride (MT) is a synthetic anticancer agent and Beta Lapachone (BL) is a naphthoquinone. Lipid polymer hybrid nanoparticles (LPHNPs) offer unique features.

Objective: The objective of the present work is to improve the therapeutic effectiveness of MT and BL by loading in LPHNPs, which were formulated separately but administered in combination to achieve reduced toxicity and enhanced effectiveness against TNBC.

Methods: The LPHNPs was prepared by nano precipitation methods and emulsion solvent evaporation methods. The optimization of LPHNPs was carried out by varying the lipid content and polymer ratio through design of experiment (DoE) approach.

Results: The optimized formulations shows a particle size were 162.5±0.54 nm,113.9±2.1 nm, PDI was 0.169 ±0.01, 0.154±0.25 and zeta potential was -20.35±0.11mV, -26.7±0.4 mV. In-vitro drug release from LPHNPs formulations at the end of 72 hrs was found to be 89.62±1.75% and 82.15±2.46%. The anticancer efficacy of optimized formulation was tested on the MDA-MB-231 and MCF-7 cell lines which produced higher cytotoxicity than the pure drugs. The cellular uptake was time-dependent and potentially inhibited cell migration, and induced apoptosis, through the expression of mRNA levels of apoptosis regulatory genes such as Bcl2, Topo I, Topo IIA and NQO1. Furthermore, the in-vivo studies demonstrated that the developed LPHNPs and their combination was effective in reducing tumor volume as well improving pharmacokinetic parameters.

Conclusion: This work reports the utility of MT-LPHNPs and BL-LPHNPs as an effective combinatorial drug therapy against TNBC.

Keywords: Triple-negative breast cancer, Beta-Lapachone, Mitoxantrone, Lipid polymer hybrid nanoparticles, Design of experiment, Combination therapy

POS-145

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Revolutionary Combo-Drug Therapy: A Breakthrough in Metastatic Melanoma Management

Melanoma is a type of skin cancer that originates from melanocytes, cells responsible for producing melanin. Conventional therapies face numerous challenges in treating melanoma, making nanotechnology-based drug delivery systems for targeted delivery and enhanced bioavailability. This study aimed to formulate and evaluate nanostructured lipid carriers (NLCs) loaded with Compound A and Compound B for melanoma treatment, leveraging their synergistic effects on multiple melanoma pathways. Compound A, an o-naphthoquinone from the Tabebuia avellanedae tree, and Compound B, a plant polyphenol, are both highly lipophilic. Compound A NLCs were prepared using Precirol (solid lipid), Labrafac (liquid lipid), and Tween 80 (surfactant), while Compound B NLCs were prepared with Glyceryl monostearate, Labrasol, and Pluronic F 127 (surfactant), both using hot melt homogenization method. 25 full factorial design using DOE optimized NLCs for Compound A had a particle size of 113.9 nm, PDI of 0.154, and an EE of 82.35%, while Compound B NLCs had a particle size of 132.9 nm, PDI of 0.168, and an EE of 73.38%. Cytotoxicity studies against A-375 cell lines showed drug-loaded NLCs are a promising approach for melanoma therapy.

Keywords: Nanostructured lipid carriers (NLCs), Drug delivery, Lipophilicity, melanoma, cytotoxicity.

POS-146

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Repurposing Terbinafine: Nano emulsion Gel as a Novel Therapy for Oral Squamous Carcinoma

Oral squamous cell carcinoma (OSCC) is a malignant tumour originating from the stratified squamous epithelium of the oral cavity, primarily caused by tobacco use, which introduces approximately 70 carcinogens and promotes the degradation of endogenous antioxidants. Terbinafine, originally used as an antifungal agent for treating fungal infections such as athlete's foot, jock itch, and ringworm, is being repurposed in this study for OSCC treatment due to its potential anticancer properties, including inhibition of cell proliferation and induction of apoptosis. This study aimed to develop a Nano emulsion-based gel loaded with terbinafine for OSCC treatment. Optimization was achieved using a pseudo ternary phase diagram involving oil (medium-chain triglycerides), surfactant/co-surfactant mixture (Tween 80 and ethanol), and water. Preformulation and optimized formulation evaluations (DSC, FT-IR, and XRPD) confirmed good compatibility. The optimized formulation exhibited a particle size of 196.1 nm, PDI of 0.189, and 80.34±1.2% entrapment efficiency. SEM imaging confirmed a spherical shape. The gel's properties included a pH of 6.7, viscosity of 2566 ± 8.3cP, extrudability of 88.2 ± 3%, and spread ability of 6.31 ± 0.2%. In vitro drug release studies showed 70.05% release over 24 hours, indicating a sustained release profile. Stability studies confirmed the formulation's stability. Based on these results, terbinafine-loaded Nano emulsion gel appears to be a viable treatment option for OSCC.

Keywords: Oral squamous cell carcinoma (OSCC), Terbinafine, Nano emulsion-based gel, Drug release profile, Stability studies.

POS-147

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Development and Characterization of Drug Regimen -Loaded LCNPs for Targeted Therapy in Triple-Negative Breast Cancer

Triple-negative breast cancer (TNBC) has a low prognosis rate due to the absence of hormones (estrogen, progesterone), HER2 downregulation, and cellular heterogeneity within individuals. Compound S acts against TNBC by targeting cancer stem cells and sensitizing chemotherapeutic drugs. Its mechanisms involve inhibiting cell proliferation, inducing apoptosis, and occupying cellular space. Molecularly, Compound S affects pathways such as NF-kappa B, p53-dependent signaling, and JNK/ERK pathways. In this study, liquid crystalline nanoparticles (LCNPs) loaded with Compound S were formulated by dissolving Glyceryl Monooleate and the drug in ethanol, followed by the addition to an aqueous phase of Pluronic F-127 as a stabilizer and vortexed. Optimization of the formulation parameters resulted in LCNPs with a mean particle size of 197.7 nm, a polydispersity index (PDI) of 0.098, and an entrapment efficiency of 96.5%. In-vitro release studies demonstrated complete drug release at 48&72 hours. Cytotoxicity assays revealed that the nanoformulation was 7.04 and 4.9 times more effective against MB 468 and MB 231 cell lines, respectively than the pure drug. The nanoformulation also exhibited stability at 4°C in stability studies. PEGylated and targeted delivery systems of Compound S-LCNPs were developed to achieve controlled release and site-specific delivery, enhancing its therapeutic potential against TNBC.

Keywords: Triple-negative breast cancer (TNBC), Liquid crystalline nanoparticles (LCNPs), in-vitro cytotoxicity, Drug delivery optimization, site-specific drug delivery.

POS-148

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Methane to Ethanol by CeVO4@TiO2 in Sunlight: Electronically Integrated QD shows the way.

Conventional methane conversion technologies suffer intense energy requirements along with significant CO2 emission, besides the high cost of production; however, a right and visible-light-driven photocatalyst can stimulate the same at ambient conditions with no CO2 emission. The present work reports the development of CeVO4 QDs assembled from its ionic precursors and integrated, structurally and electronically, into the pores of TiO2 (CeVO4@TiO2; CVT). Conversion of Ce3+ and VO3- into CeVO4 upon calcination leads to integration with TiO2 pores and trillions of heterojunctions. Photocatalytic activity evaluation for methane activation under one sun conditions reveals nearly 100% selectivity towards ethanol; ethanol yield of 4.36 µmol/h.cm2 was observed with 1 mg of photoanode material spread over 1 cm2. Normalization to 1 g catalyst (spread over 1000 cm2) reveals an ethanol yield of 174.4 mmol/ g.h in the present study. which is comparable to the noble metal-based benchmark catalysts. The synthetic strategy and activity reported are unique and render prospects of scaling up the productivity by fine-tuning the system as well as opening up a wider scope for

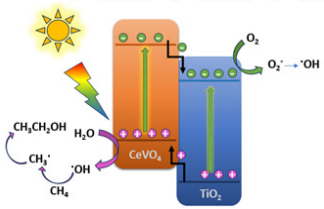

Fig.1 Schematic for methane photo-oxidation to ethanol over CVT thin film.

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POS-149

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Transforming Sunlight Energy into Chemical Energy: Photocatalytic Glycerol Oxidation for Enhanced Value-Added Outcomes

Achieving unassisted, economical, and sustainable artificial photosynthesis for highly efficient liquid fuels remains a significant challenge. This study addresses this by focusing on the critical factors of solar light absorption, charge separation at heterojunctions, and charge utilization. We selectively oxidized glycerol to glyceric acid and lactic acid via photocatalysis, accompanied by hydrogen production, showcasing a novel approach by synthesizing light-absorbing $BiVO_4$ quantum dots (BVQDs).

A TiO_2-based thin film nanocomposite was prepared, creating an artificial leaf with a reduced band gap of 2.34 eV, compared to pure titania's 3.2 eV, due to the integration of BVQDs in TiO_2 nanopores. High selectivity towards the desired products was observed at specific glycerol concentrations under visible light/sunlight. Direct assembly of BVQDs into TiO_2 mesopores and integrated structurally and electronically, leading to trillions of heterojunctions within a 1 cm^2 device with 1 mg material, enhancing structural and electronic integration. The cathode was made using noble and non-noble metal-based materials.

This study provides valuable insights into optimizing reaction conditions for producing value-added products during glycerol photocatalysis, highlighting the efficiency and sustainability of using TiO_2-based semiconductor materials integrated with quantum dots. Additionally, the hydrogen generated offers further benefits, contributing to the overall system's sustainability and efficiency.

POS-150

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Designing Rare Earth Material Doped Group VI Transition Metal Nanoparticle-based Electrodes for Overall Water Splitting

Electrochemical water splitting, which comprises of hydrogen evolution reaction (HER) at cathode and oxygen evolution reaction (OER) at anode, is a promising way to generate green hydrogen as fuel, although the sluggishness limits its commercialization. To address this problem we have prepared a series of M-Er/C type material by doping the rare earth metal, Er, with a partially filled f-orbital metal into carbon coated group VI transition metal nanoparticles (M = Cr. Mo W) to use the "d-f electronic ladders"1 to boost the electron transfer and facilitate the reaction kinetics. The microscopic studies showed disk and nano-aggregate morphology of the materials and multivaency. While comparing the their ability as working electrode materials towards reduction and oxidation processes MoErC showed excellence among other materials and also commercial noble metal electrocatalysts with lower overpotentials of 236 and 383 mV at 100 mA cm-2 current density for HER and OER, respectively in alkaline water. Moreover, Mo-Er/C showed electronic as well as morphological stability over 100 h that indicated its suitability for wide range application.

