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12th National Conference on Condensed Matter Physics and Applications

ABSTRACTS

Date: 13-14 Dec 2024

Venue: MIT, Manipal

Organised by

Department of Physics,

Manipal Institute of Technology, MAHE,

Manipal- 576104.

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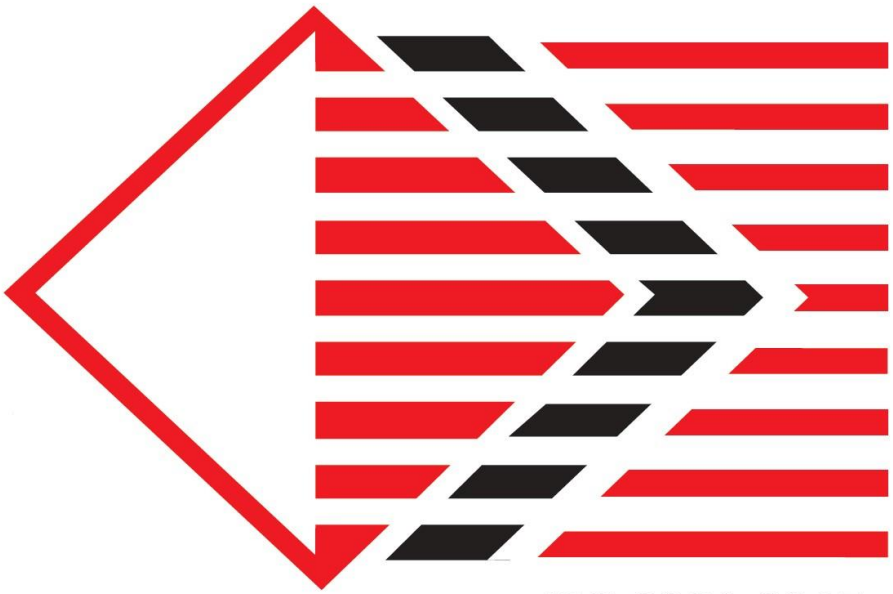

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12th National Conference on

Condensed Matter Physics and Applications

(CMPA-2024)

Date: 13 –14, December 2024

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PROGRAM SCHEDULE

Day 1: December 13, 2024 (Friday)

8.30 AM – 9.15 AM	**FORMAL REGISTRATION**
9:30 AM – 10:10 AM	**INAUGURATION**
10.20 AM – 10.40 AM	**Photo Session: Near Innovation Center, AB-4, MIT**
10.40 AM - 10.50 AM	**High Tea**
10:55 AM – 1.55 PM	**INVITED TALK-1: KEYNOTE PRESENTATION** **Prof G U Kulkarni** **President, JNCASR, Bangalore** **Topic: Volatile Memristor: A Potential Circuit Element for Dynamic Neural Networks** **Chairperson: Prof. Mohan Rao** 
12:00 AM – 1:00 PM	**INVITED TALK-2** **Dr Sreedhara M B** **IISc, Bangalore** **Topic: "Misfit Layered Compound: A Heavily Doped Platform for Unconventional Properties".** **Chairperson: Dr. Dhananjaya Kekuda** 
1:00 PM – 2:00 PM	**Lunch Break**
2:00 PM – 2:20 PM	**Overview of Research Facilities available at MIT** **Dr. Nagaraja K K** (Research Coordinator, Dept. of Physics) **Chairperson: Dr Bhaghyesh** 
2:20 PM – 3:00 PM	**INVITED TALK-3** **Dr Suchand Sandeep** MIT, Manipal Topic: "**Insights on carrier multiplication for improved quantum dot solar cells**" **Chairperson: Dr Bhaghyesh** 
3:00 PM – 3:15 PM	***Tea Break***
3:15 PM- 5.00 PM	**ORAL PRESENTATIONS - 1**
6.00 PM – 7.00 PM	**CULTURAL PROGRAM** (By Research Scholars and M.Sc students, Department of Physics and Civil Engineering, MIT Manipal) Venue: MIT Central Library Auditorium (4th floor)
7.00 PM	**Dinner**

Day 2: December 14, 2024 (Saturday)

8 AM – 9 AM	**Breakfast**
9.00 AM – 10:00 AM	**INVITED TALK-4** **Dr. Sajan Daniel George** Professor and Head, DAMP, MAHE **Topic: Interface Engineering at Nanoscale: Emerging Applications** **Chairperson: Dr Sudha D Kamath** 
10.00 AM –11:00 AM	**INVITED TALK-5** **Dr. Mahadeva Bhat** **Scientist G, SSPL Lab, DRDO** **Topic: Materials Engineering for High-Speed and High-Power Electronic Devices** **Chairperson: Dr Mahesha M G** 
11:00 AM – 11:15 AM	**Tea Break**
11:15 PM – 12:15 PM	**INVITED TALK-6** **Dr. Vinaya Kumar K B** BITS Pilani, Goa **Topic: Polymer Piezoelectric for Self-Powered Wearable Sensing** **Chairperson: Dr Nagaraja K K** 
12:15 PM – 1:00 PM	**INVITED TALK – 7** **Dr. Venkataramana B** Senior Scientist, CSIR-NAL, Bangalore Topic: **"Solid Particle Erosion and Corrosion Resistant Metal/Ceramic Nanolayered Multi-Layered Coatings for Gas Turbin Compressor Blades"** **Chairperson: Dr Raghavendra K G** 
1:00 PM – 2:00 PM	***Lunch Break***
2:00 PM – 3:30 PM	***Poster Presentations***
3:30 PM – 4:00 PM	**TEA BREAK**
4:20 PM- 5:00 PM	**FEEDBACK AND CONCLUDING SESSION**

ORGANIZING COMMITTEE		
Chairman	**Dr. Sudha Kamath**	
Convener	**Dr. Gurumurthy S C**	
Co-Convener	**Dr. Nagaraja K K**	
Treasurer	**Dr. Raghavendra K G**	
Scientific Sessions and Evaluation (Presentation Records, Prizes etc.]	Dr. Ashok Rao Dr. Mohan Rao K. **Dr. Pramoda K Shetty** Dr Raviprakash Dr. B V Rajendra Dr. Dhananjaya Kekuda **Dr. Mahesha M G** Dr. Aswathnarayana Prabhu Dr. Ismayil Dr. Gowrish Rao K Dr. Mamatha Daivajna Dr. Gurumurthy S C Dr. Nagaraja K K Dr. Kalpataru Panda **Dr. Bhagyesh** Dr. Dinesh Negi Dr. Raghavendra K.G. Dr. Vikash Mishra Dr Suchand Sandeep	Mr. Chandra Ms. Kavya D M Ms. Nisha Naik Mr. Sanketh H S Mr. Atul Kumar Sinha Ms. Aruna P T
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Food	**Dr B. V. Rajendra** Dr Gowrish Rao K Dr Nagaraja K. K. Dr Akhilesh Ranjan	Mr. Tejas Ms. Manasa Shankar Ms. Shreepooja Bhat Ms. Anushree Jogi Mr. Raghavendra Kaushal
Stage Committee and Technical Support [Laptop, pointer, Memento, Flowers, Prizes etc.]	**Dr. Gurumurthy S C** Dr. Gowrish Rao K Dr. Bhagyesh Dr. Raghavendra K.G.	Mr. Lozil Denzil Mendonca Mr. Shivakumar J Shetty Mr. Kiran R. Mr. Chandra Kharvi Mr. Sanketh H S Ms. Prathiksha Ms. Prajnashree M Ms. Nanditha T K Ms. H Panchami Chatra Mrs. Namitha B
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Invited speakers:

KEY NOTE SPEAKER

PROF. G U KULKARNI
JNCASR, BANGALORE

Title: Volatile memrister: A potential circuit element for dynamic neural networks

SPEAKER

DR. SREEDHARA M B
IISC, BANGALORE

TITLE: MISFIT LAYERED COMPOUND: A HEAVILY DOPED PLATFORM FOR UNCONVENTIONAL PROPERTIES

SPEAKER

DR. MAHADEVA BHAT
SCIENTIST, DRDO

TITLE: MATERIALS ENGINEERING FOR HIGH SPEED AND HIGH POWER ELECTRONIC DEVICES

SPEAKER

DR. VINAYA KUMAR K B
BITS PILANI. GOA

TITLE: POLYMER PIEZOELECTRIC FOR SELF-POWERED WEARABLE SENSING

SPEAKER

DR. VENKATARAMANA B
SENIOR SCIENTIST
CSIR-NAL, BANGALORE

TITLE: SOLID PARTICLE EROSION AND CORROSION RESISTANT METAL/CERAMIC NANOLAYERED MULTI-LAYERED COATINGS FOR GAS TURBINE COMPRESSOR BLADES.

SPEAKER

DR. SUCHAND SANDEEP
ASSOCIATE PROFESSOR - RESEARCH
MIT, MANIPAL

TITLE:
SILVER NANOROD BASED PLASMONIC RANDOM LASERS AND THEIR APPLICATIONS

SPEAKER

DR. SAJAN GEORGE
HEAD, DAMP, MAHE

TITLE: INTERFACE ENGINEERING AT NANOSCALE: EMERGING APPLICATIONS

Paper ID	Authors	Title
CMPA-1	Raghavendra K. G, Gurumurthy Sangam	Pyrochlore – Fluorite Structural conundrum in Rare Earth Zirconates
CMPA-2	Vikash Mishra	Study of H+-ion irradiation effect in 2D α-MoO_3
CMPA-3	Gowrish Rao K	Studies on vacuum deposited ZnTe films
CMPA-4	Mohan Rao K, Jason Rebello	Influence of Molar Concentration on the Structural and Optical Properties of Zirconia Thin Films Deposited via Sol-Gel Spin Coating
CMPA-5	Shreepooja Bhat, Shivakumar Jagadish Shetty, Gurumurrthy S.C	Hydrothermal Decoration of Ag-Ag_2S NPs on F-MWCNTs for Multifunctional Polymer Composites
CMPA-6	K. K. Nagaraja	Surface morphology and c-orientation of Sc doped AlN on Si(111) and Mo/Si(111) surfaces
CMPA-7	Gautham Jeppu, Amrutha Acharya, Chikmagalur Raju Girish	Competitive Adsorption of Arsenic and Fluoride by Superparamagnetic Iron Oxide Nanoparticles:
CMPA-21	Chethan K N	One-Dimensional Functional Material-Based Nanofluid for Heat Transfer Applications
CMPA-22	Edsel Xavier Dias, Aruna P T, Mallikarjun Bhavanari	Ti-doped $CoMnO_X$ as an electrocatalyst for oxygen evolution reaction at 100 mA/cm^2

CMPA-23	Ishwar Bhiradi, Somashekhar S Hiremath	Energy Storage And Photosensitivity Of In-Situ Formed Multimetallic Heterogeneous Nanoparticles Generated Using Multi-Tool Micro Electro Discharge Machining Process
CMPA-24	Sandeep G S, Poornachandra Pandit1, Shreelaxmi Prashant	Synthesis and characterization of alkali activated materials for high temperature applications
CMPA-25	Moolya Jyoti Poovappa, S. Sandeep, Vishwanath Managuli2, Kodihalli K. Nagaraja1	Effect of Sputtering pressure on the preferred orientation of Aluminum nitride (AlN) thin films deposited using RF magnetron sputtering.
CMPA-26	Rajashekhar Pujar, Shreepooja Bhat, Gurumurthy S.C	H_2S-Assisted Vapor Phase Synthesis of Ag_2S Thin Films for Resistive Switching Applications
CMPA-51	Anikaramya.U , Jostol Len Pinto , Kavya G K , Chethan G and Narayan Y	Mechanical Properties of Borassus Flabellifer Fruit Fiber and Polyester Resin Matrix Composites: Effects of Varying Ratios
CMPA-52	Vijeth H, Yashaswini M, Devendrappa H	Nanostructured Polypyrrole Composite for Solid State Supercapacitor Application
CMPA- 53	Ms. Abhirami R K, Dr. Suraj Soman , Dr. Sourava Chandra Pradhan	Fabrication and Characterization of Z-type Dye-Sensitized Solar Modules for the indoor photovoltaic applications
CMPA-54	C. Shalini , K. K. Nagaraja , S. Pramodini	Piezo-Catalytic Degradation of Binary Dyes Mixture Using Aluminium Doped Zinc Oxide (AZO) Nanoparticles
CMPA-55	Rahina M K, Murari M S, Rani M Pattab	Optimizing the Synthesis of Bismuth Ferrite Nanoparticles: Effects of Calcination Temperature on Structural Characteristics and Catalytic Activity

CMPA- 56	Sujith S, Ranjan B Shetty and Y Narayana	Accumulation of α-emitting 210pb in home-grown spices in foothills of western ghats in southern karnataka
CMPA-57	Shravani K, A.M Hunashyal and Sandhya Jalgar	Evaluation of energy absorption capacity of polymer nano-composite damper for concrete structures.
CMPA-58	Sudarshan K. R, Sudarshan G. H, Abhishek B, Jayarama A, Narayana Yerol, Shriganesh Prabhu and Richard Pinto	Enhanced Electrical Conductivity and Surface Properties of IZO Thin Films via Ammonium Acetate Treatment for Optoelectronic Device Applications
CMPA- 59	Ranjan B Shetty, Sujith S, Y Narayana	Assessment of 210Pb Spatial Variability in Soil and Aquatic Vegetation along Udupi's Coastline, Karnataka, India
CMPA- 60	Swetha M T, Bhimaraya R Biradara, Partha Pratim Dasa, Sib Sankar Malb	Carbon Nanotube-Supported Vanadium Substituted Phospho-Molybdo Nanohybrid for Supercapacitor Application
CMPA- 61	Vidyalakshmi V, Dr Gowrish Rao, Dr Mahesha M G	Fabrication and Characterization of NiO/ZnO Heterojunction Photodetectors for UV Sensing
CMPA-62	Vedanth Prabhu, Gurumurthy S C	Enhancing Corrosion Resistance of Iron with Copper Nanoparticle and Polymer Coatings
CMPA-63	Tanya Sood, Ramseena Thundiyil, P. Poornesh	In_2O_3 Thin Film Sensors for SO_2 Detection: Influence of Molar Concentration on Sensitivity at Trace Levels
CMPA-64	Harini U, Dr. Caroline Ponraj	Non enzymatic electrochemical detection of pesticides using Bismuth ferrite nanoparticle

CMPA-65	Manasa Bhat , G Ramachandran , Kaustab Ghosh	Theoretical investigation of interaction of amino acid and functionalized group with graphene nanoribbon – DFT calculation
CMPA-66	Sumukha M, Shoshankumar N, Saideep Shirish Bhat, Gurumurthy S C, Neelamma B Gummagol, Shilpa M P	Single Step Fabrication of Flexible PVA/Ag2S Nanohybrid Films for Nonlinear Optical Applications
CMPA- 67	Anusuya Periyasami, Prashanth Kumar	Analysis of interface trap charges on RF/analog performances of dual-gate-source-drain Schottky FET for high-frequency applications
CMPA-68	Ramseena Thundiyil, Poornesh P	Tailoring defect engineering for third-order nonlinear processes in NiO thin films via microwave irradiation
CMPA-69	Sandeep B Shetty, Ismayil	Structural and Electrochemical Insights into Sodium acetate Doped ι-Carrageenan Solid Polymer Electrolytes
CMPA-70	Sowmya A, Nisarga, Nanditha T.K , Shreepooja Bhat, Roopa Nayak Gurumurthy S.C	Kinetics-Controlled Synthesis of AuAg Nanosheets for Enhanced Degradation of Organic Dyes
CMPA-71	Nisarga, Sowmya A, Shreepooja Bhat , Nanditha T.K, Ravikirana , Roopa Nayak, Gurumurthy S.C	Ag@Ag2S Decentralized Core-Shell Nanoparticles for Effective Dye Mitigation
CMPA-72	Kiran Keshyagol , Shivashankarayya Hiremath, Vishwanatha H.M , Pavan Hiremath	Numerical Investigation of Dielectric Enhancement in PDMS-Barium Titanate Composites for Improved Capacitance and Energy Storage
CMPA-73	Shreepooja Bhat , Vishwashreelakshmi. P.S , Nanditha T.K , Maqsood R. Waiker, Gurumurthy S.C	Efficient 4-NP Mitigation Adapting Eco-Conscious Ag-Ag2S Nanoparticles

CMPA-74	Shivakumar Jagadish Shetty, Shreepooja Bhat, Shivamurthy R C, Gurumurthy S C	Metal Sulfide-Modified F-MWCNTs Nanofluids: Boosting Heat Transfer Efficiency
CMPA-75	Saideep Shirish Bhat, Shilpa M P, Shivakumar Jagadish Shetty, Raghavendra K G, Ishwar Biradi, Gurumurthy S C	Enhancing the Photocatalytic Activity of ZnO/RGO Composite Thin Films via Photo Annealing
CMPA-76	Nanditha T K, Shreepooja Bhat, Gurumurthy S. C	Colocasia esculenta-Derived AgCo Nanoparticles: Eco-Friendly Catalysts for Dye Reduction
CMPA-77	Madhu S, Ashok Rao, Nagaraja K K	Effect of N2 Ratio on Sputtered Copper Nitride Thin Films for Thermoelectric Application.
CMPA-78	Aparna C, Pramoda Kumara Shetty, Mahesha M G, Yashodhara I, Karunakara N	Impact of Gamma Radiation on Structural and Photonic Properties of Tungsten-Doped Indium Oxide Thin Films for Dosimetric applications
CMPA-79	Ramaraja Varma V, Ganesh Sanjeev, Shreedatta Hegde, Shruthi K N, Mohan Kumar, Sahana G K, Sushma	MPA Capped ZnSe Quantum Dots Embedded in Methyl Cellulose Polymer for Enhanced UV Photodetectors
CMPA-80	Rashmi N, F. J. Serrao, K.Kumara, M. B. Savitha, N.B. Rithin Kumar	Investigations on effect of rGO on Optoelectrical Properties of pure and Al doped ZnO thin films
CMPA-81	Nanditha Nair, Gurumurthy S C, Vidya S Rao	Factors influencing the hydrothermal synthesis of $SrTiO_3$ nanoparticles
CMPA-82	Shivappa S L, Rakshitha T M, Pavithra H K, Kotresh K, Rajani L Karigar, Sushma S S, Prasanna Kumar S P,	Synthesis and characterization of Ni-ZnO nanocomposite for CO_2 gas sensing applications

	Kavitha C M, Dr. K M Eshwarappa	
CMPA-83	Rajani L Karigar , Prasanna Kumar S P , Meghana H, Padma S K , Shivappa S L a,Sushma S S ,K M Eshwarappa	Synthesis and characterisation of CMC/PEG-ZnO/CuO polymer nanocomposite for energy storage applications
CMPA-84	Jyothilakshmi R., Sandeep, Srihari N.V., K. K. Nagaraja	Tailoring Structural, Elastic, and phonon Properties of AlN through Sc-Doping: A Combinatorial Approach
CMPA-85	Sushma S S, Shivappa S L, Rakshitha T M, Pavithra H K, Kotresh K, Rajani L Karigar, Prasanna Kumar S P, Kavitha C M, Dr. K M Eshwarappa	Synthesis and characterization of Ni-ZnO nanocomposite for humidity sensing applications
CMPA-86	Kirankumar M C , Santhosh Kumar M V, Kirthan B R	Photoluminescence investigation of Zn2+-doped MgO nanoparticles obtained via the green synthesis route.
CMPA-87	Siri M K, Chandrashekara M N	Studies on the effects of relative concentrations of pvdf and peo on the structural, thermal and tensile properties of pmma/pvdf/peo ternary polymer blend
CMPA-88	Shweta G. M , Naik L. R ,Mathad S. N , Pujar R. B , Manjunatha K	Copper doped Nickel Zinc Nanoferrites by Solution Combustion Method: Structural and Antibacterial Properties
CMPA-89	Inchara D R, Mamatha D Daivajna, Gurumurthy S C, M S Murari	Investigation of hexamanganite thin-films for their suitability in photovoltaics.