Keywords: Erbium; GroupVI; Electrode; Redox; Water splitting.

POS-151

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Mechanistic Insights Into Interfacial Effects In Plasma-Modulated Mos_2 For Room Temperature Selective Detection of NH_3 and NO_2

Keyword : NO2 sensor, NH3 sensor, ppb-level response, MoS2, plasma treatment, liquid phase exfoliation

Transition metal dichalcogenides (TMDs), particularly MoS2, are extensively utilized for diverse applications owing to their tuneable electrical, optical, and mechanical characteristics. Investigations have elucidated that the electrical properties of MoS2 can be finely modified by controlling its surface properties using diverse methodologies [1]. Notably, plasma treatment stands out as an effective technique for adjusting defect levels and conduction mechanisms in MoS2 [2].
In this study, a systematic approach was employed to obtain few-layered MoS2 nanosheets from bulk MoS2 through a liquid-phase exfoliation process. The exfoliated nanosheets were subsequently exposed to Ar and O plasma treatments, serving as an effective strategy to alter the surface properties of the material. Material characterization confirmed the successful exfoliation and revealed significant structural changes in the MoS2 nanosheets after plasma treatment compared to the untreated sample. The optimized Ar and O2-treated MoS2-based sensors were then subjected to rigorous gas sensing measurements. Intriguingly, the Ar-treated MoS2 sensor showcased enhanced sensitivity toward lower concentrations of NO2, whereas the O2-treated counterparts demonstrated improved sensitivity and selectivity to NH3. The practical viability of these devices was examined through various tests encompassing selectivity, response and recovery times, stability, etc. The real-time applicability of the device was evaluated by implementing the developed sensor array prototype for detecting meat spoilage and analyzing vehicle exhaust emissions. Collectively, these findings underscore a sophisticated approach in the realm of gas sensor development.

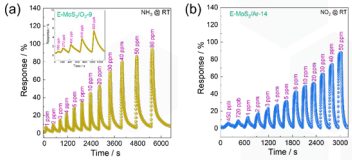

Fig.1 Dynamic response of the O2 and Ar plasma-treated MoS2 sensors to different concentrations of (a) NH3 and (b) NO2, respectively, at room temperature and 40% RH.

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Although the electrochromic devices are reported almost five decades ago, it is not commercialised owing to the high cost. There has been enormous amount of work to make the EC devices cheaper but almost no work to make the devices power-independent. The few reported works either utilised non electrochromic materials or able to switch the device only once. Here in by exploiting the position of highly explored tungsten oxide and vanadium doped nickel oxide films with respect to the aluminium anode potential, we have established a Redox Potential based Self-Powered EC (RP-SPEC) devices which can run few tens of cycles by itself afterwards it can be photo-charged to initial operating conditions. By designing three types of device architecture to fabricate the device we have shown two types EC displays and smart window. Dual-functionality of RP-SPEC is utilised as electrochromic energy storage device. Connection between Al to W03, AlxW03 to V-Ni0 and Al to V-Ni0 configurations provide 1.1, 1.21 and 1.6 Volts and this was utilised to power a timer display for 81, 03 and 36 hours. Utilisation of industrially used EC materials and anode and demonstration of large area (28 cm2) RP-SPEC smart window renders this technology to be easily adapted and produced in industrial scale.

POS-153

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Synergistic Heavy Metal Remediation: Green-Synthesized Zinc Oxide Nanoparticles Leveraging Aquatic Weeds for Enhanced Water Purification

Water pollution is a critical concern for both the environment and human health. Heavy metals present in polluted water can have severe impacts on human reproduction, digestion, neural, and muscular health, in addition to disrupting entire ecosystems. Aquatic weeds have demonstrated the ability to adsorb toxic heavy metals from water, offering a natural solution. By integrating advanced technologies like nanotechnology with nature-inspired approaches, we can achieve a synergistically improved method for addressing this issue.

This project delves into the innovative use of green-synthesized zinc oxide nanoparticles derived from aquatic weeds for the remediation of heavy metals in water. The green synthesized nanoparticles were characterized by Fourier transform infrared red spectroscopy and scanning electron microscopy analysis. Further, it was tested for adsorption of cadmium from water at a laboratory level showing potential for the same. Utilizing aquatic weeds not only provides an eco-friendly way to synthesise zinc oxide nanoparticles but also enhances the overall effectiveness of heavy metal removal. The green synthesis process aligns with sustainable practices, reducing environmental impact while harnessing the potential of aquatic plants for heavy metal remediation of water.

Keywords: Aquatic plants, heavy metal remediation, water pollution, nanoparticles, green synthesis

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Functionalized Magnetic Nanoparticles for breast cancer therapy: "An in vitro and in vivo Approach

Cancer, a multifaceted and formidable disease, has emerged as a growing global health crisis with a rising number of new cases each year making it a critical health challenge which demands attention and action due to its aggressive nature and lack of targeted therapies. In this research work, we prepared diverse super paramagnetic materials with precisely tailored properties in terms of functionalization and controlled dimensions through various synthesis techniques. Various characterization techniques are employed to confirm the material's morphology and phases such as XRD to verify its crystalline structure, FTIR to determine the various functional groups and functionalization, FESEM and HRTEM to examine the surface topology and particle size distribution and VSM to assess the magnetic saturation behaviour of the material. Further, Magnetic hyperthermia (MHT), was performed at different concentrations to investigate the heating ability of the materials. Materials were loaded with drug and it showed high encapsulation efficiency and enhanced cytotoxicity towards MCF-7 breast cancer cells. It also showed good compatibility on various organs of BALB/c mice as checked through histopathological studies. Our results reveal that the developed magnetic nanoparticles have tremendous promise for revolutionizing cancer treatment by enabling effective magnetic fluid hyperthermia and chemotherapy through paving the way for more effective, targeted, and gentler cancer therapies.

Keywords: Superparamagnetic nanoparticles, Cancer therapy, Magnetic Fluid Hyperthermia, Chemotherapy, Active targeting.

POS-155

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Eco-friendly ZnO nanoparticles from Citrus limon Linn peel extract for sustainable treatment of waste water

Depletion in the world's drinking water supply and the quandaries associated with purification of used water have made it obligatory to devise better strategies to obtain potable water. Several attempts have been made to commercialize plausible natural alternatives for efficient exclusion of the metals and pathogens. Nanotechnology is a promising and sustainable alternative for water remediation. Hence, great attention has been paid to the nanotechnology as a possible way of improvement. Present study focuses on the green synthesis of zinc oxide nanoparticles by an eco-friendly, simple and cost-effective method using lemon peel extract. The synthesized zinc oxide nanoparticles were characterized using Scanning Electron Microscopy, UV–visible absorption spectroscopy and Fourier transform infrared spectroscopy. A SEM result shows the nanoparticles synthesized are spherical shape and are considerable number of agglomerates. UV–Vis absorption spectra exhibit the sharp characteristic absorption peak of zinc oxide nanomaterials, FT-IR confirmed the presence of multifunctional zinc oxide nanomaterials and phyto-chemical constituents of citrus fruit peel extract. Synthesized zinc nanoparticles are used for the treatment of the waste water by assessing the turbidity, Chemical oxygen demand, Biological oxygen demand, heavy metals such as Manganese and Iron. Zinc oxide nanoparticles synthesized through green synthesis evidenced to be excellent nano-sorbents, antimicrobial, and biocompatible resources with promising application in sustainable treatment of waste water.

Key words: Zinc oxide, Fruit peel, nanosorbents, antimicrobial.

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Green synthesis of Kapok Buds nanoparticles for enhanced biological applications

This study presents the green synthesis of silver nitrate ($AgNO_3$), titanium dioxide (TiO_2), and zinc acetate ($Zn(OAc)_2$) nanoparticles using Ceiba pentandra (commonly known as Marathi Moggu or Kapok Buds) as the biological reducing agent. It provides a sustainable alternative to chemical methods that is not only environmentally favorable but is also cost-effective. The nanoparticles synthesized were characterized by different techniques of analysis to verify that they had been formed and in a stable manner. The synthesized nanoparticles were tested for the evaluation of their antimicrobial potential against Escherichia coli (E.coli) using Kanamycin as a positive control. The study results revealed appreciable antibacterial activity, highlighting the potent antimicrobial ability of these nanoparticles. Furthermore, we were able to demonstrate the excellent free radical scavenging activity and antioxidant property of the nanoparticles by evaluating their antioxidant potential.The study involves a comparative analysis of the silver nitrate ($AgNO_3$), titanium dioxide (TiO_2), and zinc acetate ($Zn(OAc)_2$) nanoparticles and accentuates the versatility of green synthesis anyway, which benefits a wide range of biomedical applications (for example in antimicrobial and antioxidant assays). These results indicated that Ceiba pentandra nanoparticles may play an excellent role in biomedicine and environment. Extensive studies are required to understand their applications in different industrial sectors.

Keywords : Nanoparticles, Ceiba pentandra, green synthesis, antimicrobial, antioxidant, free radical scavenging.

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Antimicrobial capability of green synthesized zinc oxide nanoparticles using citrus sinensis (orange) peel extract

Foodborne diseases caused by food pathogens have resulted in serious health problems. So, food packaging plays a significant role in controlling the foodborne pathogens, giving safety and keeping up the great nature of nourishment. ZnO NPs discover applications in food packaging materials as a result of their antimicrobial impact against food pathogens such as Escherichia coli (E.coli) bacteria, C.welchii bacteria, Epsilonproteobacteria, Firmicutes bacteria, Gammaproteobacteria, Lactobacillales, Present study focuses on the green synthesis of zinc oxide nanoparticles by an eco-friendly, simple and cost-effective method using citrus sinensis (orange) peel extract. The surface modification of the synthesized ZnO NPs was performed using Chitosan.The in-vitro analysis of antimicrobial activity of the synthesised ZnO NPs was carried out against food pathogen like Escherichia coli by Kirby-Bauer test. The results showed that the ZnO NPs have antibacterial inhibition zone of 28 mm, 27mm, 25mm and 8mm at the concentrations of 10mg/ml, 8mg/ml, 6mg/ml and 2.5mg/ml respectively against E. coli. The surface modified ZnO NPs showed enhanced inhibitory effect on the growth of E. coli compared to unmodified ZnO NPs. Synthesized Zinc oxide nanomaterials were found to be potent in inhibiting the growth of foodborne pathogens.

Key words: zinc oxide nanoparticles, E coli, Antimicrobial, citrus sinensis (orange) peel extract

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Green Synthesis Of Nanoparticles From Cloves. A Folk Medicine

Green synthesis of nanoparticles from natural sources offers sustainable and eco-friendly alternatives to conventional chemical methods. Clove (Syzygium aromaticum) is utilized in nanoparticle synthesis for its bioactive compounds—eugenol, eugenyl acetate, and flavonoids—acting as efficient reducing and stabilizing agents. These facilitate eco-friendly conversion of metal ions into nanoparticles. Clove-derived nanoparticles are biocompatible, cost-effective, and suitable for diverse applications. The study mainly focuses on the synthesis of Silver nitrate, Titanium dioxide and Zinc acetate. The synthesized nanoparticles were assessed for their antimicrobial effectiveness against E. coli, employing kanamycin as the control. The study revealed substantial microbial inhibition, emphasizing the nanoparticles' considerable antimicrobial efficacy. Additionally, we demonstrated the antioxidant scavenging activity of these nanoparticles, suggesting their potential applications in enhancing biomedical treatments and environmental remediation efforts. This study presents a comparative analysis of Zinc acetate, Titanium dioxide, and Silver nitrate nanoparticles, highlighting the versatility and advantages of green synthesis methods. These nanoparticles show promise across diverse biomedical applications, including drug delivery systems, antimicrobial coatings for medical devices, cancer treatment through targeted therapy, and environmentally friendly approaches to water purification and pollution control.

Key words: Clove, Silver , Drug delivary, Remediation

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Plant based treasure hunt is an asset to mankind, one such asset is Bay leaf which is a good source of vitamin A, vitamin B6, and vitamin C which support a healthy immune system. Bay leaf (Laurus nobilis) is also used in folk medicine.that might affect blood sugar and cholesterol levels. People use bay leaf for diabetes, common cold, high cholesterol, asthma, and many other conditions. This study presents the synthesis of nanoparticles from Laurus nobilis (commonly known as Bayleaf). Bayleaf,commonly known for its culinary uses, is a plant rich in phytochemicals such as flavonoids, alkaloids and essential oils. It has many medicinal properties such as antioxidant, anti-inflammatory, antimicrobial and digestive aid effects. It offers a green and sustainable approach for nanoparticle production. In this study, an aqueous extract of bayleaf was prepared by centrifugation and used to reduce salts such as Titanium dioxide (TiO2), Silver nitrate (AgNO3) and Zinc acetate, leading to the formation of nanoparticles. These salts were chosen for their distinct properties and as they do not have any side effects. Antioxidant and antimicrobial assays were performed to evaluate the efficacy and potential of the nanoparticles. Based on the results obtained, a comparative analysis was done for all the three nanoparticles formed by the reduction of metal salts by bayleaf extract. The tests showed that Zinc has the least antimicrobial activity and Silver has a high ability to scavenge free radicals. This study can be harnessed for its potential application in food, pharma and nutraceutical industries.

Keywords: Bayleaf, flavonoids, alkaloids, nutraceutical.

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Pomegranate peels offer antioxidant-rich, anti-inflammatory benefits, support cardiovascular health, aid digestion, and promote skin health. This study offers a green and sustainable approach for the synthesis of Silver nitrate, Titanium dioxide, and zinc acetate using Punica granatum peel (commonly known as pomegranate peel).
Pomegranate peel extract was aqueous in nature with Silver Nitrate, Titanium oxide, and Zinc Acetate. Furthermore, evaluation was carried for their antioxidant potential and their free radical scavenging activity. The result provided that Ti had the least antimicrobial resistivity and Zn had the highest antimicrobial resistivity.Pomegranate showed highest scavenging activity making it a potential source for food and nutraceutical. This eco-friendly method not only produces nanoparticles with uniform size and shape suitable for medical diagnostics, drug delivery systems, and water purification but also minimizes environmental impact and enhances sustainability in nanoparticle synthesis.

KEYWORDS: antioxidant-rich, anti-inflammatory, diagnostics, skin health

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Ecofriendly and sustainable approach for Taro leaves utility- A nano approach

Colocasia ("Colocasia esculenta") commonly known as taro known for its edible property as tuber, rich in fat and water soluble vitamins, minerals and anti nutritional factors offering anti-inflammatory, antioxidant, and digestive aid properties. This medicinal plant was targeted for green synthesis of nanoparticles which supplements sustainable and eco-friendly alternative to conventional chemical methods. This study explores the synthesis of nanoparticles from Colocasia esculenta (taro) leaves using silver nitrate (AgNO3), titanium dioxide (TiO2), and zinc acetate as precursor materials. Colocasia leaves, abundant in bioactive compounds, serve as reducing and stabilizing agents in the green synthesis of nanoparticles. The antimicrobial activities of the nanoparticles were evaluated where the zone of inhibition was close to zinc acetate compared to AgNO3 and TiO2 and also the antioxidant properties were highest for the zinc, exhibiting promising results. This study demonstrates the viability of Colocasia leaves as a source for nanoparticle synthesis, promoting green nanotechnology and expanding its practical applications in nutraceutical, pharma and cosmetic industries

Keywords- Taro, Antioxidant, Antinutritional factor

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Ecofriendly Approach for Nanoparticle Synthesis of the Most Common Non-Alcoholic Beverage - Coffee

Coffea arabica and Coffea canephora are known for their valuable coffee beans. However, their husks, often discarded, are rich in bioactive compounds, vitamins, minerals, and antioxidants. The study targets the green synthesis of nanoparticles from these husks, offering an eco-friendly alternative to conventional chemical methods. Coffee bean husks were used to synthesize nanoparticles from silver nitrate (AgNO3), titanium dioxide (TiO2), and zinc acetate. The husks act as reducing and stabilizing agents in this green synthesis. The antimicrobial activities of the nanoparticles were evaluated, with Silver Nitrate showing the highest antioxidant properties and a significant zone of inhibition, outperforming Zinc Acetate and Titanium Dioxide. This study demonstrates the viability of coffee bean husks as a source for nanoparticle synthesis, promoting green nanotechnology and expanding its applications in nutraceutical, pharmaceutical, and cosmetic industries.

Key Words: Coffee, bioactive compounds, antioxidant properties, nanoparticles

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Green Synthesis Of Nanoparticle From Ajwain -A Common Culinary Asset

Ajwain (Trachyspermum ammi), a member of the Apiaceae family possessing significant medicinal properties such as antiseptic, antiflatulent, and antispasmodic effects because of its phyto constituents act as effective reducing and capping agents, facilitating the green synthesis of nanoparticles. This study investigates ajwain extract's role in synthesizing zinc oxide (ZnO), silver nitrate (AgNO3), and titanium dioxide (TiO2) nanoparticles. Ajwain extract efficiently reduces metal ions, yielding nanoparticles with distinct properties. The synthesized nanoparticles were tested for antibacterial properties against E. Coli. Antibacterial assays demonstrated significant zones of inhibition for Zinc Oxide, silver nitrate and Titanium dioxide nanoparticles, however the highest zone of Inhibition was observed in silver nitrate, highlighting their potential in combating bacterial infections. Following the synthesis, nanoparticles were also subjected to antioxidant assay. The antioxidant assays using DPPH revealed the nanoparticles' remarkable antioxidant properties. This research underscores ajwain's efficacy in green synthesis, offering promising applications in biomedicine particularly in developing antibacterial agents and antioxidants for therapeutic uses. Furthermore, this procedure is a sustainable and eco- friendly approach with diverse applications in Agriculture, environment sectors as well.

Key words: Ajwain, biomedicine, antioxidants, green synthesis

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Green Gold from Jackfruit: Transforming Peels into Nanoparticles

Nature has its own valuable assets in the plant treasuries. One such under utilized and recalcitrant plant is Jackfruit; its peel is a rich source of bioactive antioxidants like vitamin C and beta-carotene, which protect the body against free radicals and strengthen the immune system. It is also rich in various phytonutrients such as alkaloids, lignans, isoflavones, and saponins. To harness it to the maximum, Nanoparticle approach was followed. This study focuses on synthesis of nanoparticles using eco-friendly and sustainable components titanium dioxide, zinc acetate and silver nitrate, followed by antimicrobial and antioxidant assays against E coli. Zinc acetate showed the maximum results for both antimicrobial and antioxidant tests whereas titanium dioxide showed the least results. Environmentally friendly and sustainable technologies can be found through green synthesis of nanoparticles. The rich composition of bioactive compounds in jackfruit peel offers an eco-friendly and cost-effective route for the green synthesis of nanoparticles, an asset to agro-waste industry.

Keywords: Bioactive antioxidants, Phytonutrients, Eco-friendly and sustainable

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Green synthesis of $AgNO_3$, TiO_2 and $(CH_3COO)_3Zn$ nanoparticles was achieved using Decalepis roots through a method called green synthesis. The roots of Decalepis hamiltonii were chosen because it can produce useful substances unlike the other traditional methods that are harmful to the environment but not this less dangerous process. These were then subjected to antioxidant and antimicrobial testing in order to examine their bioactivity. In comparison with $(CH_3COO)_2Zn$ and TiO_2 nanoparticles, $AgNO_3$ nanoparticles demonstrated the highest against microbial activity as per studies conducted. The behaviour of AgNO3 nanoparticles suggests that they could be used for medical applications because of their better anti-oxidant properties. Italsoshowshoweffectiverootextractof Decalepishamiltoniicouldbeinmakinggreennanosynthesiswhile emphasizing on essential characteristics like antibacterial properties of $AgNO_3$ nanoparticles; hence it opens up more ways towards further research and development in the field of nanomedicine.

Keywords
Decalepis, nutraceutical, anti-inflammatory, anti-microbial, nano-medicine

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Proximity-induced p-wave superconductivity in dual topological insulator BiTe

Recently, dual topological insulators (DTIs) have garnered attention for their potential to reveal the coexistence of topologically protected states arising from various underlying symmetries. However, their capacity to exhibit topological superconductivity remains unexplored. In this study, we present evidence of p-wave superconductivity at the DTI (BiTe)/s-wave superconductor (NbSe2) heterojunction through a series of electrical transport measurements. Four-terminal differential conductance measurements conducted at low temperatures reveal notable features such as a sharp V-shaped zero-bias dip and convex-shaped coherence peaks. Fitting the differential conductance using a multiband 2-D Blonder-Tinkham-Klapwijk (BTK) model uncovers two distinct superconducting gaps with anisotropic p-wave and s-wave characteristics, respectively. Detailed spectra, dependent on out-of-plane magnetic fields, demonstrate that the anisotropic p-wave gap is destroyed at significantly lower fields compared to the s-wave gap. Differential conductance measurements at various magnetic field orientations indicate that the superconductivity in this system is highly sensitive to the direction of the applied field. The disappearance of superconducting features in the differential conductance spectra above the critical temperature further supports our findings. Additionally, signatures of superconductivity observed in magnetoresistance (MR) and resistance vs. temperature (RT) measurements corroborate our observations.