CMPA-90	Vidya M, Raghavendra K G, Gurumurthy S. C	Synthesis and Microstructural Investigations in Co-Doped Lanthanum Zirconate
CMPA-91	Spoorthi N.S, Akshay Prabhu, Ravitheja G,Jayanna H.S, Ashok R.L	Synthesis and Characterization of rGO/ZnO Electrodes using Psidium Guajava Fruit Extract: Its Electrical and Optical Properties.
CMPA-92	Bhoomika K U, Akshay Prabhu, Priyanka K Aradhyamath, H. S. Jayanna, Ashok R Lamani,	A Simple Sonochemical Approach to Synthesize rGO/CuO Nanocomposite for Methylene Blue Dye Degradation
CMPA-93	Darshan S G1, Akshay Prabhu, Aparna R A, H. S. Jayanna, Ashok R Lamani	Averrhoa Bilimbi Fruit Extract Facilitated Synthesis of rGO/Co3O4 Nanocomposite for Methylene Blue Dye Degradation
CMPA-94	Jishina Ka, Rani M Pattabia, Vaishali Raib, Rashmi Kunhiramana, Manjunatha Pattabia	Antibacterial Activity of Spherical Porous Gold Nanoparticles Aga Certain Pathogenic Bacteria
CMPA-95	Rashmi Kunhiramana , Vaishali Raib , Raifa Abdul Azizc, Jishina K, Rani M Pattabia	Seed-mediated formation of core-shell AuAg bimetallic nanoparticles for antibacterial applications
CMPA-96	Anushree Jogi and Mamatha D Daivajna	Study of Structural and Dielectric Properties of SrFe12O19 Hexaferrite: An Influence of Sintering Temperature
CMPA-97	Ashwini Ashok Burali, Veda G and R F Bhajantri	Dielectric and Ionic Conductivity Studies on PVA/Sodium Alginate and Sodium Perchlorate Salt Composite for Energy Storage Application
CMPA-98	Nurendra K L, Akshay Prabhu, H. S. Jayanna, Ashok R Lamani,	Synthesis, Characterization, and Butane Gas Sensing Performance of rGO/NiO Nanocomposite

CMPA-99	Mayank.O ,Omkar Sharma , Dr Gajanan Honnavar	Exploring the Electrical Behavior of Quantum Dot Embedded Polymer System for Advanced Electronics
CMPA-100	Mallikarjun Hoogar, Rajashekar F BhajantriMohan S, Suhas M Malenahalli	Study on enhancing Na+ ionic conductivity of poly(methyl methacrylate) (PMMA)/polyvinylidene fluoride (PVDF) solid polymer electrolyte with incorporating ZrO2 nanofiller and NaClO4 salt.
CMPA-101	Niveditha G, Ravitheja G, Ashok R Lamani, Akshay Prabhu, Jayanna H.S, Shivakumar Jagadish Shetty, Saideep Shirish Bhat, S.C. Gurumurthy	Photocatalytic studies of sol-gel synthesized LaFeO3/NiO nano composite
CMPA-102	Ravitheja G, Ashok R Lamani1, Niveditha. G Akshay Prabhu, Spoorthi N S1, Jayanna H.S, Shiva Kumar Jagadish Shetty, Saideep Shirish Bhat, S.C. Gurumurthy	Visible light photocatalytic degradation of Methylene blue by LaFeO3/NiO/rGO nano-composite.
CMPA-103	Y.S. Hemanth, G. Ravitheja , Ashok R Lamani, Akshay Prabhu, N. S. Spoorthi , H.S. Jayanna , Shiva Kumar Jagadish Shetty, Saideep Shirish Bhat, S.C. Gurumurthy	Visible light photocatalytic degradation of Methylene blue by LaFeO3/NiO/GO nano-composite.
CMPA-104	Shivakumar Jagadish Shetty, Gurumurthy S C, Shivamurthy R C	Mixed-Dimensional Nanofluids for Thermal Enhancement Using Mixture of 1D and 2D Materials
CMPA-105	Dr. Chehak Nayyar, Dr. Gurumurthy S.C, Dr. Jothi M. Varghese	Titanium surface modified with strontium nanoparticle coating for enhanced antibacterial and biological activities

CMPA-106	Shreya Kodarkar, Shivakumar Jagadish Shetty, Saideep Shirish Bhat1, Gurumurthy S C	Investigating Optical Properties of Functionalized Nanofiller-Polymer Composites
CMPA-107	Akarsh M Arjun , Gurumurthy S C	Fabrication of TiO2 decorated silica gel for photocatalytic applications
CMPA-108	Samarth Tolpadi, Rajendra B.V, Suresh D. Kulkarni	Synthesis and characterization of Co3O4 thin films by Spray pyrolysis for supercapacitor applications
CMPA-109	Mohammad Saquib , Ramakrishna Nayak , M. Selvakumar	Formulation and Optimization of Ni-MOF/CuSe Nanocomposite Ink for High-Performance Flexible Microsupercapacitors
CMPA-110	Nandini P S, Sachin Shet, and Sudha Kamath	Neutron shielding of bismuth added heavy metal oxide glasses
CMPA-111	Shashi Pandey, Swaroop Ganguly	Emerging Trends in Wide Bandgap Semiconductor Technologies (SiC and GaN) for Power Devices
CMPA-112	Puttanna G B, Sagar M D, Harish Kumar D C and Gowtham G K	Investigation of Natural Capping Agent for CdS and ZnS QD's using Madras Thorn Leaves: Green Synthesis
CMPA-113	Suhas M Malenahalli, Rajashekar F Bhajantri, Mohan S, Mallikarjun Hoogar	Electrochemical and UV irradiation study on Na+ ion conducting of poly(ethelyne oxide) (PEO)/Polyvinylidene fluoride (PVDF)/ TiO2 / NaClO4 blend solid polymer electrolyte for energy storage application.
CMPA-114	Veda G Ashwini Ashok Burali and R F Bhajantri	Structural, thermal and ionic conductivity studies of sodium iodide (NaI) blended hydroxypropyl

		methylcellulose (HPMC) polymer electrolyte films
CMPA-115	Kalpitha M Bangera , Mohammad Saquib, Ramakrishna Nayak , M. Selvakumar	Advanced Formulation of $MoTe_2$/Carbon Nanofiber Nanocomposite Conductive Ink for High-Performance Screen-Printed Flexible Microsupercapacitors
CMPA-116	Shilpa Shetty , Mohammad Saquib , M. Selvakumar , Chiranjit Ghosh , Ahipa Tantri Nagaraja , Ramakrishna Nayak	PEDOT:PSS Water-Based Conductive Ink Infused with Polypyrrole and Reduced Graphene Oxide for High-Performance Micro-Supercapacitor and Humidity Sensor
CMPA-117	Akash Rajaraman Kowshi, Bavitha J, Keerthana Umesh	Magnetic behaviour of Nano Particles for Advanced Electronics
CMPA-118	ShapeAnusha Dinakar Rao, Raghavendra Bairy, Pawan Nayak N, Suresh D Kulkarni, Neelamma Gummagol	An investigation of thirdorder nonlinear optical and limiting properties of spray pyrolysisdeposited Zn1-xCrxO nanostructured thin films for optoelectronics
CMPA-119	Neha K H and R F Bhajantri	Polymer Composite Electrolyte PVA/Hydroxypropyl Methyl Cellulose Doped with $NaNO_3$ Salt for Ionic conductivity and Dielectric properties
CMPA-120	Binay Kumar Tripathy, S. Gurumurthy	Rural rubber wastewater treatment using a sequential coagulation-flocculation and ultraviolet assisted Fenton oxidation in presence of nanoparticle

CMPA-121	Nisarga1, Sowmya A, Shreepooja Bhat, Gurumurthy S.C, Roopa Nayak	Metal Sulfide Nanoparticles/PVA Nanocomposite for Optoelectronics Applications
CMPA-122	S.G Siddanth , Mohammad Saquib , Ramakrishna Nayak, M. Selvakumar	Multivariate Central Composite Design Approach for Optimizing Ag-Doped Polypyrrole in Interdigitated Flexible Microsupercapacitors
CMPA-123	Manjunatha K, Sharada T, Bhuvan Kulkarni Suchetan P A, Shweta G M	Design, Characterization, X-ray diffraction and Microbial study of tert-butyl 4-(2-ethoxy-2- oxoethyl)-piperazine-1-carboxylate and tert-butyl 4-(2- hydrazino-2-oxoethyl)piperazine-1-carboxylate
CMPA-124	Vijaykumar C J, Soumya S Bulla, Chetan Chavan, Yashaswini R1, Priya G V, Sachin H	Optical and Structural Studies of Al2O3 Nanoparticle incorporated PVA- MgCl2 Nanocomposite Films
CMPA-125	Preethika, Raghavendra Bair, Anusha Dinakar Rao, Pawan Nayak N, Suresh D Kulkarni, Neelamma Gummagol	Morphological, Structural, and Optical Properties of Al Doped ZnO Thin Film Prepared by Spray Pyrolysis Technique
CMPA-126	Akshay Prabhu, Shivakumar Jagadish Shetty, Gurumurthy S.C, H. S. Jayann, Ashok R Lamani	ZnO Decorated rGO Nanocomposite for Efficient Organic Dye Degradation under UV and Visible Light Irradiation
CMPA-127	Kaviya R, Loganathan M and Murugesan	Metal organic framework based on zinc nitrate and recovery terephthalic acid for battery application
CMPA-128	A Ajisha, A Murugesan & M Srinivasan	Synthesis of metal doped cathode material for sodium ion battery by hydrothermal method
CMPA-129	Ashadevi K S, G Reddy Manjunatha, M Harsh, S Sujitha, Maradur P Sanjeeva, Shanbhag V	Phase Dependentent sensing behaviour of TiO2 for H2 sensor

	Ganapatia, Nalajala Naresha	
CMPA-130	Nishitha Prabhu, Ramakrishna Nayak,	Fabrication and characterization of MOF-Polyaniline-based Flexible thermoelectric generator for low-temperature applications.
CMPA-131	Kishore Prasad S,Chethan B. S, Manjunatha K, Sunil K	Synthesis, Characterization, Computational and Single Crystal X-ray Studies of Novel Isatin Derivative of Biological Interest
CMPA-132	Sarojani Kommoju, Varalakshmi B N, M. Raveendra Kiran,Hidayath Ulla, Dibya Yadav Shagufi Naz Ansari	Ipomoea purpurea Derived Carbon Dots for Efficient Bisphenol-A Degradation
CMPA-133	Varalakshmi B N, Sarojani Kommoju,Shagufi Naz Ansari, Dibya Yadav, M. Raveendra Kiran, Hidayath Ulla	Elucidating the Effect of 2,3,5,6-Tetrafluoro-tetracyanoquinodimethane (F4TCNQ) on the performance of Green OLEDs
CMPA-134	Mr. C. S. Vicas and Dr. Rani M. Pattabi	Hydrothermally Synthesized Al-Doped $BiVO_4$ as a Potential Antibacterial Agent Against Methicillin-Resistant Staphylococcus aureus
CMPA-135	T.S. Guruprasad a, V. Kery vinb, G. Kermouchec, Y. M arthouretc, S. Sao-Joaoc	Micromechanical response of carbon fibers under compressive load
CMPA-136	Stephania D'souza, Adithya PrPAVITH, M.G Mahesha	Characterization of la doped CuO thin films grown by spray pyrolysis technique.

CMPA-137	Koustubh V Kari, Mohan Doddamani, Gowri Soman, Jagadeesha Angadi V, Gurumurthy Hegde	Enhanced Electrochemical Performance of Pr-Doped $NiFe_2O_4$ for High-Efficiency Supercapacitors
CMPA-138	Channamma Kori, Jagadish K A, Gowravi S, Dhananjaya Kekuda	Influence of oxygen flow rates on properties of Cu-doped TiO_2 thin films grown by DC magnetron sputtering
CMPA-139	Karthik V, Ravi Singh K , Sridhar M. A., Sadashiva M. P	Identification of Potential Inhibitors of SARS-CoV-2 Through Virtual Screening, Crystallography, DFT, Docking and Molecular Dynamics Simulation Approach
CMPA-140	Prasanna Kumar S P , Rajani L Karigar, Meghana Ha, Padma S K , Shivappa S La, Sushma S S,K M Eshwarappa	Optical studies of ZnO/CuO nanocomposite
CMPA-141	Nayana E Subhash , Soumya Nair , Srilatha Parampalli Srinivas, Sulatha V Bhandar, Bharath Raja Guru	3D printed biodegradable polymer-based drug delivery implants for a drop free post cataract surgery magement
CMPA-142	Anjali1, Fasiulla Khan, Sarvajith M	Zinc phthalocyanine-based composite for photocatalytic remediation of methylene blue dye
CMPA-143	Sharanya R , Kalpataru Panda.	Solid-State Lighting Properties of Samarium-Doped $SrAl_2O_4$ Phosphors
CMPA-144	Syeda Raiyan, Roshni P N, Nafiya Farooqi, Sanjana H, Sadiyah M S, Samraddhi Savant, Prakash K K, Swaroop K	Development of Hydrogel-Based Facial Masks Incorporating Natural Antimicrobial Extracts for Skin Care
CMPA-145	Adarsh Raj L. , Sebghatullah Amini, Rumana Farheen S. M,	Advanced PVA-PPy Based Composite Materials for High-Efficiency Triboelectric Nanogenerators

	Sangamesha M. A, Krishnaveni S	
CMPA-146	Anusha D Shetty, Harshini Dasari, Nethaji S	Adsorption and Photocatalytic degradation of Emerging pollutants from aqueous phase
CMPA-147	Lozil Denzil Mendonca, El Kebir Hlil, Mamatha D. Daivajna	Bismuth Vacancy Induced Pseudo Cubic Structural Phase Transition in Rhombohedral La0.7Ba0.3MnO3: A Scope for Magnetic Hyperthermia
CMPA-148	Tejas , Sudha D Kamath	Structural and optical properties of Tb3+ doped Ba2ZnSi2O7 phosphors for solid state lighting applications
CMPA-149	Aparna Ramesh , Tarak Nath Das Tapas Kumar Maji, Goutam Ghosh	Chiroptical Switching in Peptide Self-assembly with Tunable Piezoelectric Behavior Through Pathway Complexity
CMPA-150	Sourav Moyra, Goutam Ghosh	Peptide-Based Supramolecular Systems with Tunable Spacers for Conductivity and Piezoelectric Applications
CMPA-151	Kiran R, Princy A, Sudha D Kamath	Temperature dependent luminescent properties of tungstate phosphor
CMPA-152	Shruthi, Ipshita Das, Babitha Kampa Sundara	Suberoylanilide Hydroxamic Acid with Novel Nano-Carriers for Drug Delivery and Brain Disease Treatment across the Blood-brain Barrier
CMPA-153	Shreyaskumar S Beerakabbi, Harshini Dasari	Production of pyro-oil and its transformation into a range of valuable products.

CMPA-154	A. Kempaiah, B.S. Palakshamurthy, Shivalingaswamy T	Synthesis, Characterization and Photo luminescence properties of ZnAl2O4: x %Eu3+, An+ (x=7mol%, An+ = Na+, Mg2+, Bi3+, n=1,2,3) phosphors for LED applications.
CMPA-155	Adarsh V N, N Swetha, Ramya Prabhu B, Omprakash S S	WO_3 Bio-Nanocomposite for Fabrication of Flexible Memristor Device
CMPA-156	Poojitha G, Ashok Rao	Investigation on Thermoelectric Properties of Ni-Doped n-type $Bi_{1.8}Sb_{0.2}Te_3$ Alloy
CMPA- 157	Suchitra Puthran and A. N. Prabhu	Crystalline Perfection and Thermoelectric property investigation of Melt-grown Sb, Se co-doped Bi_2Te_3 single crystals
CMPA-158	Moolya Jyoti Poovappa, S. Sandeep, Vishwanath Managuli2, Kodihalli K. Nagaraja1	Effect of Sputtering pressure on the preferred orientation of Aluminum nitride (AlN) thin films deposited using RF magnetron sputtering.

CMPA-1

Pyrochlore – Fluorite Structural conundrum in Rare Earth Zirconates

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Abstract: Thermal barrier coatings with low thermal conductivity, a compatible coefficient of thermal expansion (CTE) with alloy substrates, and adequate mechanical properties are essential for high-temperature applications, including aero engines and thermal power plants. To improve engine efficiency, extending the operational temperature limits is necessary, driving the demand for novel materials with comprehensive properties. Recently, pyrochlore-structured rare-earth zirconates have gained attention, particularly lanthanum zirconates, due to their excellent thermal properties and robust phase stability. However, challenges remain regarding their poor mechanical properties and low CTE. To address these limitations, strategies such as elemental doping and process modifications have shown promise for tailoring the microstructure and enhancing material properties. This study investigates the phase and microstructure stability of Gd-doped $La_2Zr_2O_7$ as a function of Gd concentration, synthesized via the co-precipitation method. Additionally, the effects of process parameters, including pH and annealing time, on the phase structure and thermophysical properties of pristine $La_2Zr_2O_7$ are examined. Detailed evaluations using X-ray diffraction, electron microscopy, chemical analysis, and thermophysical property measurements are presented, with key insights from this comprehensive investigation highlighted in the conference presentation.

Keywords: Pyrochlores, Raman Spectroscopy, High Temperature, Phase studies

CMPA-2

Study Of H^+-ion Irradiation Effect in 2D A-Moo_3

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Abstract: Layered transition metal dichalcogenides (TMDs) with a band gap in the range 1-3 eV is the emerging new class of two-dimensional (2D) materials that can interact with light to convert the photons to electrical signals for its attractive applications in photonics, electronics, and optoelectronics [1]. Also, there is the presence of uncontrollable defects, which degrades the functionalities of TMDs at higher temperatures. To overcome the aforementioned limitations of TMDs, there is a need for a new material which can replace these materials. In this regard, α-MoO_3 is one of the candidates of 2D oxide materials, which exhibits high charge carrier mobility of about 1100 $cm^2 V^{-1}s^{-1}$ [2] and high k-dielectric (value >200) [3], which is beneficial in reducing coulomb scattering, which is most significant in the TMDs because of the low value of dielectric constant. Moreover, it has good transparency with visible light and exhibits controllable semiconducting properties [4].In this present work, first, we demonstrate the growth of cm-size α-MoO_3 crystal using the physical vapor deposition technique latter the thickness of these crystals is reduced by using the mechanical exfoliation technique. The H^+-ion irradiation has been carried out on the mechanically exfoliated α-MoO_3 flake using 30 keV source with the fluence of 1×10^{16} ions/cm^2. Interestingly in the H^+-ion irradiated α-MoO_3 flake, a new broad defect-induced photoluminescence peak is emerging in the visible range. To know the origin of this peak, we have performed the HSE calculation by considering the oxygen vacancy in α-MoO_3, and it has been found that in the theoretical simulated absorption spectra and the total density of state, the additional peak appears near the same position where the defect induced PL appears. Which confirms defect induce emission in H^+-ion irradiated α-MoO_3 flake. The present study will open the possibilities to explore the α-MoO_3 in tunable optoelectronics applications.

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CMPA-3

Studies on Vacuum Deposited Znte Films

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Abstract: The Zinc Telluride (ZnTe) films were deposited on glass substrates by thermal evaporation. X-ray diffraction (XRD) analysis of the films revealed cubic structure with strong (111) preferred orientation. Films obtained on substrates maintained at room temperature were non-stoichiometric while those obtained at a substrate temperature of 553 K were nearly stoichiometric. Electrical conductivity, carrier concentration and the mobility of the carriers increased at elevated substrate temperature.

Keywords: ZnTe; thermal evaporation; substrate temperature; stoichiometry

CMPA-4

Influence of Molar Concentration on the Structural and Optical Properties of Zirconia Thin Films Deposited via Sol-Gel Spin Coating

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Abstract: Zirconia is a promising material for electronic applications due to its high dielectric constant, wide bandgap, and excellent thermal and chemical stability. In this study, zirconia thin films were successfully deposited on soda lime glass substrates using the sol-gel spin coating technique. The precursor solutions were prepared by dissolving 0.05 M, 0.1 M, 0.15 M, and 0.2 M zirconium chloride in 2-methoxy ethanol, followed by deposition at 2000 rpm for 30 seconds and annealing at 500°C for 1 hour. Structural characterization using X-ray diffraction confirmed a monoclinic ZrO_2 structure (space group $P2_1/c$), with improved crystallinity observed at higher molar concentrations. The crystallite size increased from 24.48 nm to 30.11 nm, accompanied by a reduction in strain (2.72×10^{-3} to 2.22×10^{-3}) and dislocation density, indicative of enhanced structural quality. Optical analysis showed a reduction in bandgap energy from 4.52 eV to 4.33 eV and a decrease in Urbach energy, reflecting diminished structural disorder and improved electronic uniformity. These findings demonstrate that molar concentration significantly influences the structural and optical properties of ZrO_2 thin films, making them promising candidates for electronic and optoelectronic applications.

Keywords: Zirconia thin films, spin coating, sol-gel method

CMPA-5

Hydrothermal Decoration of Ag-Ag_2S NPs on F-MWCNTs for Multifunctional Polymer Composites

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Abstract: Nanostructured composite polymers with tunable optical and electronic properties are critical for advanced optoelectronic and memory technologies. This study synthesizes Ag-Ag_2S alloy nanoparticles (NPs) via chemical reduction and decorates them onto functionalized multi-walled carbon nanotubes (F-MWCNTs) through a hydrothermal process. Decoration parameters, including temperature (80°C, 100°C, 120°C) and duration (10, 12, 14 hours), were optimized, with the best sample prepared at 80°C for 14 hours, exhibiting uniform NP decoration. These decorated F-MWCNTs were incorporated into a polyvinyl alcohol (PVA) matrix to create composite polymers with tailored optical properties. UV-Vis spectroscopy demonstrated enhanced plasmonic absorption and reduced transmittance with increased NP loading, while X-ray diffraction (XRD) confirmed Ag_2S crystalline phases and successful integration into the polymer matrix. The Ag-Ag_2S/F-MWCNTs/PVA composites exhibited superior optical and structural performance, highlighting their potential for photodetectors, sensors, energy storage systems, and memristor-based resistive random-access memory (RRAM) devices.

CMPA-6

Surface Morphology and C-Orientation of Sc Doped Aln on Si(111) and Mo/Si(111) Surfaces

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Abstract: In this work, we present the optimization of Sc power to get good crystallinity with higher Sc concentration. Al target power was set at 175 W along with other parameters such as substrate temperature, nitrogen to argon flow rate, etc. Then, Sc power was varied from 40 W to 100 W in the 20 W step. To perform electrical characterization, molybdenum (Mo) as the bottom electrode due to its exceptional compatibility with AlN, such as less lattice mismatch (1.1%). Deposited AlScN The deposited films show preferential orientation along the c-axis (002) and have high crystallinities for all the samples. All the characteristic peaks correspond to wurtzite AlN shifted towards a lower diffraction angle, owing to the effective substitution of larger ionic radii (0.73 Å) Sc (3+) ions in Al (3+) sites (0.51 Å). EDS characterization confirms the effective substitution of Sc in AlN. The maximum 36% of Sc is alloyed in films deposited at 80 and 100 W. FESEM top surface and cross-section images validate the densely packed grains without any voids and columnar growth of the films. AFM results depicted films deposited at 80 W have the least RMS roughness of 0.93 nm.

Keywords: Sc doped AlN; sputtering; AFM; FESEM; c-axis orientation

CMPA-7

Competitive Adsorption of Arsenic and Fluoride by Superparamagnetic Iron Oxide Nanoparticles:

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Abstract: This research explores the competitive adsorption of arsenic and fluoride from aqueous solutions using synthesized superparamagnetic iron oxide nanoparticles (SIONP). The behaviour and efficiency of SIONP were investigated through batch experiments. The influence of adsorbent dosage, contact time, and solution pH in binary component systems was performed. Under optimal conditions, the SIONP demonstrated remarkable efficiency in adsorbing arsenic and fluoride, achieving maximum contaminant capacity. Similarly, the SIONP effectively removed 90% of As(V) and fluoride in binary-component systems, showcasing its potential for simultaneous contaminant removal. Time-dependent studies revealed that the adsorption process in binary-component systems followed a pseudo-second-order kinetic model, indicating chemisorption as the dominant mechanism. The various models were utilized to analyze the competitive adsorption isotherm data, using Extended Langmuir and Extended Freundlich isotherm models. It further highlights the potential effectiveness of SIONP as an adsorbent. The experiments were conducted by varying the concentration of arsenic while keeping fluoride constant and vice versa at different pH levels. Overall, this research yields valuable insights into the competitive adsorption of arsenic and fluoride using synthesized superparamagnetic iron oxide nanoparticles. The findings may contribute to developing innovative water treatment approaches, enhancing the purification of water resources for safer and cleaner usage.

Keywords: Arsenic; Fluoride; magnetic iron oxide nanoparticles; Binary adsorption; Competitive isotherm modeling.

CMPA-21

One-Dimensional Functional Material-Based Nanofluid for Heat Transfer Applications

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Abstract: Heating was a common issue faced by industries. To remove the excess amount of heat, liquid circulation systems were used. In the liquid circulation system, conventional fluids like water or ethylene glycol were used. These conventional fluids reached its limit. Hence nanoparticles were dispersed in conventional fluid to prepare a new class of fluids called nanofluids. Here, pristine multi-walled carbon nanotubes (P-MWCNTs) were functionalized using an acid treatment approach. Using various spectroscopic and microscopic techniques, functionalization was successfully confirmed. The dispersion stability of the prepared nanofluids was measured using zeta potential and visual inspection techniques. The viscosity measurement depicts non-Newtonian behaviors of the nanofluids. About 22.14% enhancement in thermal conductivity was observed for 10 wt% nanofluid. By decorating zero- or two-dimensional materials the properties can be tuned and the nanofluids can be utilized for practical applications.

CMPA-22

Ti-doped $CoMnO_X$ as an Electrocatalyst for Oxygen Evolution Reaction at 100 mA/cm²

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Abstract: Human dependence on fossil fuels contributes to over 30 billion tonnes of CO_2 emissions annually, driving the urgency for sustainable energy alternatives like green hydrogen generation via water electrolysis (WE) [1]. While the WE industry is currently dominated by noble metal electrocatalysts like Pt, IrO_2, RuO_2, etc., their high cost, scarcity and low durability at high current densities hinder widespread implementation [2]. Transition metal-based electrocatalysts present a promising alternative offering high conductivity and oxophilicity for efficient OH^- adsorption with electron transfer to facilitate efficient O_2 generation [3]. Herein, we report the synthesis of CoMnTi-based electrocatalyst over nickel foam (NF) via the hydrothermal route and systematically evaluate their electrochemical performance towards oxygen evolution reaction (OER) in an alkaline electrolyte. $Co_1Mn_{0.6}Ti_{0.3}O_x$/NF requires an overpotential of 410 mV to deliver a current density of 100 mA/cm², with a Tafel slope of 73.48 mV/dec and an R_{ct} of 0.94 Ω. Durability studies conducted via chronopotentiometry at 100 mA/cm² for 6 h reveal a negligible increase in the overpotential highlighting its excellent stability. This work underscores the potential of the CoMnTi-based electrocatalyst as a cost-effective and durable alternative for industrial-scale WE, providing a roadmap for advancing toward sustainable energy solutions.

Keywords: electrolysis; electrocatalyst, catalyst, oxygen evolution reaction, green energy

CMPA-23

Energy Storage and Photosensitivity of In-Situ Formed Multimetallic Heterogeneous Nanoparticles Generated Using Multi-Tool Micro Electro Discharge Machining Process

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Abstract: This research explores the development of segregated multi-metallic heterogeneous nanoparticles synthesized in-situ using an advanced Micro-Electro Discharge Machining (Micro-EDM) technique. The study evaluates energy storage capabilities and photosensitivity by analyzing useful heat gain, temperature variation, and thermal efficiencies of nanofluids in a custom-built mini parabolic solar trough collector. Additionally, light absorbance properties and bandgap energies of the nanoparticles were examined under varying light intensities. Theoretical insights delve into how factors such as metallic vapor pressure, dielectric temperature, and material attributes influence the mechanisms of heterogeneous particle formation.
Experiments were conducted by using a silver plate as the anode and varying the number of copper, gold multi-tool pins at the cathode, submerged in a dielectric medium with CTAB surfactant. The nanoparticles formed were well-dispersed and heterogeneously structured, with an average particle size showing variability depending on the experimental conditions. XRD analysis confirmed the presence of FCC-structured Ag and BCC-structured Cu2O. Among the experiments, one demonstrated the highest particle synthesis rate, while another yielded nanofluids with the best thermal efficiency and optimal bandgap energy. The highest useful heat gain is obtained by the 3rd experiment due to higher silver content whereas highest overall thermal efficiency of 14.5% and bandgap energy of 2.75 eV is obtained by the 7th experiment nanofluid. Overall, the study highlights the potential of silver based multi-metallic nanoparticles in energy storage and photosensitive applications.

Keywords: Energy storage; Photosensitivity; Solar trough collector; Multi-tools; Heterogeneous nanoparticles; Stability.

CMPA-24

Synthesis and Characterization of Alkali Activated Materials for High Temperature Applications

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Abstract: Environmental sustainability in the production of construction materials is the need of an hour by reducing carbon emissions. As the cement industry contributes around 8% of global CO_2 emissions, there is a need for the development and assessment of ecofriendly alternatives without compromising mechanical and durability properties of conventional cement for intended applications. Alkali activated materials produced by the activation of calcium/alumino silicates using alkali salts are viable alternatives as they form cementitious solid by polymerization. The study focuses on the synthesis and characterization of thermally exposed Alkali Activated mortars (AAM), a binding agent which hardens to hold masonry units in the masonry construction, to find their acceptability and adoptability in various high temperature applications. Even though mortars are non-combustible; their mechanical, physical, and chemical properties deteriorate when exposed to high temperatures depending on the intensity and duration of exposures. Alkali Activated mortars (AAM) are produced by activating fly ash and slag using sodium hydroxide and sodium meta silicate pentahydrate in solid form in different proportions and are exposed to temperatures up to 1000^{o}C with constant retention period after 28days of ambient curing. After exposure to high temperatures, specimens are assessed for their deterioration with the help of residual mechanical strengths supported by SEM, EDS and XRD. The study revealed better performance of well-proportioned AAM as compared to conventional cement mortar w.r.t elemental ratios (Si/Al and Ca/Si), dense microstructure due to the formation of hydrates (C-S-H and C-A-S-H), phase changes and minimal crystalline structure deterioration.

Keywords: Alkali Activated mortar; High temperature; Characterization.

CMPA- 25

Effect of Sputtering Pressure on The Preferred Orientation of Aluminum Nitride (Aln) Thin Films Deposited using RF Magnetron Sputtering.

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Abstract: Since the development of MEMS technology, piezoelectric thin films have been the material of interest for both transduction and sensing applications. Aluminium nitride (AlN) thin films have gained a lot of attention as a potential candidate material due to their unique properties such as CMOS compatibility, high-temperature resistance and hardness, etc. [1] . However, AlN's piezoelectric coefficient depends on the crystal structure and growth direction. Generally, (002) orientation yields good piezoelectric response in AlN. In this study, the effect of sputtering pressure on the orientation of AlN films on sapphire substrates was analyzed. The films were deposited using radio frequency magnetron sputtering at a substrate temperature of 300 °C, Ar/N_2 concentration of 3:1, RF power of 175 W, and target-to-substrate distance (TSD) of 8 cm. It was observed from the XRD plots that highly (002) oriented films, along with minute (101) and (100) peaks, were grown at lower pressures. With the increase in the sputtering pressure, the intensity of (101) peaks goes on increasing at the expense of the intensity of (002) peak, which is attributed to the decrease in the mean free path of sputtered particles at higher sputtering pressures, causing the sputtered particles to lose most of their kinetic energy before reaching the substrate surface. Consequently, the atoms on the surface find it difficult to rearrange into the close-packed (002) plane, which has a higher formation energy. Higher sputtering pressure favors the formation of the (100) plane because there is less bombardment of ejected Al atoms on the growth layer [2], [3], [4]. Therefore, decreasing pressure is beneficial for the preferential growth of the closely packed (002) plane, while higher sputtering pressure leads to the deterioration of the (002) orientation.

Keywords: AlN thin films; RF magnetron sputtering; sputtering pressure.

CMPA-26

H_2S-Assisted Vapor Phase Synthesis of Ag_2S Thin Films for Resistive Switching Applications

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Abstract: Resistive Random-Access Memory (RRAM) is a promising alternative to traditional memory technologies. This study explores resistive switching in Ag_2S thin films, which were made using a new H_2S gas passing technique, focusing on optimizing the films. Our research primarily focuses on the crystal structure changes, noting a significant transition from the highly symmetrical fcc lattice of pure silver to the less symmetrical monoclinic lattice of Ag_2S. This structural transformation, confirmed through X-ray diffraction (XRD) analysis, has profound implications for memory technologies. Scanning Electron Microscopy (SEM) analysis further revealed a densely packed crystal lattice in the Ag_2S film. The current-voltage (I-V) characteristics exhibited distinct bipolar resistive switching behavior, with the device demonstrating stable resistive switching between -40 to 40 V over 50 cycles. The current jump observed in the resistive switching behavior ranged from 10^{-7} A to 10^{-6} A. These findings highlight the potential of the Ag/Ag_2S/Ag device for neuromorphic applications.

CMPA-51

Mechanical Properties of *Borassus Flabellifer* Fruit Fiber and Polyester Resin Matrix Composites: Effects of Varying Ratios

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Abstract: As awareness grows about the environmental and health hazards posed by non-biodegradable plastics and synthetic fibers, there is a significant shift towards adopting sustainable, eco-friendly alternatives. Usage of natural fibers and bio wastes can help us in reducing usage of plastics and reuse of agricultural domestic waste. Given their availability, recyclability, and eco-friendliness, natural fibers are an excellent choice. The present study investigates the potential of *Borassus flabellifer* fruit fibers, sourced from South Coastal Karnataka, as a sustainable reinforcement in polyester resin composites and focuses on evaluating the mechanical properties of these natural fiber composites. These composites are fabricated using the open hand layup method, with variations in fiber and matrix ratios of 1:30, 1:40, 1:50, 1:60, and 1:70. These ratios are employed for mechanical tests, and the composites are cut according to ASTM standards. Among the fabricated composites tests for Tensile, Flexural and Compression strength was conducted using Tec-Sol India UTM. The composite with a 1:50 and 1:70 ratio with the values 19.27 and 19.37 MPa respectively exhibited superior tensile strength compared to the other ratios tested. The composite with a 1:60 ratio with the value 71MPa exhibited superior flexural properties, while the ratio of 1:40 with the value 22.28 MPa held prominence for compression attribute. Considering the various factors contributing to these results, we conclude that selecting the optimal ratios based on mechanical behaviour is crucial for industrial applications and uses. While the composite is eco-friendly and biodegradable, optimizing the fiber-to-matrix ratio for mechanical behavior is based on the factors influencing the results and the type of approach needed. By optimizing the fiber content, we can develop composite materials that are durable, resistant to bending, and capable of withstanding significant pressure. By exploring various fiber arrangements and enhancing the fabrication process, we can further unlock the potential strength of these composites and using a readily available resource to create a greener future.

Keywords: Natural fiber; Natural fiber composite; Polyester Resin; Matrix ratio; Flexural strength; Tensile strength; Compression strength.

CMPA-52

Nanostructured Polypyrrole Composite for Solid State Supercapacitor Application

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Abstract: In this work a chitosan-polypyrrole nanotube/molybdenum disulfide (CS-PNTs/MoS_2) nanocomposite has been successfully developed using a simple two-step chemical polymerization and hydrothermal method for flexible supercapacitor applications. This nanocomposite combines the excellent conductivity of MoS_2 and the enhanced pseudocapacitance of polypyrrole, with chitosan improving cyclic stability by preventing MoS_2 aggregation and enhancing surface area. The CS-PNTs/MoS_2 electrode achieved a high specific capacity of 759 C/g and, in a flexible supercapacitor, delivered a power density of 7680 W/kg and energy density of 32.12 Wh/kg. The device retained 91.2 % capacity after 10,000 cycles and maintained 97 % capacity under bending, making it highly flexible and stable for wearable energy storage.