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Sustainable Approach Towards The Synthesis Of Nanoparticles From Star Anise

Star anise (Illicium verum) has a characteristic star-shaped look and tastes somewhat like liquorice; it is used mostly for culinary purposes, although it is also reputed to have therapeutic properties. The antioxidant, antibacterial, and anti-inflammatory activities are as a result of the presence of flavonoids, phenolic acids, and essential oils, among other bioactive principles. This work, therefore, explores the use of these characteristics in synthesizing silver nitrate, titanium dioxide, and zinc acetate nanoparticles using starillicium verum extract as a natural reducing and stabilizing agent. The researchers described nanoparticles that were produced and tested them for bioactivity by conducting antibacterial and antioxidant tests on them. According to the maximal absorbance readings at specific wavelengths, zinc acetate nanoparticles were found to have the highest activity among all the types used during the antioxidant assay; at the same time, other studies suggested that in the antibacterial one, these same materials surpassed AgNO3 as well as TiO2 nanoparticle's effects against different kinds such as those causing diseases.
These findings reveal green nanoparticle production ability using herbs especially star anise. The plant as it contains bioactive chemicals assists greatly in synthesizing while also enhancing practical features present in nanoparticles. There was high potential on zinc acetate nanoparticles because it had good activities against oxidation and bacteria; hence, appropriate in the medical field.These results demonstrate the potential of green production of biologically active nanoparticles utilizing star anise in pharmaceutical applications. This study demonstrates the efficiency of star anise-mediated nanoparticle synthesis and provides the path for future research into natural product-based nanotechnology for the development of innovative medicinal medicines.

Keywords: Antioxidant , Antibacterial ,Anti-inflammatory ,Flavonoids ,Phenolicacids ,Essential oils

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Cinnamon offers antioxidant-rich, anti-inflammatory effects, improves heart health, controls blood sugar, high antimicrobial activity, potential cancer-protective effects, and improves dental health. This study offers an environmental-friendly and sustainable approach for the synthesis of Silver nitrate, Titanium dioxide, and Zinc acetate using Cinnamomum verum (commonly known as cinnamon). Cinnamon extract was aqueous in nature with Silver Nitrate, Titanium oxide, and Zinc Acetate. In addition, an analysis was carried for their antioxidant potential and their free radical scavenging activity. The result provided that Ti had the least antimicrobial resistivity and Zn had the highest antimicrobial resistivity. Cinnamon showed high scavenging activity making it beneficial for protecting cells and tissues from oxidative damage, which is implicated in the development of chronic diseases such as cardiovascular disease, diabetes, and cancer. This environment-conscious method not only produces nanoparticles with uniform size and shape suitable for medical diagnostics, drug delivery systems, and water purification but also minimizes environmental impact and enhances sustainability in nanoparticle synthesis.

Keywords: antioxidant-rich, anti-inflammatory, heart health, antimicrobial, cancer-protective, dental health.

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Angle-dependent optical studies on size-reduced monolayer of self-assembled polystyrene spheres

Monolayer of polystyrene (PS) spheres were self-assembled at the air-water interface [1]. Thus formed monolayer exhibits a hexagonally ordered close-packed (CP) crystalline state which was transferred onto a silicon substrate. Experimental techniques such as reactive ion etching (RIE), reflectance spectroscopy, optical microscopy, and scanning electron microscopy (SEM) were employed to investigate these systems. Close-packed spheres were transformed to size reduced, non-close-packed (NCP) state through optimized RIE parameters. The duration of RIE is found to be linearly related to the reduced sphere size. The morphology of the spheres was imaged using optical microscopy and SEM. Further, we discuss the spectral features of the CP, and NCP spheres obtained at different angles of incidence [2]. This study is expected to assist in understanding the influence of order [3] on the angle dependency of structural colors.

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Green Synthesis of Nanoparticles from bast fiber: Evaluating Antimicrobial and Antioxidant Efficacy

Bast fiber, sourced from Silk cotton, exhibits unique properties such as hydrophobicity, high porosity, and a hollow lumen structure, making it an excellent natural template for nanoparticle synthesis. This study explores the synthesis of nanoparticles from silk cotton fiber and evaluates their antimicrobial and antioxidant activities. Nanoparticles were synthesized through eco-friendly methods including sol-gel processing, hydrothermal synthesis, and in situ reduction, leveraging the inherent characteristics of silkcotton fiber for controlled nanoparticle size and morphology.
Characterization of the synthesized nanoparticles was performed using X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), and Fourier-transform infrared spectroscopy (FTIR). The antimicrobial activity was assessed against various bacterial strains using standard disk diffusion and broth dilution methods, while the antioxidant activity was evaluated through assays such as DPPH and ABTS.
Results indicate that bast fiber-derived nanoparticles exhibit significant antimicrobial properties, effectively inhibiting the growth of both Gram-positive and Gram-negative bacteria. Additionally, these nanoparticles demonstrated strong antioxidant activity, showcasing their potential in scavenging free radicals. The hollow, porous nature of this bast fiber not only enhances the functional properties of the nanoparticles but also aligns with green chemistry principles, minimizing environmental impact. Silk cotton fiber serves as a sustainable and efficient template for producing nanoparticles with notable antimicrobial and antioxidant activities, offering promising applications in biomedicine and environmental remediation.

Keywords: Antimicrobial activity, Antioxidant, Eco-friendly, Sol-gel, Hydrothermal

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A Paradigm Shift For Lc Alignment And Low-Voltage Infrared Regulators: Solution-Processed Hexagonal-Boron Nitride Nanoflakes

The field of 2D materials and liquid crystals (LCs) is a vibrant area of study, attracting significant attention due to the unique properties and versatile applications of these materials. 2D materials, especially hexagonal boron nitride (h-BN), exhibit exceptional mechanical, electrical, and thermal properties due to their single-layer atomic thickness. When integrated with LCs, which are known for their tuneable optical and electronic characteristics, they form novel soft-nano systems that open up new possibilities for advanced technologies. Recent research has focused on understanding the interactions between 2D materials and LCs, exploring the synergetic effects that arise from their integration. For instance, the studies presented here have shown that h-BN deposited using a solution-processed technique known as electrophoretic deposition (EPD) can affect the alignment and, hence, improve the electro-optics of LCs, leading to enhanced device performance [1]. This has been demonstrated not only on the traditional ITO-based transparent conducting substrates but also on non-ITO-based substrates like Al-doped zinc oxide (AZO) [2]. Besides alignment, the incorporation of h-BN nanoflakes into an LC-polymer system paved the way for novel applications, such as the fabrication of electrically actuated infrared regulators and radiative heat barriers [3]. The path to obtaining such optimized device designs necessitates not only experimental efforts but also theoretical studies and simulations.

As research in this field continues to advance, the integration of 2D materials with LCs is expected to unlock new functionalities and applications. Collaborative research efforts are necessary to push the boundaries, paving the way for innovations, especially in electronic devices. The development of scalable synthesis methods and the exploration of new 2D materials will further expand the possibilities, bringing innovation and technological progress.

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POS-172

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Low Impact Synthesis Of Nanoparticles From Jackfruit Seeds

Jackfruit seeds are a nutrient-dense byproduct of the jackfruit, a tropical tree fruit native to parts of South and Southeast Asia. They are highly nutritious, providing fibre, protein, vitamins, minerals, and antioxidants that can improve digestion, support heart health, boost metabolism, and help prevent anemia. This study proposes an ecofriendly process for the production zinc acetate, titanium dioxide, and silver nitrate nanoparticles from jackfruit seeds. Absorption Maxima of the aqueous solution of the three nanoparticles was measure where both Titanium oxide and silver nitrate showed absorbance peak at 330nm whereas zinc acetate showed a absorbance peak at 327nm.The antibacterial capabilities of the synthesized nanoparticles had been tested against E. coli and significant zone of inhibition was measured in antibacterial assays for titanium dioxide, zinc oxide, and silver nitrate nanoparticles. The highest zone of inhibition was noted for the silver nitrate nanoparticles. Nanoparticles were also subjected to antioxidant assay using DPPH revealing its antioxidant properties. The use of jackfruit seeds as a precursor material in nanoparticle synthesis provides a cost-effective and renewable alternative to conventional methods. This procedure is not only environmentally friendly but also has the potential to be applied in agriculture, such as in the development of nano fertilizers or nano pesticides, and in environmental remediation. The procedure also provides various advantages to existing methods of nanoparticle synthesis such as: sustainability, cost-effectiveness, studies have shown that green-synthesized NPs are beneficial in various medicinal applications, including cancer treatment, targeted drug delivery, and wound healing. The versatility and effectiveness of jackfruit seed-mediated nanoparticle synthesis make it a promising tool for researchers and industry professionals seeking to develop innovative and sustainable solutions in biomedicine, agriculture, and environmental protection.

Key Words: Sustainable, renewable, green synthesized, Jack fruit

POS-173

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Metal Thiolates as Reactive Precursors for Facile Synthesis of AgBiS2 Nanocrystals (NCs) in Ambient Conditions and Their Application in Self-Powered Broadband Photodetectors

$AgBiS_2$ nanocrystals (NCs) are promising optoelectronic materials due to their high absorption coefficient and environmentally friendly, earth-abundant constituents. They are suitable alternatives to lead and cadmium-based optoelectronic devices. Therefore, developing convenient synthesis techniques that minimize the use of large amounts of chemicals, solvents and high temperatures is crucial for their practical application. We report a facile synthesis of phase-pure $AgBiS_2$ quantum dots (QDs) NCs through solid-state grinding under ambient conditions. This method utilizes the high reactivity of metal thiolate intermediate complexes formed during the process and readily produces $AgBiS_2$ NCs of desirable properties such as phase purity, crystallinity, adherence to stoichiometry and broad absorbance in the ultra-violate (UV)-visible (vis)-near Infrared (NIR) region of the spectra. The initial choice of metal salts determines the nature of the metal thiolate intermediate complex, which in turn affects the quality of the final $AgBiS_2$ NCs. The as-synthesized NCs are then used as an active layer in a photodetector device, without any post-synthetic treatment and for the first time, self-powered UV-Vis-NIR broadband photodetection was observed in $AgBiS_2$ NCs-based photodetector devices.