Keywords: Polypyrrole, Molybdenum sulfide, Nanotube, Supercapacitor, Energy density.

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CMPA- 53

Fabrication and Characterization of Z-type Dye-Sensitized Solar Modules for the indoor photovoltaic applications

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Abstract: Dye-Sensitized Solar Cell (DSSC) technology is a photovoltaic technology that mimics natural photosynthesis, categorically coming under third generation photovoltaics. With nearly three decades of development, DSSCs have established a prominent position in the photovoltaic arena owing to its unique merits like roll-to-roll compatibility, cost-effective fabrication techniques using affordable and readily available materials, adaptability to flexible substrates, and higher power conversion efficiency under indoor or artificial lighting compared to conventional first and second generations of solar cells. This work builds an understanding on the DSSC technology from a module perspective, reviewing the progress in manufacturing technologies, outlining its evolution as a potential future candidate in photovoltaic sector and aims to optimize and evaluate the performance of Dye-Sensitized Modules (DSMs) under various indoor lighting conditions. DSMs having a size of 5×5 cm2 and an active area of 13.44 cm2 were fabricated using screen-printing method and they were tested under twelve light intensities for forward and backward illumination using warm white and daylight LEDs. The TiO_2 film thickness was optimized, and the performance metrics, including current-voltage (J-V) characteristics were measured. The study also analyzed series resistance, shunt resistance, open-circuit voltage (VOC), short-circuit current (ISC), fill factor, and efficiency with respect to light intensities. Transmittance and absorbance of the Z907 dye were assessed. The VOC, ISC and efficiency was observed to be the highest when the module was under the day light LED in the forward illumination condition. The optimized DSMs achieved a power conversion efficiency (PCE) of over 6% under daylight LEDs under forward illumination and more than 3% under warm white LEDs. Optimizing the device with better components it could be utilized in several fields such as wireless sensors and devices, low-light environments building-integrated applications etc. While dye-sensitized solar modules have several advantages for indoor applications, including their ability to work in low-light conditions and their design flexibility, they also have some limitations, such as long-term stability and efficiency compared to other types of solar cells. As technology and research continue to advance, DSSCs / DSMs might become even more suitable for indoor photovoltaic applications.

Keywords: DSSC; Dye-Sensitized Modules; indoor photovoltaic applications; power conversion efficiency

CMPA-54

Piezo-Catalytic Degradation of Binary Dyes Mixture Using Aluminium Doped Zinc Oxide (AZO) Nanoparticles

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Abstract: The present work focuses on the degradation of Acid Blue 25 (AB-25) and Methyl Orange (MO) dyes and binary dyes using AZO nanoparticles under piezo-catalytic degradation method. AZO nanoparticles with aluminium dopant with concentration of 3 wt.% is synthesized using sol-gel synthesis method. Structural analysis is done using X-ray diffraction (XRD), bandgap of the nanoparticles is calculated using Tauc's plot and chemical bonds are detected using Fourier transform infrared (FTIR) spectroscopic analysis. Using XRD results the crystallite particle size is found to be 37.30 nm. The bandgap of the AZO nanoparticles is calculated to be 2.7 eV and the maximum absorption wavelength of AB-25 and MO is found to be 600 nm and 464 nm respectively, using UV-vis absorption spectra. The FTIR analysis revealed the presence of Al-O bonds along with Zn-O bonds in the nanoparticles. The piezocatalytic degradation of single dyes and binary dyes is been studied under ultra sonification for 75 minutes with 50 mg AZO loading. Single AB-25 and MO dyes showed 97.86 % and 99.24 % at the rate of 0.040591 min-1 and 0.048757 min-1 respectively. The binary degradation analysis showed the degradation results of AB-25 and MO to be 98.38 % and 99.11 % at the rate of 0.037312 min-1 and 0.045922 min-1 respectively. Figure 1. Absorption spectra of (a) as prepared single and binary dyes and (b) piezo-catalytic degradation of binary dye in 75 minutes with 50 mg AZO loading. Keywords: Piezo-catalysis, Aluminum doped Zinc Oxide, Dye degradation. Acknowledgment: Authors CS and SP acknowledge the support from REVA University for the facilities provided to carry out this research work (RU/R&D/SEED/PHY/2024/08)

CMPA- 55

Optimizing the Synthesis of Bismuth Ferrite Nanoparticles: Effects of Calcination Temperature on Structural Characteristics and Catalytic Activity

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Abstract: Bismuth ferrite (BiFeO3 or BFO) emerges as a promising multiferroic material with substantial potential for applications in addressing environmental challenges through energy efficient devices, sensors for environmental monitoring, photocatalyst, renewable energy application and energy storage devices. This study investigates the effects of controlled calcination on the crystallinity, particle size, morphology and catalytic activity of BFO nanoparticles synthesized via an auto-combustion method and calcinated at 450 °C, 550 °C, and 650 °C. Powder X-ray diffraction (XRD) analysis revealed that crystallinity increased with higher calcination temperatures, while also indicating impurity phases minimal at 550 °C, and more prominent at 650 °C. The crystallite size reached its minimum at 550 °C, measuring 26 nm, compared to 31 nm at 450 °C and 33 nm at 650 °C. These results were further confirmed by particle size measurements obtained from Field Emission Scanning Electron Microscopy (FESEM) analysis. FESEM images also demonstrated the evolution of grain morphology, with non-homogeneous grains at lower temperatures and improved homogeneity at higher temperatures. Energy dispersive spectroscopy (EDS) analysis confirmed that the stoichiometric ratio was optimal at 450 °C, with significant Bi ion volatilization occurring at higher temperatures. All samples were rigorously evaluated for their catalytic performance in reducing 4-nitrophenol (4-NP) to 4-aminophenol (4-AP), a crucial transformation in environmental remediation. Remarkably, the BFO nanoparticles calcined at 550 °C exhibited exceptional catalytic activity, reducing 4-NP to 4-AP within just 8 minutes, vastly outperforming the 25 minutes required by the 450 °C sample and the 15 minutes by the 650 °C sample. The rate constant for the 550 °C sample reached an impressive 0.45076 min^{-1}, further underscoring its superiority. This research not only emphasises the significant impact of calcination temperature on the structural and morphological properties of BFO nanoparticles but also establishes 550 °C as the optimal condition for enhancing catalytic performance. Such advancements in BFO nanoparticle synthesis pave the way for innovative solutions in environmental protection, particularly in the effective remediation of hazardous pollutants, thereby contributing to a sustainable future.

CMPA- 56

Accumulation of A-Emitting ^{210}Pb in Home-Grown Spices in Foothills of Western Ghats in Southern Karnataka

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Abstract: Lead-210, one of the radioactive progenies of ^{238}U, is present in environment and contribute to natural radiation exposure. Plants absorb minerals from the soil through their roots, and these radionuclides are also absorbed together with the minerals. Activity of ^{210}Pb in six different spices, collected from foothills of western ghat region, were determined by radiochemical analysis method. After radiochemical separation, ZnS (Ag) alpha counter was used to calculate activity of ^{210}Pb in the selected samples. The average ^{210}Pb activity concentration in soil of the region was found to be 8.01 ± 0.62 Bq Kg^{-1}. The selected spices samples have the average value of 6.2 ± 0.51 Bq Kg^{-1}. Present study shows a considerable dose contribution from the intake of ^{210}Pb through spices. Even though the levels are within the recommended limits, there is a need of monitoring the lead content in the environment due to its radioactivity and toxicity.

Keywords: Spices; Radioactivity; Lead-210; western ghats; dose

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CMPA-57

Evaluation of Energy Absorption Capacity of Polymer Nano-Composite Damper for Concrete Structures.

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Abstract: Damping plays a crucial role in reducing the destructive effects of seismic events on structures by minimizing vibrations and enhancing stability. This research involves the development of a polymer nano-composite damper designed to absorb critical energy. The study examines the energy absorption characteristics of a novel damper composed of epoxy, rubber powder, and nano-silica, integrated into beam-column junctions under dynamic loading conditions. The primary objective is to quantify the energy absorption capacity and assess the damper's performance in improving the resilience of structural systems subjected to seismic forces. Experimental tests, including compressive strength, flexural strength, and cantilever free vibration tests, were conducted to evaluate the mechanical properties and damping performance. Microstructural analysis was performed using Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Spectroscopy (EDX) to study the damper's internal structure. The results revealed that the damping ratio of the developed polymer nano-composite damper increased by 20%, compared to the standard concrete damping ratio of 5%. Additionally, the compressive and flexural strengths were 30% higher than those of regular concrete specimens. Overall, the findings demonstrate a significant improvement in energy dissipation, with the nano-composite damper effectively reducing dynamic loading effects and thereby enhancing the overall stability of the structure.

Keywords: Damping, Energy absorption, dynamic loading, Cantilever free vibration testing, Microstructural analysis.

CMPA-58

Enhanced Electrical Conductivity and Surface Properties of IZO Thin Films via Ammonium Acetate Treatment for Optoelectronic Device Applications

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Abstract: In this study, the impact of ammonium acetate (AA) treatment on the structural and electrical properties of indium-doped zinc oxide (IZO) thin films were studied for electronic and optoelectronic device applications. IZO thin films were deposited on silicon substrates utilizing a solution-based spin-coating technique in which AA was added to the precursor solution. Further, oxygen plasma treatment was applied on Si-SiO_2 wafers to increase the surface hydrophilicity and uniform film deposition. The hydrophilicity, crystallinity, grain size and electrical conductivity of the AA treated films were compared with untreated films. AA-treated IZO films have shown increased hydrophilicity and decreased contact angles. Plasma treatment has further enhanced this effect. XRD analysis showed improved crystallinity and an increase in crystallite size, indicating uniformity. Atomic force microscopy (AFM) and field-emission scanning electron microscopy (FESEM) measurements has shown rougher surface morphology and larger grain sizes in AA-treated films. This effect can lead to increased electrical conductivity, achieving a conductivity of 7.04 S cm^{-1} compared to the 0.32 S cm^{-1} for untreated films. This is attributed to the suppression of the coffee-ring pattern and decreased surface defects. AA treatment and oxygen plasma treatment offers a viable pathway to achieve high-quality and conductive IZO thin films with increased adhesion properties and reduced defects. Thus, these treatments enhance the AA-treated IZO thin films for applications in optoelectronic devices.

Keywords*:* IZO thin films, transparent conducting oxides (TCOs), ammonium acetate (AA) treatment, oxygen surface plasma treatment, spin coating, optoelectronic devices.

CMPA-59

Assessment of ^{210}Pb Spatial Variability in Soil and Aquatic Vegetation along Udupi's Coastline, Karnataka, India

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Abstract: Lead (^{210}Pb) is a toxic heavy metal that poses significant risks to both ecological and human health. Lead is one of the final radioactive daughters in the ^{238}U series, present in the environment and contributing to natural radiation exposure. Plants absorb minerals from the soil through their roots, including radionuclides such as lead. This study investigates the accumulation of ^{210}Pb in soil and aquatic vegetation in the coastal regions of Udupi, Karnataka, India. Samples were collected from various sites, and ^{210}Pb concentrations were measured determined by radiochemical analysis method. After radiochemical separation, ZnS (Ag) alpha spectrometer was used to calculate activity of ^{210}Pb in the selected samples. The results reveal a spatial variability in ^{210}Pb levels, with higher concentrations observed in urbanized areas compared to more pristine sites. Aquatic plants demonstrated a notable ability to bio accumulate ^{210}Pb, suggesting their potential use as indicators of environmental contamination. The average ^{210}Pb activity concentration in soil of the region was found to be 10.02 ± 0.82 Bq Kg^{-1}. The selected aquatic samples have the average value of 26.2 ± 0.71 Bq Kg^{-1}. The findings underscore the need for monitoring and management strategies to mitigate ^{210}Pb pollution in coastal ecosystems, as well as the importance of public awareness regarding the health implications of heavy metal exposure.

Keywords: Aquatic plant; Lead-210; Radionuclides; Bioaccumulation; Coastal

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CMPA-60

Carbon Nanotube-Supported Vanadium Substituted Phospho-Molybdo Nanohybrid for Supercapacitor Application

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Abstract: Designing efficient energy storage systems is one of society's most complex technical issues as it moves toward renewable energy. Pursuing higher energy and power densities in energy storage devices, particularly those with long cycle life, has prompted the investigation of supercapacitors (SCs) utilizing advanced materials[1]. In this study, we report the synthesis and electrochemical performance of a composite material that incorporates carbon nanotubes (CNTs) and phospho-vanado-molybdate $H_4[PVMo_{11}O_{40}]$ polyoxometalates (POMs)[2]. The CNT-PVMo11 composite material is prepared hydrothermally (at 160°C for 12 hrs), and the resulting complex was studied in SC applications using electrochemical analysis. The cyclic voltammetry of CNTPVMo11 composites shows the capacitive dominant process (b=0.8), and it exhibits 54.12% capacitive behavior at a scan rate of 10 mV/s. The Galvanostatic charge-discharge (GCD) analysis of CNT-PVMo11 hybrid electrode material shows a specific capacitance of 229.35 F/g with energy and power densities of 31.85 Wh/kg and 2000 W/kg, respectively, at 1 A/g current density (Figure 1(a)). The electrode material also showed 90 % capacitance retention after 6000 cycles at 8A/g current density, indicating the material's remarkable stability (Figure 1(b)). The high specific capacitance, excellent energy density, and impressive cycling stability of the hybrid material make it a promising candidate for next-generation supercapacitor electrodes.

Keywords: Carbon nanotube (CNT), Polyoxometalate, Supercapacitor, Energy and power densities.

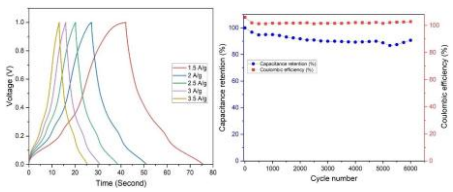

Figure 1: (a) GCD plot and (b) Cyclic stability of CNT-PVMo11 nanohybrid material

CMPA-61

Fabrication and Characterization of NiO/ZnO Heterojunction Photodetectors for UV Sensing

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Abstract: Nickel oxide (NiO), a p-type semiconductor with a wide bandgap [1] , is a promising material for ultraviolet (UV) photodetection due to its strong UV absorption [2] . To enhance the photodetector performance, a NiO/ZnO heterojunction was fabricated using spray pyrolysis [3] . The structural, morphological, optical, and electrical properties of the heterojunction were investigated. The films exhibited good crystallinity and a smooth surface morphology. The optical bandgap of the heterojunction was reduced from 3.35eV to 3.21 eV, widening the light absorption window.Photoluminescence analysis confirmed the formation of ZnO and identified the emission peaks. Electrical characterization revealed a significant photoresponse and an ideality factor close to unity, demonstrating efficient charge carrier separation and transport. These results suggest that the NiO/ZnO heterojunction is a promising candidate for high-performance UV photodetectors [4] .

Keywords: Nickel oxide; Zinc oxide; heterojunction; spray pyrolysis.

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CMPA-62

Enhancing Corrosion Resistance of Iron with Copper Nanoparticle and Polymer Coatings

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Abstract: The purpose of this study is to address the significant issue of corrosion in machinery. Temporary solutions such as paint, oil, and grease provide short-term protection, while long-term durability is achieved by coating iron with corrosion-resistant materials. This research investigates the effectiveness of coating iron strips with copper nanoparticles using the electrodeposition method. To prevent oxidation of the copper nanoparticles, the strips were further coated with polyvinyl alcohol (PVA) via dip coating. The stability of the coatings was evaluated through mechanical testing, atmospheric exposure, and characterization techniques, including scanning electron microscopy (SEM) and electrochemical impedance spectroscopy (EIS). Results demonstrate that the iron strips coated with copper and PVA exhibit corrosion rates reduced compared to uncoated samples. These findings suggest that PVA/copper coatings provide a promising approach to enhancing the lifespan of iron components in various industrial applications.

CMPA-63

In_2O_3 Thin Film Sensors for SO_2 Detection: Influence of Molar Concentration on Sensitivity at Trace Levels

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ABSTRACT

We conducted a study focused on characterization of In_2O_3 thin films synthesized through spin coating technique. Structural studies revealed that In_2O_3 thin film exhibits polycrystalline nature, and most intense peak is along (222) plane. The optical transmittance of In_2O_3 thin films for various concentrations are performed across the spectral range of 300-1100 nm. The films exhibit excellent transparency, in the range of 90 – 95 % The defects of oxygen and Indium vacancies are confirmed by the room temperature PL analysis. Sulphur Dioxide (SO_2) sensing measurements were conducted at enhanced temperature of 250°C. In_2O_3 demonstrated favorable responses of 0.23 and 0.32, respectively, for 3 ppm of SO_2 gas. The enhanced sensing capabilities of the In_2O_3 sensor towards SO_2 gas hold great promise for various gas sensing applications.

Keywords: In_2O_3, Spin Coating, Sensor response, SO_2, Response time.

CMPA-64

Non Enzymatic Electrochemical Detection of Pesticides using Bismuth Ferrite Nanoparticle

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Abstract: Monocrotophos (MCP) belonging to the organophosphorus pesticide group has been widely used in agriculture to protect the crops from weeds and insects. However, its excessive usage has led to acute poisoning in the food by leaving the residues in the fruits and vegetables. Since, these pesticides are highly soluble in water there is a chance for major leaching in water bodies causing pollution in their reservoirs. Initially methods like High performance liquid chromatography (HPLC), gas chromatography, colorimetric techniques etc. have been used which are time consuming and costlier. With the aim of identifying the residual concentrationof MCP, we have developed an enzyme less electrochemical sensor with high sensitivity and selectivity by incorporating Bismuth ferrite (BFO) into the system. Bismuth ferrite samples were successfully prepared using one pot hydrothermal method. Initially to confirm the structure and morphology of the sample; XRD, Micro Raman spectroscopy and High resolution scanning electron spectroscopy (HRSEM) was performed. Further, the asprepared samples were utilized for electrochemical sensing purposes. BFO samples were coated on the FTO (fluorine doped tin oxide) substratesand employed as a working electrode in the three electrode setup. Detection of MCP was verified using Cyclic voltammetry(CV) and differential pulse voltammetry (DPV). Limit of detection was found to be 0.6 mM in room temperature. Highest conductivity of the nanocomposite was proved using impedance spectroscopy (EIS). Under optimum conditions the developed sensor exhibit good selectivity and sensing capability by detecting the highly toxic MCP pesticide. The synthesized nanostructure was found to be non-toxic and environmental friendly thus making them a promising candidate for electrochemical pesticide detection.