POS-174

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Design and Development of Tenofovir-Infused Mucoadhesive Chitosan Microparticles in Dispersible Vaginal Tablets for HIV Pre-Exposure Prophylaxis

Tenofovir disoproxil fumarate (TDF) loaded bioadhesive chitosan microparticles (CM) were developed using emulsification internal gelation technique. Among various batches, ECH-4 demonstrated high entrapment efficiency (68.93±1.76%) and sustained drug release, achieving 88.05±0.38% over 24 h in simulated vaginal fluid (pH 4.5) (SVF). Scanning Electron Microscopy indicated that ECH-4 CM were spherical with a rough surface. Laser scattering analysis with the Malvern Mastersizer indicated particle sizes ranging from 0.52±0.10 µm to 284.79±21.42 µm. Solid-state characterization of ECH-4, using DSC and PXRD, revealed that TDF was present in an amorphous state as a solid-solid solution within the chitosan matrix. Ex vivo mucoadhesion studies using rabbit mucosa revealed that 10.34±2.08% of ECH-4 CM remained adhered after 24 h. These microparticles were incorporated into dispersible tablets (DT-TCM) intended for intravaginal administration to prevent HIV transmission during sexual intercourse. In vitro release from the dispersible tablet (F3) in SVF showed a sustained release profile, with 89.98±1.61% of TDF released at 24 h. The dissolution profile of DT-TCM was similar to that of the TDF-loaded CM, with f1 (difference factor) and f2 (similarity factor) values of 1.52 and 78.02, respectively. Therefore, DT-TCM emerges as a promising alternative novel drug delivery system for pre-exposure prophylaxis against HIV.

Keywords: Vaginal drug delivery; chitosan; tenofovir; mucoadhesion; dispersible vaginal tablet.

POS-175

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Emergence of In Materia Intelligence in Energy-efficient Neuromorphic Devices realized using Self-forming Hierarchical Structures

Emulating brain-like functions using electronic circuits has always been the holy grail for the scientific community for decades. For this purpose, already developed conventional computing architecture limited by von Neumann bottleneck consumes an enormous amount of energy while facing several other challenges.[1] Neuromorphic devices made of two-terminal resistive switching memristors such as valence change memory (VCM), electrochemical metallization (ECM) and others, operating on different mechanisms are promising due to the possibility of achieving high integration density and low power consumption.[2] Among all, the dynamic formation and relaxation of conductive metallic filaments in ECM devices under electrical pulsing is rather intricate and has much more to offer.[3] Although, the artificial synaptic devices in literature are paradigms of complex computing tasks but often lack the inherent dynamically evolving topology of the biological neural network (BNN), considered as the basis for various cognitive functionalities.[4,5] Closely mimicking the hierarchical structural topology with emerging behavioral functionalities of BNN in neuromorphic devices comprising a network of synapses is considered of prime importance for the realization of energy-efficient intelligent systems. In this regard, building an artificial synaptic network (ASN) using a self-forming approach seems promising due to structural similarity with the biological system and low fabrication cost.[6] We have developed an ASN comprising of hierarchical structures of isolated Al and Ag micro-nano structures

Figure 1. Self-formed hierarchical structures of Al (blue) and Ag (grey) of different length scales (left side), closely mimic the structural hierarchy of biological neural network (right side). Diverse range of Ag filamentary structures (red) show wide ranging synaptic plasticity similar to biological counterpart.

developed via the utilization of a desiccated crack pattern, anisotropic dewetting, and self-formation.[7] The strategically designed ASN, despite having multiple synaptic junctions between electrodes, exhibits a threshold switching (Vth ~ 1-2 V) with an ultra-low energy requirement of ~1.3 fJ per synaptic event. The emerging potentiation behavior of the conductance (G) profile under electrical stimulation and its permanence beyond are realized over a wide current compliance range of 0.25 to 300 μA, broadly classifying the short- and long-term potentiation grounded on the characteristics of filamentary structures. The scale-free correlation of potentiation in the device hosting metallic filaments of diverse shapes and strengths evidence of in materia intelligence providing an ideal platform for understanding and replicating the complex behavior of the brain for neuromorphic computing.

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POS-176

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Highly Stable Nb-based Anodes for Li- and Na-ion Batteries

Stable anode materials with fast charging capabilities are critical for realizing next-generation Li-ion batteries (LIBs) and Na-ion batteries (SIBs). In this context, Nb-based anode materials have recently garnered significant attention due to their enhanced stability towards Li+ and Na+ insertion. Despite their exceptional stability, there are few reports on Nb-oxide or sulfide-based anodes, possibly due to difficulties associated with synthesizing pure phase of the materials. Herein, we report a simple synthetic approach to obtain highly crystalline pure-phase NbO2, 3R-NbS2 and Nb3VS6 through the decomposition of the niobium hexadecylamine (Nb–HDA) complex at high temperatures in the presence of H2S gas. Further, when employed as an anode in LIBs and SIBs, excellent long-term cycling stability was observed for NbO2 with 92% capacity retention at 1 A g-1 for 1000 cycles (LIB) and 70% capacity retention at 0.1 A g-1 for 500 cycles (SIB). In the case of 3R-NbS2, exceptionally high cycling stability was observed for 2500 cycles at 0.5 A g-1 with 85% capacity retention. The Nb3VS6 anode showed further improvement in cycling stability with 100% capacity retention for 2500 cycles at 0.5 A g-1. The highly stable nature of these anodes was attributed to their dominant pseudocapacitive nature, enabling facile charge storage over longer cycling times.

POS-177

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Development and Evaluation of Biodegradable Nanoparticle for Intravaginal Delivery of Efavirenz for HIV Prevention

HIV remains a critical global health challenge, affecting 40.4 million worldwide with increasing cases. Pre-exposure prophylaxis (PrEP) through antiretroviral agents offers preventive potential, particularly in topical vaginal formulations aimed at blocking viral transmission. In this context, Efavirenz (EFZ) loaded PLGA nanoparticles (NPs) were prepared in this present study by a modified emulsion-solvent evaporation method with Pluronic F-127 as a surfactant. SEM and AFM confirmed spherical shape and surface topography of the NPs that would be suitable for vaginal delivery. FTIR confirmed compatibility of the EFZ with other excipients used to produce NPs. DSC and PXRD revealed the amorphous state and reduction of crystallinity of EFZ in the NPs. The particle size (144.3 ± 2.13 nm), PDI (0.248 ± 0.14), and zeta potential (-17.52 ± 0.78 mV) indicating the stability of the NPs. The NPs exhibited a good percent entrapment of 87.00 ± 1.37%. In simulated vaginal fluid (SVF) (pH 4.5), in-vitro dissolution studies showed sustained release of EFZ from NPs over 12 hours. This study underscores NPs potential as an effective delivery system for delivery of EFZ in HIV PrEP, offering sustained drug release and stability that would be crucial for intravaginal formulations in preventing HIV transmission.

Keywords: HIV-PrEP; polymeric nanoparticles; PLGA; efavirenz; intravaginal delivery.

POS-178

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High-Performance Seawater Splitting Enabled by a Non-Noble CuV Metal-Organic Frameworks on Graphene-Coated Nickel Foam

To advance clean energy fuel production via water electrolysis, a robust and highly efficient electrocatalyst is essential. In this study, a copper-vanadium bimetallic metal-organic framework (MOF) was synthesized on graphene-coated nickel foam (GNF). Through extensive analysis of various combinations, the optimal Cu: V ratio was identified, achieving low overpotentials ($\eta 10$) of 220 mV for the oxygen evolution reaction (OER) and 104 mV for the hydrogen evolution reaction (HER). Impedance analysis indicated that, compared to pristine nickel foam, the interfacial graphene layer significantly improved charge transport. The graphene-coated electrodes demonstrated stable overall water-splitting performance in both alkaline and seawater conditions. This study can provide new insights into the rational design and synthesis of nanostructured MOFs for catalytic applications.

POS-179

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Unconventional superconductivity in the dual topological insulator BiSe via superconducting proximity effect

The realization of unconventional superconductivity within topological phases is highly sought after due to its potential for creating topologically protected qubits. To induce superconductivity in such topological phases, we examine the proximity effects at the interface between a dual topological insulator (DTI) BiSe and an s-wave superconductor NbSe2. Low-temperature differential conductance measurements reveal a dual-dip feature with a V-shaped inner dip, indicative of unconventional superconductivity, in accordance with the dual-gap 2-D Blonder-Tinkham-Klapwijk (BTK) model. The BTK analysis indicates the destruction of the two gaps at two different magnetic fields, resembling the two critical fields observed in low-temperature magnetoresistance measurements. Additionally, temperature-dependent differential conductance neasurements show that the inner gap vanishes at significantly lower temperatures compared to the outer gap.

POS-180

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Bi bilayer driven 1D conduction channel coexisting with topological crystalline insulating state in BiTe

Here, we provide the first experimental evidence of the coexisting dual topological surface states in BiTe using Scanning Tunnelling Microscopy and Spectroscopy. Our findings offer valuable insights into the co-existence and interaction of Weak Topological Insulator (WTI) and Topological Crystalline Insulator (TCI) surface states, which may lead to the discovery of new topological phenomena. Through the analysis of topographic step images of the cleaved sample, we identified the surface termination and nature of the step edge. Our spectroscopy measurements and conductance mapping revealed that only the step edges containing a Bi bilayer exhibit weak topological surface states with the presence of a characteristic 1D conducting channel. However, the top surface has topological crystalline surface states, irrespective of the surface termination, as clearly visible from the Dirac dispersion nature of differential conductivity. The presence of two different topological surface states protected by different symmetries opens up great possibilities for tuning the topological nature by controlled symmetry breaking, which can be applied in spintronics. As BiTe is theoretically predicted to be a Higher Order Topological Insulator (HOTI), this study can be extended in the future to find experimental signatures of HOTI.
Bi bilayer driven 1D conduction channels coexisting with topological crystalline state in BiTe

POS-181

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Photochromic Metal-Organic Hybrid "Soft" Material: Light Driven Switching of Morphologies and Optoelectronic Properties

Exploring the influence of external stimuli on metallo-supramolecular polymers reveals their potential for responsive soft materials and precise nanoscale self-assembly. Here, we unveil a light-induced, reversible gel-to-sol phase transition within a metal-coordinated supramolecular polymer system, incorporating a photochromic DTE unit and ZnII ions, forming a coordination polymer gel (CPG). UV illumination (λ = 365 nm) triggers electrocyclic ring closure, causing a gel-to-sol transition, while altering the wavelength (λ > 400 nm) reverses it to sol-to-gel. Morphological analysis reveals a reversible transformation from fibers (open form) to spherical nanoparticles (close form). This ring closure enhances the electronic properties of CPG by increasing molecular conjugation. Electrical measurements show a reversible switch in CPG from a low-conducting state (open form) to a high-conducting state (close form), with on/off ratios of ~54 at 1V and ~35 at -1V. Thermoelectric measurements confirm charge transport is dominated by the highest occupied molecular orbital (HOMO), with the on-state exhibiting a lower thermopower of 13 μV/K compared to 180 μV/K in the off-state. Density functional theory (DFT) calculations support the HOMO-dominated charge transport observed in the thermoelectric measurements. This study highlights the potential of CPG as reversible electrical and thermoelectric photoswitches, opening new avenues in molecular electronics.