Keywords: Bismuth ferrite, electrochemical sensor, pesticide detection, Hydrothermal synthesis.

CMPA-65

Theoretical investigation of interaction of amino acid and functionalized group with graphene nanoribbon – DFT calculation

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Abstract: Graphene nanoribbons (GNR) are one-dimensional planar monolayer strips of graphene having hexagonal honeycomb structure. GNRs are widely used as sensors due to its significant surface to volume ratio, high carrier mobility, unique optical properties, outstanding electrical conductivity and thermal properties. Among the different amino acids glycine drew great attention in research due to its simple, compact structure and its significant biological importance. Several papers have focused on the interaction of amino acids and functionalization group with graphene. However, the theoretical understanding of altered conduction and density of states spectrum towards the enhancement of sensitivity is unclear. So, in order to achieve the aforementioned goal, we have investigated the interaction of graphene nanoribbon with amino acids and different functionalized group at different position of GNR and studied its effect on the electronic properties which serves to be vital for biomedical and sensing applications. Using non-equilibrium Green's function method along with density functional theory, we have computed the electronic properties of GNR before and after adsorption of functionalized group. As a result, when glycine was made to adsorb on the surface and edge of GNR the conductance and sensitivity was found to be more at the surface than edge because at the surface the formation of van der Waal force enhances the conductance of graphene whereas at the edge glycine molecule undergo significant suppression which in turn reduces conductance. For the addition of dopants to GNR we found the following decreasing order of sensitivity: Boron-Nitrogen

CMPA-66

Single Step Fabrication of Flexible PVA/Ag_2S Nanohybrid Films for Nonlinear Optical Applications

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Abstract: The present study deals with the investigation on optical, structural, morphological, and nonlinear optical properties of nanocomposites of polyvinyl alcohol (PVA) and silver sulphide (Ag_2S). Pure PVA and PVA/Ag_2S flexible and free-standing nanocomposite films with various weight percentages (0.5, 1, 3%) of Ag_2S were synthesized utilizing the solution casting approach. The prepared composite films were examined using X-ray diffraction (XRD), Fourier transform infrared (FTIR) spectroscopy, UV-visible spectroscopy, Field emission scanning electron microscopy (FESEM), and z-scan measurements. XRD analysis confirmed the semicrystalline structure of plain PVA and PVA/Ag_2S composites. Upon increasing the concentration of Ag_2S, the crystallinity of PVA has been reduced. FTIR spectra depicted various bands corresponding to the different bonds present in the pure and composite films. The optical properties such as absorption and transmittance as a function of wavelength is investigated. The bandgap of PVA/Ag_2S composite films has reduced from 5.51 eV to 3.11 eV, whereas Urbach energy has increased from 0.506 eV to 0.915 eV with the increase in weight percentage of Ag_2S nanoparticles. The morphological images of the prepared nanocomposite films depicted the uniform distribution of Ag_2S nanoparticles. The z-scan analysis showed the improved nonlinear optical characteristics of PVA upon the addition of Ag_2S nanoparticles. Further, with the increase in weight percentage of Ag_2S nanofiller, the nonlinear absorption coefficient has been increased, while limiting threshold value has been reduced indicating the suitability of flexible PVA/Ag_2S films for the optical power limiting applications.

Keywords: PVA; Ag_2S; z-scan; nonlinear optical properties; limiting threshold

CMPA-67

Analysis of Interface Trap Charges on RF/Analog Performances of Dual-Gate-Source-Drain Schottky FET for High-Frequency Applications

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Abstract: This article mainly focuses on the impact on interface trap charges (ITCs) on dual gate source-drain Schottky barrier tunnel field effect transistor (D-G-S-D-STFET) using a high-k dielectric material. Here the high-k material raises the coupling capacitance between the channel and the gate electrode, therefore increases the charge concentration more than a conventional device because of the additional dual-source region. A higher Ion/Ioff current ratio and a reduced off-state leakage are obtained in the design of D-G-S-D-STFET. Moreover, the comparison of the D-G-S-D-STFET device is made with both the dual-metal gate TFET and conventional STFET. Further, the DC and analog/RF performances are characterized by Silvaco TCAD in terms of transfer characteristics (ID–V_{GS}), cut-off frequency (f_T), transconductance (gm), gain bandwidth product (GBP), transconductance generation factor (TGF), and transconductance frequency product (TFP). Comparatively to the conventional structures at a gate length of 40 nm has been observed that the Cut-off Frequency (f_T) and the TGF are increased in the proposed device to 60 GHz and 259 V^{-1} range respectively with the positive and negative trap charges. Hence, the results verify that the D-G-S-D-STFET is more suitable for high-frequency applications.

Keywords: Trap charges, Schottky barrier, High-k dielectric materials, Tunneling.

CMPA-68

Tailoring Defect Engineering for Third-Order Nonlinear Processes in NiO Thin Films via Microwave Irradiation

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Abstract: Microwave power-induced effects on defect engineering, along with the structural and optical properties of spray-pyrolyzed NiO thin films, were investigated for nonlinear applications. The microstructural analysis confirmed a polycrystalline NiO phase with a face-centered cubic structure, with XRD peak shifts attributed to thermal expansion from MW irradiation. Defect centers were studied through linear optical characterizations, including UV-Vis spectroscopy and photoluminescence. UV-Vis analysis revealed a reduction in bandgap following MW irradiation, indicating defect formation. Gaussian fitting of room-temperature PL spectra showed quenching, suggesting the dominance of nonradiative recombination. The third-order nonlinear optical properties of microwave-irradiated NiO nanostructures were examined using the Z-scan technique, which revealed reverse saturable absorption. An enhanced nonlinear absorption coefficient of 10^{-1} m/W was observed with irradiation, highlighting the potential of these materials for optoelectronic applications.

Keywords: Microwave irradiation, Nonlinear optics, Reverse saturable absorption.

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CMPA- 69

Structural and Electrochemical Insights into Sodium acetate Doped ι-Carrageenan Solid Polymer Electrolytes

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Abstract: This study investigates the structural and electrochemical properties of Sodium acetate doped ι-Carrageenan solid polymer electrolyte (SPE) films prepared using the solution casting method across various salt concentrations. FTIR analysis confirmed complex formation between the metal salt and polymer matrix. The electrochemical stability window of the highest conducting polymer electrolyte was determined via I-V characterization, calculated to be 3.65 V, indicating robust stability for electrochemical applications. I-t characterization assessed the ion transference number, showing 97% ionic conduction, which emphasizes the ionic contribution to the material's electrochemical behavior. Impedance analysis revealed enhanced electrical properties with increasing salt concentration, reaching an optimal limit. The highest ionic conductivity achieved was 1.1×10^{-5} S cm^{-1} at room temperature for the sample with 30wt% salt, marking this SPE as a promising candidate for sodium-ion batteries.

CMPA-70

Kinetics-Controlled Synthesis of AuAg Nanosheets for Enhanced Degradation of Organic Dyes

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Abstract: The development of advanced nanomaterials for environmental remediation has earned significant attention in recent years. This study presents the synthesis of Silver-Gold bimetallic nanosheets (AuAg BNS) through a kinetics-controlled chemical reduction method, followed by comprehensive structural and morphological analysis. These nanosheets exhibited remarkable catalytic efficiency, achieving 100% degradation of Rhodamine B in 13 minutes under ambient conditions using sodium borohydride as a reducing agent. The comparative analysis demonstrated that the catalytic efficiency of the bimetallic nanosheets surpasses that of their monometallic counterparts, revealing the enhanced performance attributed to the synergistic effects of the bimetallic structure. The kinetic analysis further revealed a pseudo-first-order reaction mechanism, highlighting the rapid electron transfer enabled by this unique structure. The findings provide a promising pathway for the generation of multimetallic nanomaterials, potentially extendable to other noble metals and alloys for the design of advanced catalytic materials

CMPA-71

Ag@Ag_2S Decentralized Core-Shell Nanoparticles for Effective Dye Mitigation

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Abstract: The textile industry produces large volumes of hazardous dye wastewater, posing serious risks to environmental and human health. This study investigates the synthesis and catalytic efficiency of Ag@Ag_2S core-shell nanoparticles in degrading p-nitrophenol (p-NP) and rhodamine B dyes. Nanoparticles with an average size of 6 nm were successfully synthesized using a chemical reduction method. Structural and morphological analyses confirmed the formation of a core-shell structure with Ag as the core and Ag_2S as the shell. These nanoparticles demonstrated exceptional catalytic activity, achieving 67.73% degradation of pNP within 24 minutes and 93.8% degradation of rhodamine B in just 18 minutes. Their enhanced catalytic performance is attributed to their smaller size, spherical shape, and high surface area-to-volume ratio, facilitating more effective adsorption and electron transfer during dye degradation. The synthesis approach is cost-effective and highly robust, offering a powerful solution for producing efficient catalysts in environmental remediation efforts

CMPA-72

Numerical Investigation of Dielectric Enhancement in PDMS-Barium Titanate Composites for Improved Capacitance and Energy Storage

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Abstract: In the present scenario, sensors and actuators are gaining significant attention due to their relevance in current technological advancements, particularly within the context of the Industry 4.0 revolution. The crucial materials used in these actuators and sensors possess a property known as dielectric permittivity. To enhance the dielectric permittivity of materials, there is a growing trend to improve this property by synthesizing composite materials using polymers as the base material and incorporating high dielectric constant ceramic materials as fillers. Predicting the effective dielectric properties of such composite materials is a challenging task. In this research, an effort was made to investigate the effective dielectric properties of a Polydimethylsiloxane (PDMS)- based composite material with Barium Titanate (BT) as the filler material. A 2D model was developed to analyze the composite material, using standard analytical equations to determine the appropriate filler concentration. The filler concentration was varied from pure 5 to 20%, and the capacitance offered by the composite was evaluated. Additionally, the electrical behavior of the material was examined when a potential was applied to the composite. The results indicate that the effective dielectric permittivity increases with the filler concentration, thereby enhancing the capacitance of the composite material. Specifically, the capacitance values showed an improvement of 59.3% at 20% filler. This demonstrates the positive impact of incorporating Barium Titanate as a filler in the PDMS matrix on the dielectric properties of the composite material. Hence, the current study is useful for investigating similar properties in other polymer-ceramic-based composite dielectric materials.

Keywords: Composite material; Dielectrics; Capacitance; Permittivity; FE analysis

CMPA-73

Efficient 4-NP Mitigation Adapting Eco-Conscious Ag-Ag_2S Nanoparticles

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Abstract: Dye-contaminated wastewater poses significant risks to human health and the environment. This study explores the synthesis and catalytic efficiency of Ag-Ag_2S alloy NPs to reduce 4-nitrophenol dye. We compare green synthesis methods with traditional chemical synthesis techniques. Structural and morphological analyses confirmed the presence of Ag-Ag_2S phases in both methods. Nanoparticles synthesized via green methods have an average size of 5.6 nm. In contrast, chemically synthesized nanoparticles have an average size of 23.5 nm. Green-synthesized Ag-Ag_2S NPs demonstrated superior catalytic performance. They achieved an 83.22% reduction efficiency within 15 minutes. Chemically synthesized NPs achieved a 54.6% reduction efficiency in 21 minutes. Notably, green-synthesized NPs reduced the dye in just 6 minutes after centrifugation. The enhanced efficiency of green-synthesized nanoparticles is attributed to their smaller size, spherical shape, and higher surface area-to-volume ratio. These characteristics promote better adsorption and electron transfer during dye reduction. Additionally, green-synthesized NPs are easier to separate due to the use of low-reducing capping agents. The green synthesis method is cost-effective, environmentally friendly, and robust. It presents a promising approach for producing efficient catalysts for environmental remediation.

CMPA-74

Metal Sulfide-Modified F-MWCNTs Nanofluids: Boosting Heat Transfer Efficiency

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Abstract: Heating is a common issue faced by automobiles owing to the motion of working parts. The excess heat generated will be removed using a liquid circulation system. Conventional fluids used in liquid circulation system reached their limit in removing heat. Hence, nanomaterials are dispersed in conventional fluids to obtain a new class of fluids called nanofluids. Here, silver and silver sulfide (Ag-Ag_2S) alloy nanoparticles were decorated on the surface of functionalized multi-walled carbon nanotubes (F-MWCNTs) to prepare nanohybrid. The nanohybrid was confirmed by various spectroscopic and microscopic techniques. The synthesized nanohybrid was dispersed in milli Q water to prepare nanofluids (0.2, 0.5, 1, and 2 v/v). The nanofluid's stability was tested by the zeta potential and visual inspection. The thermophysical properties of the sample were tested by measuring the viscosity and thermal conductivity (TC). The sample yielded about 102.6% and 262% enhancement in TC value at room temperature and at 50 ℃ for 1 v/v concentration nanofluids, respectively. The enhancement demonstrates the suitability of the nanofluid for heat transfer applications.

Keywords: Ag-Ag_2S; F-MWCNTs; Decoration; Nanohybrid; Thermophysical properties

CMPA-75

Enhancing the Photocatalytic Activity of ZnO/RGO Composite Thin Films via Photo Annealing

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Abstract: This work emphasizes on comparative analysis between photo and thermal annealing of ZnO/RGO thin films prepared by the sol-gel-based spin coating method. Structural, morphological, and elemental analysis confirm the successful integration of ZnO with RGO. Both films display nearly identical optical and photoluminescence properties, but the UV-based annealed sample showcased superior qualities. A higher degradation rate (89.03%) than a thermal annealed sample (84.93%) is observed. The pH effect is also studied on dye degradation from which we obtained 99.14% for base medium. Increasing the temperature up to 50 ℃ enhances the dye degradation rate with ZnO/RGO UV by 7.75%. These findings imply that annealing ZnO/RGO films with UV light can notably enhance their performance by maintaining similar properties as thermally annealed samples.

Keywords: UV Irradiation, Nanocomposite, Wastewater Treatment

CMPA-76

Colocasia esculenta-Derived AgCo Nanoparticles: Eco-Friendly Catalysts for Dye Reduction

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Abstract: Silver-cobalt bimetallic nanoparticles (AgCo BNPs) are synthesized via a green approach using *Colocasia esculenta* plant extract as a bioreducing and stabilizing agent. The formation and bimetallic nature of AgCo BNPs are confirmed using scanning electron microscopy (SEM), X-ray diffraction (XRD), and transmission electron microscopy (TEM). Catalytic performance studies reveal that AgCo BNPs exhibit superior efficiency in reducing environmental pollutants such as p-nitrophenol and rhodamine B, as well as mixed dye systems, under ambient conditions. Comparative assessments with monometallic Ag and Co nanoparticles indicate that AgCo BNPs possess enhanced catalytic efficiency, achieving high degradation rates within minutes. The results emphasize the potential of green-synthesized AgCo BNPs for sustainable applications in catalysis and environmental remediation, showcasing the dual benefits of eco-friendly synthesis and high catalytic activity in treating complex dye mixtures. This study advocates for further exploration of bimetallic nanomaterials in catalysis and green chemistry applications.

Keywords: Bimetallic; Catalytic Activity; Organic dye, P-nitrophenol

CMPA-77

Effect of N_2 Ratio on Sputtered Copper Nitride Thin Films for Thermoelectric Application.

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Abstract: Sustainable development of goals of goal 7 ensures the access to reliable, affordable, and clean energy for all people. according to recent reports only 17% of SDGs target is achieved but half of that indicating moderate progress. To reach universal access to electrical energy by 2030, we need to improve renewable energy production and enhancement in energy efficiencies. thermoelectricity is one of the renewable energies used to produce green energy, it is essential to enhance the efficiency of this application. This study investigates the role of nitrogen in Cu_3N thin films fabricated through DC magnetron sputtering, focusing on their structural and electrical properties. Copper nitride thin films deposited on Glass with different (Ar/N_2) concentration of N_2 is 50%, 57%, 62%, 66%, 75%. The nitrogen content in Cu_3N thin films significantly influences their structural characteristics, such as crystallographic phase, crystallite size, and surface morphology. Through systematic analysis, including X-ray diffraction (XRD) exhibits (111) Plane at lower nitrogen concentration and (100) Plane at higher nitrogen concentration which evidently shows Anti- Reo_3 crystal structure and scanning electron microscopy (SEM) shows triangular pyramid like structure of Cu_3N thin films with varying nitrogen concentration. Moreover, the electrical properties of these films, conductivity, and carrier concentration, mobility are thoroughly examined using Hall measurements. This research contributes to a deeper understanding of the nitrogen-induced modifications in Cu_3N thin films, offering insights into optimizing their structural and electrical properties which is suitable for thermoelectric applications.

Keywords: Cu_3N thin films, DC sputtering, structural properties, thermoelectric applications

CMPA-78

Impact of Gamma Radiation on Structural and Photonic Properties of Tungsten-Doped Indium Oxide Thin Films for Dosimetric applications

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Abstract: Tungsten doped indium oxide (IWO) thin film were deposited on glass substrate using spray pyrolysis and the film thus obtained are irradiated with gamma radiation of doses 25 Gy, 50 Gy, 100 Gy and 200 Gy. Structural properties were studied using XRD and Raman spectroscopy. According to XRD analysis, the films showed a single-phase and polycrystalline cubic structure with (400) preferred orientation. The cubic crystalline structure of the deposits is further supported by the Raman measurement. The dominant process of defect generation is responsible for the rise in the photoluminescence peak intensities following gamma exposure. The TL curve indicates the suitability of IWO for dosimeters. The elements contained in the sample are identified using XPS. The oxygen vacancies produced during gamma exposure determine the structural, optical, and electrical characteristics.

Keywords: W doped Indium oxide; Thin film; Spray pyrolysis, Gamma dosimetry

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CMPA-79

MPA Capped ZnSe Quantum Dots Embedded in Methyl Cellulose Polymer for Enhanced UV Photodetectors

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Abstract: The study demonstrates successful dispersion of hydrothermally synthesized MPA-capped ZnSe quantum dots (QDs) into a methyl cellulose (MC) matrix via a solution casting technique. Comprehensive characterization of the resulting polymer nanocomposite (PNC) filmswere carried out for optical, structural, and elemental analyses. UV-Vis absorbance spectra revealed that the PNCs are transparent in the visible spectrum while exhibiting enhanced absorbance below 400 nm due to the introduction of new energy levels within the bandgap of the ZnSe QDs. Emission spectra showed prominent band-edge emission at 415 nm and defect-related emission at 470 nm, with intensity enhancement correlating with higher ZnSe concentrations. The PNC demonstrated effective wavelength conversion from UV to visible light, as confirmed by both UV-Vis and fluorescence spectroscopy. XRD patterns confirmed the preservation of the structural integrity of both ZnSe QDs and the MC matrix, while XPS provided insights into the successful integration of ZnSe QDs, revealing the oxidation states of the constituent elements. Photon-enhancing properties of the PNCs were further evaluated under various UV wavelengths, with 0.4 wt% ZnSe concentration showing the most significant enhancement, attributed to its optimal surface-to-volume ratio. These combined effects of photo-enhancement and wavelength conversion highlight the potential of these PNCs for applications in short-wavelength detection technologies.