POS-182

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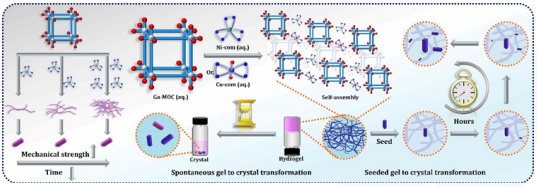
Higher order supramolecular assembly of the bi-component soft system essentially need a pre-programming to perceive its exciting chemical properties. Most of these soft gel materials are considered as stable and the aging effect are rarely studied. Herein, we have introduced a gallium-based metal organic cube (Ga-MOC) as monomeric unit which specifically interacts with chosen binder to grow as three-dimensional network, results in gelation. Charge assisted hydrogen bonding (CAHB) interaction plays the crucial role to hold the monomeric components and guide the amorphous gel network to reorganize into a highly ordered crystal state over time. The mechanical strengths of the hydrogel have been tuned upon varying the Ga-MOC-to-binder's stoichiometric ratios monitored by rheometric technique. With increasing the binder ratios, the mechanical strength of the hydrogels increases due to higher order of H-bonding network. Intriguingly, over a period of time, hydrogels can be transformed into crystals without any external stimuli which suggested that the hydrogels are kinetically controlled metastable state whereas crystals are the thermodynamically stable state. FESEM and AFM images suggests transformation of nanofibrillar network to form the cubical micro-crystals. Further, seeding effect was introduced to speed up the regular gel to crystal transition process. Each of these occurrences were connected to draw the energy profile diagram under the kinetic and thermodynamic aspects.



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Control Over Secondary and Nanostructures in Peptide Self-assembly: Impact of Linker Lengths

The roles of natural self-assembling systems have inspired the fabrication of artificial supramolecular structures with applications in biomaterials, optoelectronics, and mechanical elastomers. In this context, the tunable self-assembly process offers numerous opportunities for controlling material properties. Among the various factors that influence the self-assembly process, systematic structural changes represent one of the interesting methods that has been relatively less explored. This study delved into the design of peptide-based supramolecular systems. By systematically varying the linker length between a pyrene chromophore and FKFD peptide motif, we unveiled the critical role of spacer length in modulating self-assembly behavior and secondary- and nanostructures. Spectroscopic and microscopic investigations revealed that subtle structural changes significantly impact π-stacking interactions, secondary structure, and ultimately nanostructure formation. Interestingly, AFM analysis revealed a 1D fibrillar nanostructure for all derivatives. However, variations in length and flexibility among these fibrils were observed, ultimately dictating the material properties. These differences may arise from distinct molecular packing arrangements influenced by the angle between the chromophore and peptide backbone, determined by linker lengths. Consequently, precise control over the spacer enables modulation of self-assembly pathways, yielding nanostructures with tailored dimensions and shapes, crucial for diverse applications.

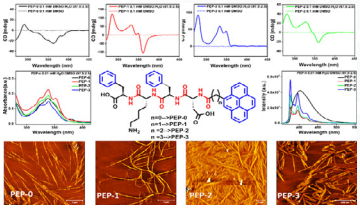

Figure 1. Spectroscopic and microscopic investigations of the peptides with different linker lengths.

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Control Over Secondary and Nanostructures in Peptide Self-assembly: Impact of Linker Lengths

POS-184

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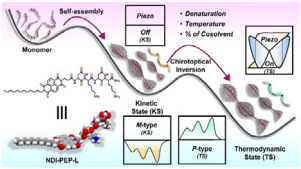
Exploring Pathway Complexity in Peptide-Based Supramolecular Self-Assembly: Unveiling Chirotopical Switches for Piezoresponsive Nanomaterials

In recent years, there has been a notable surge in interest surrounding the exploration of pathway complexity in supramolecular self-assembly, to effectively control the dimensions of nanostructures and their corresponding material properties. While extensive research has delved into the self-assembly of various organic and π-chromophore-based compounds, the focus on similar investigations involving peptides has been relatively limited. We have explored the pathway complexity in the supramolecular self-assembly of naphthalene diimide conjugated tetrapeptides NDI-PEP-L and NDI-PEP-D enantiomers which have been synthesized using solid-phase synthesis with Fmoc chemistry and characterised their self-assembly behaviour by UV-Vis, fluorescence, FTIR, NMR, CD spectroscopy, and Atomic force microscopy. The self-assembly of NDI-PEP-L revealed supramolecular chirotopical switching influenced by temperature, denaturation process and cosolvent contents. The chirotopical switch transitions self-assembled structures from a M/P-type helical organization with irregular nanoparticles (kinetically stable state) into a P/M-type helical organization with well-defined nanofibers (thermodynamically stable state). This transition creates "on-off" piezoresponsive peptide-based nanomaterials, showing potential for dynamic control over material properties. All the studies were validated with the enantiomer, NDI-PEP-D. This study pioneers the control of piezoresponsive behavior through chirotopical switch in peptide-based nanomaterials, offering new insights and opportunities for tailoring material properties in self-assembled states.



Scheme 1. Schematic representation of chiral switching of NDI-PEP-L through pathway complexity.

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Transition metal dichalcogenide-based piezoelectric polymer nanocomposite for energy generator and pressure sensors

In an era when traditional energy sources are depleted, the piezoelectric nanogenerator (PENG) plays an important role in renewable energy. PENG can be employed in variety of applications, including wearable energy harvesting devices, pressure sensors, and tactile sensors [1]. The current study focuses on improving PVDF's piezoelectric properties by introducing nanoparticles. This area of research investigates a variety of nanomaterials, although fundamental understandings of nanomaterial selection remain unknown. TMDs have exceptional properties like high conductivity, flexibility, high specific surface area and great mechanical strength [2]. This study uses vanadium disulfide (VS2) as a nanofiller in polyvinylidene fluoride to improve output performance and better understand the fundamental mechanism of improving PVDF's piezoelectric capabilities. The studies revealed that the high surface charge and minimum addition of VS2 nanomaterial can produce higher piezoelectric performance by aligning the PVDF molecule into its most piezoelectric active phase (β). The fabricated energy generating and pressure sensing prototype displayed an outstanding power of 2115.25 μW and a power density of 114.4 μW/cm2 when short-circuited with a load resistance of 1 MΩ.
Keywords: Piezoelectric nanogenerators, pressure sensors, wearable electronics.

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In-situ generated γ-NiOOH on electrochemically activated Ni60Nb40 nanoglass as potential catalyst for urea-assisted hydrogen generation

Electrochemical urea oxidation reaction (UOR) offers an efficient and affordable way of producing hydrogen with the advantages of treating urea-containing wastewater.1 Though in-situ formed NiOOH species are reported to be active species for UOR and more active than the synthesized ones, the mechanistic study of the actual active species remains a daunting task due to the possibility of different phases and the instability of surface-formed NiOOH.2 In the present investigation, Ni60Nb40 Nanoglass, which comes under the category of metallic glass with nanosized grains connected by amorphous interfaces, is shown as a promising ligand-free UOR catalyst.3 Nanoglass possesses glass-glass interfaces that can provide higher accessible surface area and facilitate more γ-NiOOH species formation. Accordingly, Nanoglass has shown outstanding UOR performance with a low Tafel slope of 16 mV/dec and durability for prolonged electrolysis (~38 mA/cm2 for 70 hours). The glassy interface is seen to stabilize the γ-NiOOH on the surface of the Nanoglass probed via in-situ Raman spectroscopy, supported by electron microscopy analysis and X-ray photoelectron spectroscopy in contrast with the β-NiOOH formation on crystalline Ni foil. The present study opens up a new direction for the development of inexpensive Ni-based amorphous UOR catalysts and sheds light on the UOR mechanism.

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POS-187

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Keywords: Microfluidic cavity, roughening, optically matching.

There is a great demand for smart partitions to serve as wide area switchable gates for light transaction across defined spaces at offices, public locations as well as homes. Partitions or windows that are in use presently, are simply transparent at best and the desired degree of see-through visibility is achieved with permanent fixtures such as screens, curtains, or such combinations. A new class of smart window is designed with a toggle option between opaque (T~ 5%) and transparent states (T~ 85%). The device consists of microfluidic cavities filled with a liquid optically matched with the glass substrate, thus rendering specular light transmission through the cavity. When devoid of the liquid, the cavities become translucent due to light scattering from the roughened internal wall surfaces. Importantly, the device consumes no energy while being in any of the two states, and the only nominal consumption, is during switching the states.

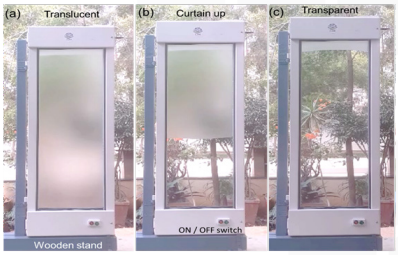

Figure 1: A large area prototype showing the switching action.

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POS-188

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Curious Case of CsPb2Br5: Extremely Soft Structure-Induced Broadband Emission

Ever since the initial report on green emissive two-dimensional (2D) all-inorganic indirect band gap semiconductor, CsPb2Br5, arguments have arisen concerning its origin of photoluminescence which has sparked continuous debate. Following the identification of the photoluminescence centres being primarily either strongly green emissive CsPbBr3 impurities or different amorphous lead bromide ammonium complexes present at the surface of the solution-based synthesized product, here in this work, an all-solid-state synthesis approach has been implemented to avoid any involvement of incertitude that may arise from unwanted external particles. For the first time, we record a progressive formation of thermodynamically favoured CsPb2Br5 phase over time, and interestingly, the pristine CsPb2Br5 exhibits a highly Stokes-shifted broadband pinkish red emission spanning from the visible to near infra-red spectrum. Emission wavelength-independent excitation and excitation wavelength-independent emission coupled with the similarity in the decay kinetics, all indicate towards the intrinsic nature of the broadband emission. The occurrence of low bulk and shear moduli estimated from sound velocity measurements, soft vibrational modes from Raman spectroscopy, and significantly low Debye temperature obtained from heat capacity measurements in the low-temperature range (2-31 K) reveal the structural softness on both global and local scale, respectively. These traits lead to the emergence of short-range elastic lattice deformation resulting from strong electron-phonon coupling upon photoexcitation generating self-trapped excitonic emission in CsPb2Br5.