Keywords: ZnSe QDs; MC; Wavelength Conversion material; Photo-enhancement

CMPA-80

Investigations on effect of rGO on Optoelectrical Properties of pure and Al doped ZnO thin films

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Abstract: In this work, pure and Al doped ZnO thin films and their composite with reduced graphene oxide (rGO) are prepared by sol-gel spin-coating technique. The combined effects of dopant and rGO on the structural, morphological, optical, and electrical properties of ZnO based composite films were investigated. XRD results of the nanocomposite thin films showed the polycrystalline nature of the films with a hexagonal (wurtzite) crystal structure and a preferred orientation along c-axis, consistent with pure ZnO [1]. Optical bandgap and %Transmittance (>90%) of the prepared samples was estimated by ultraviolet–visible (UV–Vis) absorption spectroscopy. The presence of D and G band peaks in Raman spectra, as well as their intensity ratio verifies the integration of rGO into ZnO to yield a nanocomposite thin film [2]. The crystallite size estimated using intensity ratio in Raman are in consistent with the XRD data. Fourier transform infrared spectroscopy (FTIR) shows a decrement in the peak of composites due to deoxygenation during reduction and minor shift in the peak, implying interaction between ZnO and functional groups of rGO [3]. I-V study revealed decrease in resistivity of nanocomposites with the addition of rGO. The obtained results reveal the possibility of using the prepared AZO-rGO nanocomposite thin films for transparent conducting electrodes in optoelectronic devices.

Keywords: Metal oxides; Doping; Reduced graphene oxide; Nanocomposites

CMPA-81

Factors Influencing the Hydrothermal Synthesis of $SrTiO_3$ Nanoparticles

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Abstract: $SrTiO_3$ nanoparticles are quite popular due to their exceptional electrical, optical and catalytic properties. There are many methods to synthesize these nanoparticles and one among them is the hydrothermal/solvothermal method. They have the capability to produce high quality crystalline materials and by adjusting the parameters like temperature, pressure, solvent type and reaction time the morphology and phase of the material can be changed. In this work, various factors influencing the hydrothermal synthesis of SrTiO3 nanoparticles have been discussed. The stoichiometric ratios of precursors, pH of the resulting solution of the precursors, temperature, reaction duration, dispersion methods and post synthesis treatment of the nanoparticles have been discussed. It offers comprehensive information regarding how the material properties changed and influenced the formation of SrTiO3 nanoparticles. A major issue that was observed was that of the unreacted anatase or TiO2 in the X-ray Diffraction (XRD) peaks. The requirement of alkaline environment for the reaction and proper dispersion of TiO2 and its influence in the formation of SrTiO3 nanoparticles have been discussed. Post synthesis calcination also worked in favor of its formation and removal of the unreacted TiO2. The SrTiO3 nanoparticles are being synthesized to be used in the photocatalysis of dyes. The inherent property of SrTiO3 is its wide bandgap. Its light absorption capabilities for photocatalysis can be improved through doping through its A-site or B-site material.

Keywords: perovskite, photocatalysis, temperature, hydrothermal synthesis

CMPA-82

Synthesis and Characterization of Ni-Zno Nanocomposite for CO_2 Gas Sensing Applications

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Abstract: This study reports the successful synthesis of a Ni-ZnO nanocomposite via the sol-gel technique, designed to investigate its structural, optical, and CO_2 gas-sensing properties. The composite was characterized through various analytical methods [1]. UV-Vis spectral analysis revealed a band gap of 3.572 eV, highlighting its potential in optoelectronic applications. FTIR spectroscopy identified functional groups such as O-H, N-H, COO-, and C-O, verifying the successful integration of organic compounds [2]. X-ray diffraction (XRD) analysis indicated a crystalline structure with defined phases, an average particle size of 29.041 nm, and an interplanar spacing of 1.82 Å [3].The gas-sensing performance of the Ni-ZnO composite was evaluated by I-V measurements, showing a decrease in electrical resistance with increasing CO_2 concentration, demonstrating its suitability as a CO_2 sensor. Sensitivity tests at room temperature within a CO_2 concentration range of 700–5000 ppm revealed high sensitivity, especially at lower concentrations (704 ppm), with decreased sensitivity at higher concentrations (5000 ppm)[4]. This suggests that the composite is highly effective for detecting low CO_2 levels, ideal for applications in indoor air quality monitoring. The Ni-ZnO nanocomposite's promising gas-sensing properties are attributed to its unique junction characteristics, which enhance charge transfer and response [4]. These results indicate the composite's potential for commercial CO_2 sensor applications, offering high sensitivity, reliable performance, and practical utility for real-time environmental monitoring.

Keywords: Nanomaterials; Nanocomposites; Sol-gel method;CO_2 gas sensor; Sensitivity;

CMPA-83

Synthesis and characterisation of CMC/PEG-ZnO/CuO polymer nanocomposite for energy storage applications

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Abstract: In this work, polyethylene glycol (PEG), carboxymethyl cellulose (CMC) and ZnO/CuO polymeric nanocomposites were synthesized. The polymeric mixture was doped with ZnO/CuO for different concentrations (0.0, 0.3, 2, and 6 wt%) by the sol-gel method. The resulting products are characterized by X-ray powder diffraction (XRD), UV analysis, Fourier transform IR spectroscopy (FTIR), Electrical properties by impedance spectroscopy (EIS) [1]. The direct energy band gap for polymeric mixture and different wt% of ZC, the value of energy band gap observed from 5.61 to 5.52 eV. On increasing the wt% of ZC the transition takes place at above the conduction band (for 0.3,2%), on further increasing the wt% of ZC (6) transition occurs below the conduction band. The indirect energy band gap for polymeric mixture and several wt% of ZC, the value of energy band gap observed from 4.70 to 3.69 eV [2]. On increasing the wt% of ZC corresponding energy band gap decreases and several energy levels occurs below the conduction band [3], [4]. The phase, purity and crystal structure of the synthesized materials were analysed from the X-Ray Diffraction analysis. The grain size of CMC/PEG + ZC (6%) shows sharp peak with high intensity indicated the crystalline nature of samples. due to the particle diameter >10nm.The effect of complexing agents on precursors used to synthesize ZC (0, 2, 6) nanocomposite was recorded at room temperature by using Brucker Alpha II (80 ATR) Spectrometer in the range between 4000 Cm-1 to 500 Cm-1. The - O–H in-plane bending and C–O Stretching (coupled) of CMC/PEG + ZC (2%) occurs in the range of 1406 Cm-1, the peak at 1180 Cm-1 consist of C–O Stretching and the peak obtained at lower wavenumber 736.9 Cm-1 assigned for C–H out of plane bending. Electrical measurements were performed using precision impedance analyser in the frequency range of 20Hz to 5 MHz at room temperature to investigate the electrical properties of the samples. In the addition of ZnO/CuO nanoparticles enhances the conductivity of the CMC/PEG matrix, with 2 wt% providing the most significant improvement.

Keywords: Nanoparticles, Polyvinyl alcohol, carboxymethyl cellulose (CMC), Electrical Properties, Energy storage, Nanocomposite

CMPA-84

Tailoring Structural, Elastic, and Phonon Properties of AlN through Sc-Doping: A Combinatorial Approach

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Abstract: Aluminium nitride (AlN) is a promising piezoelectric material having a moderate piezo response as compared to other piezoelectric materials; it can be enhanced by doping or alloying. Sc alloying increases the piezo response of AlN up to four-fold through elastic softening; it also increases the electromechanical coupling coefficient, which is a prominent figure of merit for any MEMS device application. In this work, we have employed the first principles approach to study the structural, elastic and phonon dispersion of AlN and AlScN, along with the deposition by magnetron sputtering. The XRD and Raman characterization confirms the presence of preferential crystallographic orientation (002) plane in Sc doped films c-axis planes shifted to lower 2 theta values and out of eight active phonon modes of AlN we can observe six active phonon frequencies confirming the wurtzite phase of the grown thin films. A1(LO) and B1(high) modes have shifted towards lower frequencies in Sc doped AlN thin films. Similar results were obtained from DFT agree with the experimentally observed values and account for elastic and phonon softening; hence, the deposited films can be used for better piezoelectric energy harvester device applications.

Keywords: AlN; Piezoelectricity; MEMS; Magnetron Sputtering; DFT

CMPA-85

Synthesis and Characterization of Ni-ZnO Nanocomposite for Humidity Sensing Applications

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Abstract: This study reports the successful synthesis of a Ni-ZnO nanocomposite via the sol-gel technique, designed to investigate its structural, optical, and humidity-sensing properties. The composite was characterized through various analytical methods[1]. UV-Vis spectral analysis revealed a band gap of 3.572 eV, highlighting its potential in optoelectronic applications. FTIR spectroscopy identified functional groups such as O-H, N-H, COO-, and C-O, verifying the successful integration of organic compounds. X-ray diffraction (XRD) analysis indicated a crystalline structure with defined phases, an average particle size of 29.041 nm, and an interplanar spacing of 1.82 Å. The Humidity-sensing performance of the Ni-ZnO composite was evaluated by I-V measurements, showing a decrease in electrical resistance with increasing % of relative humidity demonstrating its suitability as a humidity sensor[2]. Sensitivity tests at room temperature within a % of relative humidity range of 40-99% revealed high sensitivity, especially at lower relative humidity (40%), with decreased sensitivity at higher %of relative humidity (99%)[3]. This suggests that the composite is highly effective for detecting low relative humidity levels, ideal for applications in indoor air quality monitoring[4]. The Ni-ZnO nanocomposite's promising humidity-sensing properties are attributed to its unique junction characteristics, which enhance charge transfer and response. These results indicate the composite's potential for commercial relative humidity sensor applications, offering high sensitivity, reliable performance, and practical utility for real-time environmental monitoring.

Keywords: Nanomaterials; Nanocomposites; Sol-gel method; Humidity sensor; Sensitivity

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CMPA-86

Photoluminescence Investigation of Zn^{2+}-Doped MgO Nanoparticles Obtained via the Green Synthesis Route.

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Abstract: The present research discloses the photoluminescence characteristics of Zn-doped MgO nanoparticles. Wherein, samples of Zn_XMgO_{1-X} (X = 0, 0.25, 0.5, and 0.75) are synthesized via the green synthesis route by using lemon juice as a fuel. The structural analysis is carried out by using powder XRD and the data is subjected to Rietveld refinement. The results reveal that pristine MgO has a single phase of F m -3 m (225) space group and a secondary phase of P 63 m c (186) space group in the Zn^{2+}-doped samples. The volume of the unit cell shrinks linearly with Zn^{2+} concentration due to a linear decrease in the lattice constant. The lattice stain value exists in the range 0.5-0.14 (%), and the crystallite size varies from 16.4 nm to 41.1 nm. The scanning electron microscope (SEM) micrographs confirm the spherical morphology of the particles and energy dispersive spectroscopy (EDS) will confirm the stoichiometry in the samples. The FTIR spectra of the samples determine the presence of all functional groups in the samples. The UV-DRS characterization infers the bandgap decreases with an increase in the concentration of Zn^{2+} ions. The photoluminescence investigation reveals the excitation peaks will absorb at 270 nm, showing good agreement in the luminescence behaviour. The obtained results will reveal that the synthesized nanoparticles are the most promising materials for UV filters.

Keywords: Zn doped MgO; Powder XRD; SEM; Bandgap; Photoluminescence.

CMPA-87

Studies on the Effects of Relative Concentrations of PVDF and PEO on the Structural, Thermal and Tensile Properties of PMMA/PVDF/PEO Ternary Polymer Blend

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Abstract: In this work, we report the preparation of PMMA/PVDF/PEO ternary polymer blends of compositions 40:50:10, 40:40:20, 40:30:30, 40:20:40 by using the conventional solution casting technique. The objective is to analyze the effects of the relative concentrations of PVDF and PEO on the properties of ternary polymer blend keeping PMMA concentration constant. The blends have been characterized by using the techniques X-ray diffraction (XRD), Fourier Transform Infrared (FTIR), Differential Scanning Calorimetry (DSC), and Universal Testing Machine (UTM). XRD patterns allowed us to quantify the variation of crystallinity index of the blend with the addition of PEO. FTIR results were used to assess the presence of the vibrational bonds corresponding to the functional group/s of individual polymers and the blend. The blend containing 40 wt% PEO exhibited better thermal stability compared to the other blend samples as indicated by its elevated glass transition temperature (T_g) and melting temperature (T_m) obtained from DSC measurements. UTM studies revealed that the fracture strain of the samples is nearly constant up to 30 wt% PEO concentration, but increases sharply for 40 wt% PEO. Among the samples prepared, the Young's modulus was found to be maximum (3717.436 MPa) for the composition 40:40:20 wt% and least (2502.165 Mpa) for 40:30:30 wt% polymer film.

Keywords: Crystallinity, Vibrational bonds, Glass transition temperature, Young's modulus.

CMPA-88

Copper doped Nickel Zinc Nanoferrites by Solution Combustion Method: Structural and Antibacterial Properties

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Abstract: The copper doped nickel zinc nanoferrites $Ni_{0.45}Zn_{0.55-x}Cu_xFe_2O_4$ where x = 0.0, 0.1, 0.2 and 0.3 were synthesized using Solution Combustion method. The obtained nanoferrites were checked using XRD and the formation of single crystalline cubic spinel structure was confirmed. The transmission electron microscope (TEM) is an ideal apparatus for the structural characterization of nanoparticles and it was utilized to study the morphological properties. The particle size of nickel zinc nanoferrites was found to be around 14 nm. Also, the synthesized nanoferrites were studied using Kirby–Bauer disk diffusion test to learn the biological properties. Among the procured nanoferrites, $Ni_{0.45}Zn_{0.45}Cu_{0.1}Fe_2O_4$ showed maximum antibacterial activity.

Keywords: Solution Combustion method; nanoferrites; Kirby–Bauer disk diffusion test

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CMPA-89

Investigation of Hexamanganite Thin-Films for Their Suitability in Photovoltaics.

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Abstract: Ferroelectric-photovoltaics have recently attracted attention as a candidate class of materials for use in Photovoltaic devices. But these ferroelectric-photovoltaic materials suffer from their low photocurrents due to their wide bandgap. To overcome this challenge hexamanganites can be used to achieve high photovoltaic efficiency as it has a small band gap. So, in our present work, hexagonal rare earth manganite $YMnO_3$, $ErMnO_3$, and $YbMnO_3$ thin films are synthesized by the Spray Pyrolysis technique. XRD analysis confirmed that the prepared samples are in single phase, crystallizing in hexagonal structure and belonging to the space group $P6_3cm$. The microstructure and grain morphology of the prepared samples are analyzed by SEM technique. The band gap of the prepared thin film samples is inspected by applying UV Visible Spectroscopy. The I-V characteristics of the samples are studied to check their electrical behavior at the nano level. The charge carrier type, carrier concentration, Hall mobility, and resistivity of the samples are determined by Hall effect measurement. The maximum photoresponse was exhibited in the visible region for $YMno_3$ and $ErMnO_3$ films and in the near IR region for $YbMnO_3$ films. This research illuminates the exploration of stable oxide semiconductors with a small band gap for suitability in futuristic solar cells.

Keywords: Photovoltaic efficiency; Spray Pyrolysis; carrier concentration; band-gap.

CMPA-90

Synthesis and Microstructural Investigations in Co-Doped Lanthanum Zirconate

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Abstract: One of the chief domains where ceramic materials are critical is state of the art high-temperature applications such as thermal barrier coatings for jet engine and gas turbines. This is due to their superior thermal stability, low thermal conductivity, and chemical compatibility with the base alloys. As industries such as aerospace and nuclear technologies push the limits of operational temperature, advanced materials with superior thermal properties are in demand. Rare-earth zirconates, especially lanthanum zirconate ($La_2Zr_2O_7$), stand out for TBCs, offering a high melting point, strong thermal stability, and low thermal conductivity, making it a prime candidate. Despite these promising aspects, $La_2Zr_2O_7$ still encounters challenges such as low coefficient of thermal expansion (CTE) and poor mechanical toughness [1]. To address these issues, microstructure tailoring of these materials, through co-doping the A and B sites is found to be an effective strategy which needs extensive experimentation [2]. Considering this, the current study investigates the structural characteristics of Gd^{3+} and Ce^{4+} co-doped $La_{2-x}Zr_{2-y}O_7$; (x: Gd^{3+} , y: Ce^{4+}) synthesized by chemical coprecipitation method. The effects of annealing temperature on the microstructure of co-doped $La_2Zr_2O_7$ were analyzed using X-Ray diffraction and Raman spectroscopic techniques to understand the phase evolution. The variant with a chemistry $(La_{0.9}Gd_{0.1})_2(Zr_{0.9}Ce_{0.1})_2O_7$ tends to form a ordered pyrochlore structure at high temperature, while $(La_{0.1}Gd_{0.9})_2(Zr_{0.9}Ce_{0.1})_2O_7$ stabilizes in a defect fluorite structure, resembling $Gd_2Zr_2O_7$. Both compositions show high structural stability, making them potential candidates for high-temperature applications. Further in-depth analysis and insights from our extensive investigation will be discussed during the conference.

Keywords: Thermal barrier coating; Rare earth zirconates; microstructure.

CMPA-91

Synthesis and Characterization of rGO/ZnO Electrodes using *Psidium Guajava* Fruit Extract: Its Electrical and Optical Properties.

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Abstract: The environmental friendly method of reducing Graphene oxide (GO) using plant extracts has garnered increased interest among researchers due to its low cost, non-toxic and simplicity. In the present study, a modified Hummer's method was used to produce GO. Psidium Guajava (Guava) fruit extract was employed in the reduction of prepared GO. The Zinc Oxide (ZnO) nanoparticles (NP's) were synthesized by solution combustion method using the same green fuel. Then GO/ZnO nanocomposite (NC) were prepared by Sonochemical method. The resultant rGO and rGO/ZnO NCs were prepared into electrodes using Doctor Blade Technique. Further, the samples were subjected to characterizations. The XRD characterization gives the structural confirmation of rGO, ZnO and rGO/ZnO NC and using Scherrer's equation the average crystalline size of NC was calculated and found to be 15 nm. Raman spectroscopy validated the hybridization of NC. The optical study was conducted using UV-VIS Spectroscopy, and the band gap of ZnO, rGO and rGO/ZnO was determined to be 3.1 eV, 2.92 eV and 2.99 eV respectively. Utilizing energy-dispersive X-ray spectroscopy (EDX), the elemental compositions was identified. Scanning electron microscopy (SEM) was employed for the morphological investigation. Using Stylus profilometry studies the thickness and roughness of the electrodes were measured. The electrical conductivity measurements of rGO and rGO/ZnO electrodes were performed using the two-probe method. The results revealed that the electrical conductivity was in the range of 10^{-7} S/cm.