POS-189

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Rapid synthesis of manganese ferrite nanocomposites: Electrochemical behavior on the effect of electrolytes

Using 1 M NaOH as the oxidative solution, we report on a rapid and facile method for synthesizing manganese ferrite (MnFe2O4) nanoparticles through chemical co-precipitation. Scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), powder X-ray diffraction (PXRD), and other techniques were used to characterize the resulting nanoparticles. Through, SEM and TEM micrographs, a spherical morphology with a diameter of ~20 nm was observed in the MnFe2O4 sample. Galvanostatic charge-discharge, electrochemical impedance, and cyclic voltammetry were used to examine the electrochemical performance of manganese ferrite nanoparticles in 0.1 M of Na2SO4 and 1 M of NaOH electrolytes. A maximum specific capacitance of 256 & 380 F g−1 in 0.1 M of Na2SO4 and 1 M of NaOH electrolytes was achieved in a three-electrode system, respectively. The MnFe2O4 nanoparticles' enhanced electronic conductivity, high surface accessibility, and synergistic activities allowed higher retention to be observed at 20 A g−1, making the 1 M NaOH electrolyte medium the most effective than 0.1 M Na2SO4 in terms of rate performance. Further details of the work will be presented during the conference and full manuscript submission.

Keywords: Rapid; facile; Manganese ferrite; Supercapacitor; High specific capacitance.

POS-190

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Potential Bark Extracts Of Azadirachta Indica Against COVID-19

Our investigation of Azadirachta Indica bark identified numerous bioactive substances through advanced methods. Phytochemical analysis of Neem bark unveiled compounds like nimbin, nimbidin, nimbidol, azadirachtin, with potential antiviral properties. These compounds show promise in combating viral infections, particularly SARS-CoV-2, by interfering with key viral proteins. Further research is warranted to validate neem bark's antiviral efficacy. Through molecular docking simulations, we identified stable binding modes, key conformational changes, and structural dynamics in neem bark compound-protein complexes. This insight enhances our understanding of how these compounds might combat SARS-CoV-2 proteins. The docking studies includes neem compounds like margolonone, gallic acid, nimbione, catechin and nimbidiol with corresponding SARS-CoV-2 proteins and their binding energies, and ligand efficiencies. Compound-protein interactions reveal lower binding energies and higher binding energies. Higher binding energies, such as those for Margolonone with PDB ID 2IDY (-10.67), suggest stronger binding affinity, whereas lower values, like for Margolonone with PDB ID 6YYT (-7.33), indicate weaker binding.
Keywords: Azadirachta Indica, Bark extracts, Docking, Higher energy efficiency

POS-191

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Tunable sp-d exchange interaction in Mn doped Dilute Magnetic Semiconductor (DMS) Nanocrystals (NCs)

Tuning sp-d exchange interaction between the magnetic dopants and excitons in dilute magnetic semiconductor (DMS) nanocrystals (NCs) creates new opportunities for utilizing these materials in spin-dependent electronics or photonic devices. This manuscript explores the tunability of sp-d exchange interactions in Mn-doped CdxZn1-xSe nanocrystals, offering insights into their potential applications in spin-dependent electronics and photonic devices. Through a combination of wavefunction engineering and alloying effects, the study achieves unprecedented control over the sign and magnitude of excitonic Zeeman splittings (ΔEZ), revealing the dynamic nature of exciton-Mn2+ interactions. Systematic investigations reveal a significant reduction in ΔEz with increasing Cd concentration, culminating in a remarkable sign reversal at x=0.25. While wavefunction control tunes the absolute value of ΔEz, the study highlights the crucial role of inducing strong band mixing for altering the sign of the sp-d exchange interaction. These findings not only advance our understanding of semiconductor NCs but also hold immense promise for applications in quantum technology, spintronics, and materials engineering.

Tunable sp-d exchange interaction in Mn doped Dilute Magnetic Semiconductor (DMS) Nanocrystals (NCs)

POS-192

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Direct Observation of sp-d Exchange Interaction in Mn2+doped All-inorganic Perovskite Quantum Dots (CsPbX3: X= Cl, Br)

Diluted magnetic semiconductor (DMS) materials, which merge the characteristics of semiconductors and magnetic materials, exhibit great potential as promising candidates for diverse applications such as spintronic devices, magneto-optical devices, quantum information processing, etc.[1] In this context, perovskite lead halide materials with dopants show great promise, exhibiting emerging properties.[2] The true characteristics of these materials lie in the presence of dopant-carrier magnetic exchange interactions. This work presents the first direct observation of such exchange interactions (sp-d exchange) in colloidal Mn-doped CsPbX3 (X= Cl, Br) quantum dots (QDs).[3] Here, we employ magnetic circular dichroism (MCD) spectroscopy to unambiguously demonstrate the successful doping and the presence of giant excitonic Zeeman splitting (ΔE_Z) CsPbX3 (X= Cl, Br) QDs doped with Mn2+ (shown in figure 1). The controllable tuning of effective exciton g-factors (g_eff) within the range of 2.1 to (-)314 has been achieved through the process of doping with 6.9 % Mn in CsPbCl3, which will facilitate their application towards future spintronics.

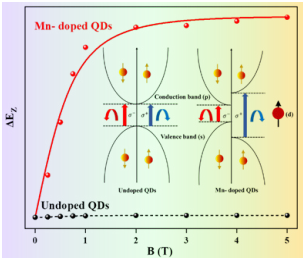

Figure1: sp-d exchange interaction in Mn-doped perovskite QDs

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POS-193

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Unveiled Traits of Nano Technology in Implant Dentistry for Osteoblastic Cell Adhesion and Differentiation: An Original Research

Background/Objective: 'Nano technology' in the medical field employs minuscule materials and devices to revolutionize healthcare sector, by offering precise engineering and regeneration of bodily tissues, leveraging nanoparticles and nanodevices for targeted therapy in its various specialities. 'Implant dentistry' being one such specialty, implants have been evolved as a novel and reliable approach to replace the missing teeth in the field of dentistry. Many materials have been tried as an implant material. One of the most biocompatible and common implant materials is titanium, which has been available for several decades. Titanium is still widely used for implant applications due to its inertness in the body, high resistance to fatigue and non-toxicity. However, there are concerns regarding potential metal ion release and mismatched mechanical property between the metals and human bones. The elastic modulus of titanium is 110 GPa whereas, human bone's elastic modulus is 18-20 GPa. When an implant is significantly stiffer than the host bone, the bone bears lesser load than the implant. The lack of load stimulation overtime causes the bone to weaken and become less dense. This process is known as stress shielding. Due to this, in fact serious post-operative complications such as osteolysis, allergenicity and loosening as well as eventual implant failure may occur.

To overcome this limitations and negative post implantation biological reactions, substitutes for metals are extensively pursued. Polyether ether ketone (PEEK) is a high-performance polymer that has gained significant attention in the field of biomaterials due to its excellent mechanical properties like elastic modulus of 20 GPa similar to that of bone, biocompatibility, chemical resistance, and radiolucency. These properties make PEEK an attractive material for use in orthopedic and dental implant applications. However, one of the drawbacks of PEEK is its lack of osteogenic potential, which limits its ability to promote bone growth and integration with surrounding tissue. In order to overcome this limitation, various surface modification techniques have been explored to improve the osteogenic properties of PEEK. One of such effort is surface modification via nano-Tio2 coating and nano-Niobium coating.

So, this study was carried out to compare the Osteoblastic cell adhesive property between unmodified PEEK, nano-Tio2 coated PEEK and nano-Niobium coated PEEK of medical grade. Methodology: Surface modification of PEEK surface was carried out by nano-Tio2 coating and nano-Niobium coating using radio frequency (RF) magnetron sputtering. After micro surface modification, surface roughness and composition of the samples was evaluated using Scanning Electron Microscope (SEM) analyses and energy dispersive X-ray spectroscopy (EDS).

POS-194

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Hydrophilicity of the samples were evaluated using Water contact angle test. Cytocompatibility and osteoblastic cell adhesion were evaluated using MTT assay. Osteoblastic cell adhesion was also examined by using phase contrast fluorescence microscopy. Statistical analysis was done using one way ANOVA and Tukey's pot-hoc analysis for optical absorbance (MTT Assay), which in turns evaluated samples biocompatibility and osteoblastic cell adhesion.

Results: Significant difference were found between optical absorbance measured on untreated PEEK, nano-Tio2 coated and nano-Niobium coated samples using MTT assay. The SEM images revealed that nano-Tio2 coated PEEK and nano-Niobium coated PEEK samples had a nanostructured surface with increased roughness compared to Untreated PEEK. Water contact angle showed good hydrophilicity of the nano-Tio2 coated PEEK and nano-Niobium coated PEEK samples than untreated PEEK. Phase contrast microscopy image showed adhered live osteoblastic cells more on nano-Niobium coated PEEK than nano-Tio2 coated and untreated PEEK samples.

Conclusion and Clinical Implications: Based on the results obtained and within the limitations in this in-vitro study, it could be concluded that, a significant improvement in the cell adhesion and cell viability was observed on the nano-Tio2 coated PEEK and nano-Niobium coated PEEK samples compared to Untreated PEEK samples suggesting that a nanocoating of Tio2 and NbO thin films on PEEK surface showed exceptional structure and characteristics with the goal of demonstrating its efficacy as a potential implant biomaterial for orthopedic and dental applications. So, nano technology and its applications in implant dentistry in the near future provides an excellent insight and voyage in health sector through its advanced research and many other therapeutic benefits.

POS-194

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Early Diagnosis of Lung Cancer Biomarkers Using Microwave Synthesized ZnO Nanoparticles

Cancer is one of the most prevalent global predicament, leading to high mortality rate. According to Global Cancer Statistics 2020, 36 major cancers have been reported from 185 countries worldwide. It is evident that, 2.2 million people have been diagnosed globally with lung cancer resulting in a massive death report of 1.8 million patients, approximately. Volatile sensors play a major role in human exhaled breath analysis especially for non-invasive early detection of lung cancer biomarker detection. Acetone, toluene and formaldehyde have been reported as the prominent biomarkers evolving from the exhaled breath of human affected by lung cancer. With this background, ZnO based volatile sensors at different nanostructures have been developed for the detection of lung cancer biomarkers at ambient atmosphere. The three different nanostructures of ZnO material were synthesized using microwave technique by modifying the precursors and calcined in the temperature of 500oC. The structural, morphological and functional groups were investigated using various characterization techniques. Finally, the three different nanostructures of ZnO material were fabricated as a sensor using doctor-blade method. The sensing studies of ZnO material was carried out using a home-made vapour sensing chamber integrated with high resistance electrometer. The three different samples of ZnO material were highly selective towards acetone, toluene and formaldehyde.