Keywords: Reduced Graphene Oxide, Zinc Oxide, Nanoparticles, Nanocomposites, Electrodes.

CMPA- 92

A Simple Sonochemical Approach to Synthesize rGO/CuO Nanocomposite for Methylene Blue Dye Degradation

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Abstract: In this work, Averrhoa Bilimbi (A. Bilimbi) fruit extract was used as a green reducing agent in the conversion of graphene oxide (GO) to reduced graphene oxide (rGO) and as a green fuel in the sol-gel combustion synthesis of copper oxide (CuO) nanoparticles (NPs). Additionally, a simple sonochemical approach was employed to synthesize rGO/CuO nanocomposite (NC). Furthermore, X-ray diffraction study (XRD), Fourier transform infrared spectroscopy (FTIR), Field emission scanning electron microscopy (FESEM) with Energy dispersive spectroscopy (EDS) and UV-Vis absorption spectroscopy were used for structural, morphological and optical characterizations of the prepared samples. Photocatalytic activity of the CuO and rGO/CuO NC were performed under UV light irradiation for the photodegradation of an organic dye - Methylene blue (MB dye). From XRD, the average crystallite size of CuO NPs and rGO/CuO NC were estimated to be 28.72 nm and 27.23 nm respectively. Morphology analysis of rGO/CuO NC exhibited the formation of relatively agglomerated and spherical-shaped CuO NPs that are uniformly decorated on the surface of the rGO. From the Tauc's plot, the optical energy band gap of rGO/CuO NC was found to be 2.26 eV. The photocatalytic study revealed that CuO was able to degrade 31% and rGO/CuO NC was able to degrade 82% of the 5 ppm MB dye in 90 minutes under UV light irradiation. Photolysis of 5 ppm MB dye in the presence of UV light demonstrated a degradation of about 4%. From the above information, we can conclude that rGO/CuO NC can be efficiently used as a photocatalyst.

Keywords: Copper oxide NPs; rGO/CuO NC; Bilimbi fruit extract; Methylene blue dye

CMPA- 93

Averrhoa Bilimbi Fruit Extract Facilitated Synthesis of rGO/Co_3O_4 Nanocomposite for Methylene Blue Dye Degradation

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Abstract: In this work, we have synthesized cobalt oxide (Co_3O_4) nanoparticles (NPs) via the sol-gel combustion method using Averrhoa Bilimbi (A. Bilimbi) fruit extract as a green fuel. Additionally, graphene oxide (GO) prepared from the modified Hummers method was reduced using A. Bilimbi fruit extract. Furthermore, a simple sonochemical method was employed to synthesize rGO/Co_3O_4 nanocomposite (NC). The samples prepared were analyzed using various characterization techniques. From X-ray diffraction studies (XRD), the average crystallite size of the pure Co_3O_4 and rGO/Co_3O_4 were found to be 25.70 nm and 24.56 nm, respectively. Surface morphology images using FESEM confirmed the decoration of Co_3O_4 NPs on the rGO structure. UV-Vis absorption spectra analysis using Tauc plot revealed the optical energy band gap value for Co_3O_4 NPs and rGO/Co_3O_4 NC which were found to be 2.17 eV and 1.87 eV respectively. A photocatalytic activity was performed to study the degradation of MB dye under UV light illumination. The study revealed that pure Co_3O_4 NPs could degrade only 38% of the 5 ppm MB dye, whereas rGO/Co_3O_4 NC could degrade 76.32% of the dye in 90 minutes of exposure to UV light. Overall, the work highlighted the use of rGO/Co_3O_4 NC as a photocatalyst in the degradation of an organic dye.

Keywords: Sonochemical method; Cobalt oxide NPs; rGO/Co_3O_4 NC; Bilimbi fruit extract

CMPA-94

Antibacterial Activity of Spherical Porous Gold Nanoparticles Aga Certain Pathogenic Bacteria

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Abstract: The kinetically controlled synthesis of porous metal nanostructures is crucial for their antibacterial properties due to their large surface area, and high porosity. In this work, porous gold nanoparticles with spherical shapes were synthesized by transmetallation reaction, and their interaction with *Escherichia coli* and *Staphylococcus aureus* was studied. The formation of porous gold nanostructures was carried out using silver nanoparticles as sacrificial templates and $HAuCl_4$ as the precursor, with an eggshell membrane as the support at room temperature. The morphology and structure of the nanoparticles were characterized using transmission electron microscopy (TEM), UV-visible spectroscopy, and X-ray diffraction (XRD). The TEM results indicated that spherical porous gold nanoparticles were obtained with average particle sizes of 13.97 nm. The antibacterial study revealed that prepared nanoparticles showed pronounced dose-dependent antibacterial effects against different human pathogenic bacteria including both gram-positive and gram-negative strains. Among these, the porous gold nanoparticles showed the best antibacterial activity against *Staphylococcus aureus*, with an inhibition zone diameter of 14 ± 0.1 mm. When comparing the minimum inhibitory concentration of both strains *S. aureus* shows significant inhibition at 1 μg/mL, whereas *E. coli* requires a higher concentration of 5 μg/mL to achieve comparable levels of inhibition. These findings suggest that porous gold nanoparticles are a promising tool for antibacterial treatments.

CMPA-95

Seed-mediated formation of core-shell AuAg bimetallic nanoparticles for antibacterial applications

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Abstract: Traditional antimicrobial agents have shown limited efficacy against resistant bacterial strains, necessitating the development of more powerful alternatives. In this context, bimetallic nanoparticles, which combine two distinct metals, have shown significant potential as antimicrobial agents. Gold-silver nanoparticles (Au-Ag NPs) are particularly promising due to their low toxicity towards human cells, a trait that makes them suitable candidates for antimicrobial applications. Therefore, this study aimed to chemically synthesize core-shell Au–Ag bimetallic nanoparticles using the seed-growth method and to investigate their antibacterial activity against gram-positive *Staphylococcus aureus* and gram-negative *Escherichia coli*. The synthesized nanoparticles, prepared with varying gold seed volumes, were characterized using UV–Vis spectroscopy, Field Emission Scanning Electron Microscopy (FESEM), Energy Dispersive X-ray Analysis (EDX), Transmission Electron Microscopy (TEM), Zeta potential analysis, and Dynamic Light Scattering (DLS). The antibacterial activity was evaluated using the disc diffusion method, with minimum inhibitory concentration (MIC) values of 2.5 mg/mL and 5 mg/mL for gram-negative and gram-positive bacteria, respectively. AuAg NPs exhibited good antibacterial activity against both bacterial strains. Better MIC value is shown against gram-negetive bacteria, which can be attributed to the structural and physiological differences between gram-positive and gram- negetive bacteria. Toxicity of the nanoparticles was tested against the adults of the fruit fly *Drosophila melanogaster* for 20 days. It was observed that the obtained nanoparticles were not much toxic against *Drosophila melanogaster*, since most of the flies survived till the completion of test period. This nanoparticle production process is eco-friendly, as it is free from organic solvents and toxic chemicals.

CMPA-96

Study of Structural and Dielectric Properties of $SrFe_{12}O_{19}$ Hexaferrite: An Influence of Sintering Temperature

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Abstract: The $SrFe_{12}O_{19}$ (SrM) hexaferrite was prepared using the standard solid-state reaction method by varying the sintering temperature. The structural and dielectric properties were investigated using X-Ray diffractometer, scanning electron microscope and impedance analyzer. Rietveld refinement shows that the prepared samples can be indexed in hexagonal symmetry belonging to space group $P6_3/mmc$. For the samples sintered at 1250°C preferred orientation was observed for (008) plane. An increase in cell volume observed for samples sintered at 1250°C, might be due to increased particle size. The average crystallite size increased with an increase in sintering temperature from 1200°C to 1250°C. SEM images revealed the increase in average grain size with increasing the sintering temperature. The dielectric constant was higher in the low frequency region and low in the higher frequency region revealing the presence of interfacial (M-W) polarization. Two relaxation peaks were observed for SrM sintered at 1200°C in the tangent loss plot. Higher AC conductivity was observed for samples sintered at 1200°C.

Keywords: Hexaferrites; dielectric properties; solid state reaction

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CMPA-97

Dielectric and Ionic Conductivity Studies on PVA/Sodium Alginate and Sodium Perchlorate Salt Composite for Energy Storage Applications

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Abstract: The poly(vinyl alcohol) (PVA)/Sodium alginate filled with different concentration (0, 5, 10,15, 20 wt.%) of sodium perchlorate salt filled polymer composite was prepared by simple solution casting technique. The effect of salt concentration on structural, chemical, electrical and dielectric properties were investigated using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), Impedance analyzer. The FTIR result show a broad -OH band and various functional groups confirms the chemical interaction of SA and salt with polymer. The XRD results reveal the structural changes upon adding the salt concentration. Nyquist plot has been performed to evaluate the ionic conductivity and the sample with 10 wt.% salt concentration shows the ionic conductivity of 4.06×10^{-6} S/cm at room temperature.

Keywords: ionic conductivity; sodium perchlorate; polymer composite.

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CMPA-98

Synthesis, Characterization, and Butane Gas Sensing Performance of rGO/NiO Nanocomposite

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Abstract: This study presents the synthesis, characterization, and butane gas sensing performance of rGO/NiO nanocomposite. Initially, Graphene oxide (GO) was synthesized via modified Hummers method and subsequently reduced with L-ascorbic acid to obtain reduced graphene oxide (rGO). Nickel oxide (NiO) nanoparticles (NPs) were prepared using the solution combustion method and integrated with rGO through a wet mixing technique to obtain the rGO/NiO nanocomposite (NC). Comprehensive structural and optical characterizations were conducted using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), UV-visible absorption spectroscopy, and Raman spectroscopy. XRD analysis revealed the average crystallite size of 29.17 nm for NiO and 26.73 nm for rGO/NiO NC, respectively. Tauc plot analysis from UV-Vis absorption spectra indicated an optical band gap of 3.21 eV for NiO NPs and 3.02 eV for rGO/NiO NC respectively, highlighting the influence of rGO incorporation in rGO/NiO NC. Gas sensitivity measurements toward 200, 600, and 1200 ppm butane gas at 100^{o}C revealed sensitivities of 0.65%, 1.58%, and 3.34% for pristine NiO NPs, and significantly enhanced responses of 17.85%, 27.96%, and 45.98% for rGO/NiO NC, respectively. The results demonstrate the potential use of rGO/NiO NC as highly responsive and efficient material for butane gas detection applications.

Keywords: rGO/NiO nanocomposite; wet mixing method; Butane Gas sensor

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CMPA-99

Exploring the Electrical Behavior of Quantum Dot Embedded Polymer System for Advanced Electronics

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Abstract : This study investigates the synthesis, characterization, and application of Mn-doped ZnS quantum dots (QDs) and their integration into polymeric matrix. Mn-doped ZnS QDs were synthesized via the sol-gel method and disperesed within polymer thin films through electro polymerization. The quantum dots and the polymer composites containing these quantum dots were further characterized using Characterization techniques, including X-ray diffraction (XRD), scanning electron microscopy (SEM), and Fourier-transform infrared (FTIR) spectroscopy, Raman spectroscopy confirmed the structural integrity and successful doping of Mn^{2+} within the ZnS QDs. for structural and morphological study. Dielectric and AC conductivity measurements demonstrated that Mn-doped ZnS QDs contribute to enhanced charge transport and improved conductivity in polymer system. Optical analysis indicates photoluminescence (PL), highlighting the potential for optoelectronic applications.
These findings demonstrate that integrating magnetic Mn-ZnS QDs within polymer matrices significantly enhances the electrical and optical properties of polymeric devices, establishing a viable pathway for developing advanced electronic and optoelectronic applications.

Keywords: Mn-doped ZnS Quantum Dots, Polymer Devices, Electrical Conductivity, Magneto-Impedance, Nanomaterials, Optoelectronics

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CMPA-100

Study on Enhancing Na^+ Ionic Conductivity of Poly(Methyl Methacrylate) (PMMA)/Polyvinylidene Fluoride (PVDF) Solid Polymer Electrolyte with Incorporating ZrO_2 Nanofiller and $NaClO_4$ Salt.

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Abstract: Improving the ionic conductivity of PMMA/PVDF for Na+ ion batteries has gained a lot of attention because of its stable electrochemical properties.In this study, a flexible PMMA/PVDF polymer electrolyte with a thickness of 70 μm was fabricated via the solution casting method. Initially, the pure polymer blend was optimized to (60 wt.%) PMMA/(40 wt.%) PVDF based on impedance studies. Further, to enhance the ionic conductivity and stability, ZrO_2 and $NaClO_4$ were incorporated into the host polymer matrix. Semi-crystalline nature of PMMA/PVDF/ZrO_2/$NaClO_4$ polymer blend electrolyte was confirmed through X-ray diffraction. Presence of functional groups in PMMA/PVDF/ZrO_2/$NaClO_4$and the interactions between the salt, nanofiller, and polymer chains were validated by FTIR analysis. The PMMA/PVDF polymer blend electrolyte loaded with ZrO_2 and $NaClO_4$ exhibits a high ionic conductivity of 5.17×10^{-6} S/cm at room temperature, with a tensile strength of 6.1 MPa and electrochemical stability around 4.0 V. A cationic transference number of 0.78 was obtained via the chronoamperometric technique using the Bruce-Vincent equation at room temperature. Additionally, the polymer electrolyte shows a good dielectric constant and stability over aging, making it a suitable candidate for Na^+ ion battery applications.

Keywords: Ionic conductivity; Cationic transference number;

CMPA- 101

Photocatalytic Studies of Sol-Gel Synthesized $LaFeO_3$/NiO Nano Composite

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Abstract: As for as, waste water treatment from textile industries are concerned, several methods have been tried to effectively and efficiently treat this polluted water before letting it into the natural water bodies. One among them is photo catalysis using nano materials, which is explored more in the recent times, due to its simple nature, cost effectiveness and harmlessness towards nature. Here in this work, in a motivation to explore the synergistic effect of nanocomposite formed by perovskite and metal oxides, for waste water remediation, we have synthesised $LaFeO_3$/NiO nano composite by modified sol-gel process. XRD studies confirmed the formation of pure phase composite material. Further using Debye-Scherrer equation and spherical crystallite approximation, the average crystallite size of pure $LaFeO_3$ and $LaFeO_3$/NiO composite was found to be 33.59 and 23.7 nm respectively. UV-Visible-DRS studies showed that the optical band gap of $LaFeO_3$ and $LaFeO_3$/NiO were found to be 2.55 eV and 3.78 eV respectively. FTIR studies confirmed the peaks corresponding to prominent Metal-oxygen bonds. FESEM studies showed the formation of sponge like morphology in the prepared nano materials. EDS studies confirmed the formation of pure material with no other unwanted impurities. The potential of the prepared material is tested for photocatalytic degradation of 5 ppm methylene blue dye under UV light irradiation and anti-bacterial applications.

Keywords: $LaFeO_3$; Nanocomposite; Dye-degradation; Photo-catalysis.

CMPA- 102

Visible Light Photocatalytic Degradation of Methylene Blue by $LaFeO_3$/NiO/rGO Nano-Composite.

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Abstract: Photocatalytic degradation of harmful organic dyes using semiconductor photo catalysts in nano form has gained considerable interest among researchers due to advantages like high surface area for effective absorption of light, simple mechanism, economical and easy to handle conditions. In this work we have tuned UV- light active $LaFeO_3$/NiO photo-catalyst into a visible light active $LaFeO_3$/NiO/rGO photo-catalyst by harnessing the synergetic effect of three classes of materials, viz; oxide perovskites, metal oxides and reduced graphene oxide. The prepared photo-catalyst is characterized by X-ray Diffraction Spectroscopy (XRD), UV-Visible Diffuse Reflectance Spectroscopy (UV-VIS DRS), Fourier Transform Infrared Spectroscopy (FTIR), Scanning electron microscopy (SEM) and Energy Dispersive X-ray Spectroscopy techniques (EDAX). The potency of the prepared nano-composite is tested for photo-catalytic degradation of 5 ppm methylene blue dye solution under visible light irradiation. The XRD analysis confirmed the formation of prepared material, the optical band gap of prepared material is found to fall in the visible region and all functional groups are confirmed by FTIR spectroscopy. The surface morphology and elemental composition of the prepared material is analysed with the help of SEM and EDAX techniques. The prepared photo-catalyst is able to degrade the dye solution by about 95% in just 40 minutes.

Keywords: $LaFeO_3$ based materials; Visible light photo-catalysis; Organic dye degradation; rGO nano-composites.

CMPA- 103

Visible Light Photocatalytic Degradation of Methylene Blue by $LaFeO_3$/NiO/GO Nano-Composite.

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Abstract: Water pollution caused by textile effluents poses a significant threat to environment sustainability. Leveraging the synergistic effect of $LaFeO_3$, NiO and graphene oxide (GO), in this work we have tuned UV- light active $LaFeO_3$/NiO photo-catalyst into a visible light active $LaFeO_3$/NiO/GO photo-catalyst. The prepared photo-catalyst is characterized by X-ray Diffraction Spectroscopy (XRD), UV-Visible Diffuse Reflectance Spectroscopy (UV-VIS DRS), Fourier Transform Infrared Spectroscopy (FTIR), Scanning electron microscopy (SEM) and Energy Dispersive X-ray Spectroscopy techniques (EDAX). The efficiency of the prepared nano-composite is tested for photo-catalytic degradation of 5 ppm methylene blue dye solution under visible light irradiation. The XRD analysis confirmed the formation of prepared material, the optical band gap of prepared material is found to fall in the visible region and all functional groups are confirmed by FTIR spectroscopy. The surface morphology and elemental composition of the prepared material is analysed with the help of SEM and EDAX techniques. The prepared photo-catalyst is able to degrade the dye solution by about 80% in just 40 minutes.

Keywords: $LaFeO_3$ based materials; Visible light photo-catalysis; Organic dye degradation; GO nano-composites.