Keywords: Acetone, Formaldehyde, Lung cancer biomarkers, Microwave technique, Toluene and Volatile based sensors.

POS-195

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Occupational Risks and Preventive Measures in Nanotechnology: A Human Factors and System Design Perspective Enhanced by TRIZ Methodology

Nanotechnology, defined as the understanding and control of matter at dimensions between 1 and 100 nanometres, presents revolutionary opportunities across various industries, including electronics, healthcare, and construction. Engineered nanomaterials, with their unique physical, chemical, and biological properties, enable innovative applications such as stain-resistant textiles and targeted cancer therapies. However, as the application of nanotechnology transitions from research to industrial and commercial settings, it introduces potential occupational hazards.

This poster presentation highlights the current understanding of health and safety issues related to nanomaterials, based on the latest research and guidelines from OSHA and other authoritative bodies. Workers in environments such as chemical labs, manufacturing facilities, and construction sites may be exposed to nanomaterials through inhalation, skin contact, or ingestion. Specific risks include respiratory inflammation and fibrosis from carbon nanotubes and nanofibers, and potential carcinogenic effects from inhaled nanoscale titanium dioxide (TiO2) particles.

To mitigate these risks, it is crucial to integrate principles of human factors engineering and system design into the development and implementation of safety measures. This involves a holistic approach that considers the interaction between workers, the workplace environment, and the nanomaterials themselves. Key strategies include:

1. Engineering Controls: Utilize ventilated enclosures and local exhaust ventilation with HEPA filters to capture nanomaterial contaminants at the source. Design these systems to be user-friendly, ensuring that workers can easily operate and maintain them without additional strain or error.
2. Administrative Controls: Establish stringent hygiene practices, spill cleanup procedures, and training programs to educate workers on nanomaterial hazards. Develop these programs using human-centred design principles, ensuring that information is accessible, understandable, and actionable for all workers.
3. Personal Protective Equipment (PPE): Equip workers with appropriate respirators, gloves, and protective clothing to minimize exposure. PPE should be ergonomically designed to maximize comfort and usability, reducing the likelihood of non-compliance due to discomfort or difficulty of use.
4. System Design for Safety Culture: Foster a safety culture by incorporating feedback loops, where workers

POS-196

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can report potential hazards and suggest improvements. Implement regular audits and assessments to ensure continuous improvement and adaptation of safety measures in response to new insights and developments.
5. Medical Screening and Surveillance: Conduct regular health monitoring for workers exposed to nanomaterials to identify potential health effects early. Design surveillance programs that are non-intrusive and respect workers' privacy, thereby encouraging participation and honest reporting.
6. TRIZ Methodology: Apply the Theory of Inventive Problem Solving (TRIZ) to identify innovative solutions to complex safety challenges associated with nanomaterials. Key TRIZ principles include:
• Segmentation: Dividing the problem into smaller, more manageable parts. For example, segmenting safety protocols for different types of nanomaterials based on their specific properties and risks.
• Prior Action: Preparing solutions in advance. Implementing pre-emptive safety measures, such as installing automatic shutoff systems that activate before hazardous nanomaterial levels are reached.
• Dynamicity: Allowing systems to adapt to changing conditions. Designing adjustable PPE that can provide varying levels of protection depending on exposure levels.
• Self-Service: Ensuring systems can maintain themselves. Developing self-cleaning filtration systems in ventilation hoods to maintain high efficiency without manual intervention.

This presentation underscores the importance of integrating human factors engineering, system design principles, and TRIZ methodology into safety protocols to effectively protect workers from the emerging risks associated with nanotechnology. By adopting effective control measures and fostering a culture of safety, industries can harness the benefits of nanotechnology while safeguarding their workforce.
Occupational Risks and Preventive Measures in Nanotechnology: A Human Factors and System Design Perspective

POS-196

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Fabrication and In-vitro Evaluation of 4-hydroxyisophthalic acid encapsulated chitosan nanoparticles on SH-SY5Y Cells

4-Hydroxyisophthalic acid (4-HIA) is a bioactive compound present in the roots of Decalepis hamiltonii, which has attracted considerable attention in attenuating oxidative stress-related neurodegenerative diseases. However, its efficacy is limited because of its low solubility and bioavailability. Therefore, the present study aimed to investigate its antioxidant and neuroprotective potential against β-amyloid (1-42)induced toxicity in SH-SY5Y cells. The 4-HIA encapsulated chitosan nanoparticles (4-HIA CS NPs) were fabricated by ionic gelation technique and characterized using DLS, XRD, SEM, HR-TEM, and FTIR spectroscopy. Antioxidant assays such as DPPH and ABTS scavenging ability were performed to assess the antioxidant potential of the fabricated NPs. The cell viability was assessed using MTT assay The bioactive component, 4-HIA, was efficiently encapsulated within CS NPs and was found to be spherical with sizes less than or equal to 150 nm through DLS, SEM and HR-TEM analysis. The XRD and FTIR spectra also confirmed the successful encapsulation of 4-HIA within CS NPs. DPPH and ABTS results revealed that 4-HIA CS NPs exhibited a significant scavenging activity than 4-HIA and CS NPs alone. Further, the 4-HIA CS NPs efficiently curtailed Aβ (1-42) induced cytotoxicity in SH-SY5Y cells. Our findings reveal that 4-HIA CS NPs can be a probable therapeutic intervention for Alzheimer's disease.

POS-197

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Ultrasonication assisted removal of Per and Poly-fluoro alkyl substances from wastewater using green synthesized Nanomaterial from Lantana camara leaf extract

Per and poly fluoro alkyl substances (PFAS), known as "forever chemicals" due to their persistent nature containing a large family of compounds, are predominantly found in many sources of water and wastewater nowadays. PFAS are evolving substances originating from industrial processes and consumer products used worldwide since the 1950s. Due to the unique properties of the carbon-fluorine bond, PFAS are stable, thermally resistant, and ineradicable, therefore, they are frequently discovered in soil, surface and groundwater, food, and the atmosphere. Numerous intriguing options for water/wastewater treatment are now available due to the rapid advancements in nanotechnology and catalytic processes. The goal of this study is to investigate a novel method of ultrasound-assisted treatment of PFAS in wastewater by incorporating green synthesized nanomaterial. In this research, titanium nanoparticles known to have high catalytic activity will be synthesized using the leaf extract of the ornamental plant Lantana camara (invasive which is found in the Karnataka region) and utilized for PFAS treatment in the presence of ultrasound. The leaf extract from Lantana camara appears to function as a capping and reducing agent. The characterization of the prepared catalyst will reveal a lot about its physiological properties and its suitability as a catalyst. The kinetic and degradation pathway study will be carried out to investigate the mechanism of degradation of PFAS during catalytic ultrasound treatment. The design of a continuous flow reactor will be undertaken from the results of the kinetic study carried out on PFAS degradation. This study anticipates a satisfactory outcome since there is a synergistic integration of effective treatments to remove PFAS substances from wastewater. Further, cost-benefit analysis and life cycle analysis will be carried out to understand the efficacy of PFAS removal from wastewater and the fate of the catalyst during the whole treatment cycle.

POS-198

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Machine Learning- Assisted Discriminative Detection of Vitamin B12 and Vitamin B9 by Fluorescent MoSe2 Quantum Dots

In this study, we present a label-free and discriminative detection approach for vitamin B12 and vitamin B9 using fluorescence assays. To achieve this, we synthesized highly fluorescent MoSe2 quantum dots (QDs) through a hydrothermal process by introducing an intercalation agent (KOH). These MoSe2 QDs exhibited a distinct blue emission at 355 nm, making them an excellent choice for our analytical purposes. The fluorescence characteristics of these MoSe2 QDs were used to develop a sensor capable of detecting both vitamin B12 and vitamin B9 by means of fluorescence quenching. Interestingly, we found that the quenching mechanisms for these two vitamins differed: vitamin B12 detection predominantly relied on Föster resonance energy transfer (FRET), while the identification of vitamin B9 was primarily due to the inner filter effect (IFE). We employed an advanced technique called machine-learning techniques to discriminate these vitamins. This approach yielded an impressive accuracy rate of 93% in distinguishing between vitamin B12 and vitamin B9.

Kewords: MoSe2 QDs, Vitamin B12, Vitamin B9, Föster resonance energy transfer, Inner filter effect, Machine-Learning technique.

POS-199

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Self-Powered Cobalt Nanocluster Decorated Flexible Graphene Based Tribo-Sensors for Respiratory Diagnosis of Critical Asthma Patient

Self-powered ultrafast sensors have received much attention for sustainable operation without any external power source in the Internet of Things (IoT) platform. This paper proposes faster responsive, highly sensitive triboelectric nanogenerator (TENG) sensors based on few layered nitrogen-doped graphene anchored with cobalt nanocluster (Co-N-Gr) to detect the relative concentration of target species, their proximity analysis, and monitor malfunction of human respiration in real-time. Herein, to understand the sensing mechanism, P-type behaviour of this active material is verified under the FET platform by reducing the leakage current density via the implementation of dual dielectric gate (NiO (200nm)-SiO2 (10nm)) oxides leading to better control over channel mobility. The device exhibits maximum sensitivity of around 4722% at zero bias conditions with excellent response and recovery time of 1.16s and 1.39s, respectively which falls within the range of standard human breathing frequency. The triboelectric nature of the sensor device at 1V bias under natural breathing exhibits a high sensitivity (39.56 %) towards relative humidity of 10-90% with excellent stability over 13 hours. In addition, our TENG sensor is highly sensitive towards NOx content upto ppb level which can improve reliability towards asthma detection as NOx content is relatively higher in asthma patients. This approach provides an integrated platform not only towards selective detection of NOx content as well as to identify the individual breathing strength. Furthermore, as-fabricated self-powered device demonstrates its potential in differentiating various respiratory status and has the capability to detect acute exacerbation of chronic obstructive pulmonary disease (AECOPD) via a distinct pattern recognition. Therefore, the work paves the way to design a low-cost flexible device fabrication on Kapton substrate integrable with wearable appliances for commercialization.

POS-200

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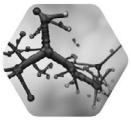
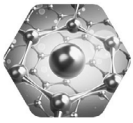


NANO Bio Stimulants



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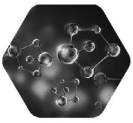

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