CMPA- 104

Mixed-Dimensional Nanofluids for Thermal Enhancement Using Mixture of 1D and 2D Materials

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Abstract: Excessive heat generation is a common problem in automobiles due to wear and tear of working parts. A suitable heat transfer system is required to avoid stalling automobiles due to the large quantity of heat generated. Liquids like water and ethylene glycol (EG) serve as a coolant by reducing generated heat. To further increase the effectiveness of these coolants, nanofluids which contain nanosized particles dispersed in base fluid like water, ethylene glycol, or a mixture of these two, can be used. In the present work, hybrid nanofluids using Ti_3C_2 (MXene) (2D) and functionalized multi-wall carbon nanotubes (F-MWCNTs) (1D) nanocomposites are prepared. The prepared material is characterized using X-ray diffraction (XRD) for structural analysis, field emission scanning electron microscopy (FESEM), scanning electron microscopy (SEM), and high-resolution transmission electron microscopy (HR-TEM) with energy dispersive X-ray analysis (EDAX) for morphological and elemental analysis, and Fourier transform infrared spectroscopy (FTIR) for identifying functional groups. The suitability of the prepared nanofluids is tested for heat transfer application by measuring the thermal conductivity and viscosity. The long-term stability of the nanofluids is verified by zeta potential measurement. The addition of the dispersant to the water has shown an enhanced thermal conductivity (about 10.83% at room temperature and 96.76% at 50 °C) while having lower viscosity compared to the base fluid (water), confirming the suitability for heat transfer applications.

Keywords: F-MWCNTs, MXene, Nanocomposite, Thermal conductivity, Viscosity

CMPA- 105

Titanium Surface Modified with Strontium Nanoparticle Coating for Enhanced Antibacterial and Biological Activities

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Abstract: Limited tissue integration and susceptibility to infection remain significant challenges associated with titanium orthopaedic implants. This study explored the potential of strontium nanoparticle coating to enhance the biocompatibility of titanium implants. Strontium, known for its antibacterial and bone-promoting properties, was applied to Grade V titanium discs through a hydrothermal method. The resulting surface exhibited a unique microporous topography with nanoscale strontium particles. X-ray diffraction (XRD) and X-ray photoelectron spectroscopy (XPS) analyses confirmed the presence of strontium and titanium phases on the coated surface. The combination of microporous structure and strontium nanoparticle coating is expected to improve the osteoconductivity of titanium implants, leading to enhanced tissue integration and long-term implant success.

Keywords: hydrothermal method; nanoparticles, strontium; titanium.

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CMPA- 106

Investigating Optical Properties of Functionalized Nanofiller-Polymer Composites

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Abstract: Polymer nanocomposites progress materials science by offering an alternative to conventional polymers, enabling the creation of materials with tailored performance. This study focuses on g-C_3N_4 and functionalized multi-walled carbon nanotubes (FMWCNTs) within a polyvinyl alcohol (PVA) matrix, employing a solution-casting method to achieve uniform films. These films exhibit tunable optical properties, as revealed by UV-Vis spectroscopy. Specifically, g-C_3N_4/PVA films show high UV absorbance, while F-MWCNTs/PVA films display enhanced light absorption with increased F-MWCNTs content, indicating the potential for UV protection, photothermal materials, and sensor applications. Nanoscale fillers in polymer matrices yield improvements in mechanical strength, electrical conductivity, and thermal stability. Nanofillers' high interfacial area and controllable interactions enable specific, enhanced properties, positioning polymer nanocomposites as versatile, advanced materials for applications requiring customised optical, mechanical, and thermal characteristics.

Keywords: Composite, F-WMCNTs, g-C_3N_4, Polymer

CMPA- 107

Fabrication of TiO2 Decorated Silica Gel for Photocatalytic Applications

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Abstract: In this study, SiO_2-TiO_2 nanocomposites were successfully synthesized using a wet chemical approach to explore their photocatalytic potential. The optical properties and photoactivity of the prepared samples were investigated through UV-visible spectrophotometry, X-ray diffraction (XRD) explains crystalline properties, and scanning electron microscopy (SEM), providing insight into their morphological characteristics. The results reveal that the SiO_2-TiO_2 nanocomposites exhibit enhanced UV absorption and a significantly higher specific surface area compared to pure TiO_2. These properties contribute to improved photocatalytic activity under both visible and ultraviolet light, demonstrated by the effective degradation of methylene blue (MB) dye. The findings suggest that SiO_2-TiO_2 nanocomposites are promising candidates for environmental applications, particularly in the treatment of dye

CMPA- 108

Synthesis and Characterization of Co_3O_4 Thin Films by Spray Pyrolysis for Supercapacitor Applications

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Abstract: Scalable and high quality Co_3O_4 thin films are very suitable for supercapacitor applications. In this study we have synthesized Co_3O_4 thin films using facile Spray Pyrolysis technique. The impact of deposition temperatures have been studied using X-ray diffraction (XRD) and Field Emision Scanning Electron Microscopy (FE-SEM). Optimized thin films display polycrystalline nature with highest peak orientation along (311) axis and various parameters like crystallite size, lattice strain and dislocation density have been calculated. Morphology found was porous and granular which is essential for supercapacitor applications. Cyclic voltammetry was done using 3-electrode setup using Ag/AgCl (satd. 3M KCl) reference electrodes to evaluate supercapacitor performance. The specific capacitance of the films was found for all the films using 1M Na_2SO_4 electrolyte in the scanning range of 0V to -0.8V (v/s Ag/AgCl).

Keywords: thin films, supercapacitors, pseudocapacitors, cyclic voltamettry

CMPA- 109

Formulation and Optimization of Ni-MOF/CuSe Nanocomposite Ink for High-Performance Flexible Microsupercapacitors

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Abstract: The growing demand for flexible and wearable electronics is driving the development of high-performance, printed, flexible micro-supercapacitors (MSCs) for energy storage. In this study, we fabricate flexible and foldable MSCs using a nanocomposite of nickel-based metal-organic framework (Ni-MOF) and copper selenide (CuSe). The conductive ink formulation, which combines Ni-MOF with CuSe nanoclusters, ensures optimal mixing and printability for screen-printing applications on synthetic paper substrates. Our fabrication method yielded flexible symmetric (FS), asymmetric solid-state supercapacitor (ASSC), and flexible asymmetric supercapacitor (FAS) devices. Among them, the NC-5 FAS device displayed impressive electrochemical performance with high areal capacitance and energy density (3.65 mWh cm^{-2}), along with a power density of 73.8 mW cm^{-2}. Further enhancement of the NC-5 FAS device in a 3D enclosure configuration resulted in an extraordinary energy density of 47.08 mWh cm^{-2} and power density of 985.8 mW cm^{-2}, with a high capacitance retention of 93.9% after repeated flexibility tests. This robust and durable device design shows potential for portable electronics, achieving reliable energy storage with sustained flexibility and foldability. The developed conductive ink features optimized viscosity and surface wettability, facilitating stable screen-printing and device fabrication.

Keywords: Metal-organic framework; Metal selenide; Flexible and foldable micro-supercapacitor; and Screen-printing technology.

CMPA- 110

Neutron Shielding of Bismuth Added Heavy Metal Oxide Glasses

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Abstract: Radiation shielding is essential in environments exposed to neutron radiation, particularly in nuclear reactors, radiotherapy rooms, and industrial radiography facilities. This study investigates the neutron shielding effectiveness of bismuth-added heavy metal oxide glasses with the general formula (60-x) B_2O_3– 20SiO_2– x Bi_2O_3– 12ZnO– 8BaO (ZBiB) at x = 0 and 12 mol%. The role of Bi_2O_3 is used as a modifier in the glass matrix, and its influence on neutron attenuation property is estimated in this study with the help of Monte Carlo simulation tools. The gamma attenuation properties are explored in the study [1].

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CMPA- 111

Emerging Trends in Wide Bandgap Semiconductor Technologies (SiC and GaN) for Power Devices

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Abstract: Wide bandgap semiconductors, such as silicon carbide (SiC) and gallium nitride (GaN), are revolutionizing the power electronics industry with their superior material properties. These materials offer higher breakdown voltage, greater thermal conductivity, and faster switching speeds compared to traditional silicon-based devices, making them ideal for high-power and high-frequency applications. In this paper we build a crystal structure having surfaces SiC(100) & GaN(111) is investigated through an ab-initio study of the pseudo-epitaxial SiC(100) & GaN(111) contact. This study employs the computationally efficient meta-generalized-gradient approximation (meta-GGA), which effectively mitigates the bandgap underestimation commonly associated with traditional density functional theory (DFT) methods. we used the Atomistix ToolKit (ATK) code from QuantumWise.

Keywords: Gallium nitride, Silicon carbide, ab-initio study.

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CMPA- 112

Investigation of Natural Capping Agent for CdS and ZnS QD's using Madras Thorn Leaves: Green Synthesis.

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Abstract: The ZnS and CdS quantum dots are synthesized by a green synthesis process, utilizing chemical method. The method involves using madras thorn (Camellia sinensis) as a capping agent. The pure samples are prepared by direct chemical method in which zinc nitrate and sodium sulfide are mixed to form zinc sulfide, whereas Cadmium sulphate and sodium sulfide are mixed to form cadmium sulfide. The Capping Procedure involves production of sample extract by half volume reduction, to this sample extract we have added $Zn(NO3)$ followed by $Na2S$ solution (Bio-complex formation) . Similarly, the procedure was carried out for $Cd(SO4)$ and $Na2S$ solution (Bio-Complex formation). By, Constant Stirring over the duration of 24 hours the bio-complexes transforms to respective ZnS and CdS quantum dots. The mentioned compounds are confirmed by X-Ray Diffraction, Fourier transform infrared spectroscopy, UV-Visible spectroscopy and Photoluminescence spectroscopy. The correlation between produced quantum dots without using sample extract (Pure samples) and with sample extract (Capped samples) are studied

CMPA- 113

Electrochemical and UV Irradiation Study on Na^+ Ion Conducting Of Poly(Ethelyne Oxide) (PEO)/Polyvinylidene Fluoride (PVDF)/ TiO_2 / $NaClO_4$ Blend Solid Polymer Electrolyte for Energy Storage Application.

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Abstract: The synthetic polymer blend electrolyte, with its enhanced ionic conductivity, is drawing considerable attention due to its ability to suppress dendrite formation and provide improved electrochemical stability. A free-standing, flexible polymer blend electrolyte, composed of 70 wt.% poly(ethylene oxide) (PEO) and 30 wt.% polyvinylidene fluoride (PVDF), was fabricated using the solution casting technique. The ionic conductivity of this pure polymer blend electrolyte was significantly enhanced by incorporating TiO_2 nanoparticle and $NaClO_4$. X-ray diffraction (XRD) analysis confirms the semi-crystalline nature of the PEO/PVDF/TiO_2/$NaClO_4$ polymer blend electrolyte, with characteristic peaks indicating the presence of anatase and brookite phases of TiO_2. Additionally, Fourier-transform infrared (FT-IR) studies validate the interactions between the functional groups, the nanofiller, and the salt. The optimized polymer blend electrolyte achieved a maximum ionic conductivity on the order of 10^{-5} S/cm, as estimated from the bulk resistance measured through electrochemical impedance spectroscopy (EIS) over a frequency range of 500 kHz to 100 Hz. This electrolyte exhibits electrochemical stability above 4.0 V and a high cationic transference number of 0.8. Moreover, the polymer electrolyte demonstrates a high dielectric constant and stable performance over time. Notably, its conductivity was further enhanced by one order of magnitude following 24 hours of UV irradiation at room temperature. Therefore, the PEO/PVDF/TiO_2/$NaClO_4$ polymer electrolyte is a promising candidate for use as an electrolyte in sodium-ion (Na^+) battery applications.

Keywords: Ionic conductivity; Electrochemical Impedance; UV irradiation

CMPA- 114

Structural, Thermal and Ionic Conductivity Studies of Sodium Iodide (NaI) Blended Hydroxypropyl Methylcellulose (HPMC) Polymer Electrolyte Films

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Abstract: Polymer-based electrolytes, known for their flexibility and ease of modification through blending have been greatly explored. This research aims to find influence of sodium iodide (NaI) salt within a hydroxypropyl methylcellulose (HPMC) matrix, analysing their structural and electrical properties. The paper outlines the synthesis of HPMC/NaI composite polymer films via the solution casting method, varying NaI concentrations (5, 10, 15, 20, 25 and 30 wt.%). Characterization involved X-ray diffraction (XRD), Fourier transform infrared (FTIR), and ultraviolet–visible (UV–Vis) spectroscopy. Assessments of AC conductivity, impedance, and modulus spanned a frequency range of 1000 Hz to 1 MHz at room temperature. The films demonstrated AC conductivity, improved impedance, and electric modulus responses across frequencies. Complex impedance analysis depicted via cole–cole plots, revealed a non-Debye type of dielectric relaxation linked with increased conductivity. These findings suggest potential use of HPMC/NaI composite polymer films as electrolyte in energy storage devices, signifying their promise in advancing such technologies.

Keywords: ionic conductivity; X-ray diffraction, AC conductivity; polymer composite.

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CMPA- 115

Advanced Formulation of $MoTe_2$/Carbon Nanofiber Nanocomposite Conductive Ink for High-Performance Screen-Printed Flexible Microsupercapacitors

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Abstract: The performance of microsupercapacitors (MSCs) can be significantly enhanced through the use of optimized nanocomposite materials. In this work, unique $MoTe_2$ and carbon nanofiber (CNF)-based nanocomposites were developed via an in-situ nucleation seeding method, combining a $MoTe_2$ precursor and graphitized CNF in a single-step process. During nucleation, $MoTe_2$ nanoparticles were physically integrated with CNFs, forming a robust composite structure. This nanocomposite was utilized to formulate a conductive ink optimized for screen printing, ensuring porosity consistency across the printed device. The resulting symmetric MSCs exhibit exceptional electrochemical performance due to the high surface area and electrical conductivity of $MoTe_2$, synergistically enhanced by the structural reinforcement of CNFs. The ink's optimized rheology ensure excellent adhesion and conductivity on flexible substrates such as polyethylene terephthalate (PET), providing superior mechanical flexibility and long-term device stability. Cyclic voltammetry (CV) and galvanostatic charge-discharge (GCD) analyses reveal outstanding areal capacitance, energy density, and rapid charge-transfer dynamics, along with excellent cyclic stability. These highlight the potential of $MoTe_2$/CNF-based MSCs for flexible and wearable electronic applications, emphasizing the critical role of advanced ink formulations in realizing next-generation energy storage devices.

Keyword: Conductive Ink Formulation; Flexible micro supercapacitor; Screen printing

CMPA- 116

PEDOT:PSS Water-Based Conductive Ink Infused with Polypyrrole and Reduced Graphene Oxide for High-Performance Micro-Supercapacitor and Humidity Sensor

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Abstract: The growing interest in multifunctional conductive ink formulations aligns with the growing demand for flexible devices such as energy storage systems and sensors. However, the challenge of integrating hydrophobic and hydrophilic materials in a water-based ink. we developed a flexible, cost-effective, water-based conductive ink composed of polypyrrole, PEDOT:PSS, and reduced graphene oxide with a new binder system for superior performance. These conductive inks are printed on a polyethylene terephthalate (PET) substrate using a simple and efficient screen-printing technique. The optimized rheological properties of the ink enable flexible micro-supercapacitors with areal capacitances of 193.16 $mFcm^{-2}$ for Polypyrrole-PEDOT:PSS (PP) and 219.7 $mFcm^{-2}$ for Polypyrrole-PEDOT:PSS-rGO (PPR) at 5 mVs^{-1}. The energy density reaches 8.45 $mWhcm^{-2}$, with a power density of 21.45 $mWcm^{-2}$. The same material seamlessly transitioned into the fabrication of a high-performance humidity sensor. The single-printed PPR-2 sensor exhibited excellent performance, showing a resistance change of approximately 32 kΩ/ %RH over a humidity range of 11% to 97% RH. The sensor is flexible, stable, and has a response/recovery time of 47 s/58 s.

CMPA- 117

Magnetic Behaviour of Nano Particles for Advanced Electronics

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Abstract: This study explores the synthesis, characterization, and applications of Cobalt-doped ZnO nanoparticles(Co-ZnO), focusing on their ferromagnetic properties. Co-doped ZnO nano particles were synthesized via the colloidal solution method starting with appropriate salts. Prepared nanoparticles were neutralized, dried and ground before further characterization.The nanoparticles were further analysed using various characterization techniques, including X-ray diffraction (XRD), scanning electron microscopy (SEM) with EDX and Raman spectroscopy. These methods confirmed the structural integrity and successful doping of Cobalt within ZnO. Vibrating Sample Magnetometry (VSM) confirmed the Ferromagnetic nature of the prepared material. Further we investigated the magneto-impedance properties of the doped ZnO with varying magnetic field. We found that impedance scales linearly with applied magnetic field.

Keywords: Cobalt doping, ZnO, Nano particles, magneto-impedance

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CMPA- 118

An Investigation of Third-Order Nonlinear Optical and Limiting Properties of Spray Pyrolysis-Deposited $Zn_{1-x}Cr_xO$ Nanostructured Thin Films for Optoelectronics

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Abstract: This study used the ultrasonic spray pyrolysis technique to develop zinc oxide (ZnO) nano-structured thin films doped with chromium (Cr) at several concentrations (0,1,3,5,10 weight percent) on a glass substrate at 350 degrees Celsius. Utilizing XRD, UV-Vis spectroscopy, and Hall effect measurement tools, respectively, the impact of chromium on zinc oxide thin films was investigated in order to extract the structural, optical, and electrical features. Hexagonal wurtzite structure with an optimal orientation of (101) was observed in the work on undoped ZnO. A decrease in crystalline size was verified by an increase in strain in relation to doping concentration. There is a change in surface roughness when doping Cr. The optical results showed that the influence of Cr doping caused the transmittance to decrease. Tauc's plot was used to determine the band-gap, which was shown to change with Cr-doping. Decreases in carrier concentration were found by Hall effect measurement under standard conditions, suggesting n-type conduction. Third-order nonlinear optical properties, including nonlinear absorption coefficient (β), nonlinear refractive index (NRI) (n_2), and susceptibility $\chi(3)$, were studied. These results imply that self-defocusing nonlinearity is present in the films. The total findings verified that the concentration of Cr in ZnO affected the structural and optical outcomes.

Keywords: ZnO thin films; Spray pyrolysis; Hexagonal wurtzite structure; Z-Scan technique.

CMPA- 119

Polymer Composite Electrolyte PVA/Hydroxypropyl Methyl Cellulose Doped with $NaNO_3$ Salt for Ionic conductivity and Dielectric Properties

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Abstract: In this work, we present the effect of $NaNO_3$ salt concentration (0, 5, 15, 25, and 35 wt.%) on eco-friendly biopolymer blend matrix comprising hydroxypropyl methyl cellulose (HPMC) and poly (vinyl alcohol) (PVA), which is prepared in the form of films using the solution casting technique. Structural, chemical composition, electrical and mechanical properties were investigated by X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), Impedence analyzer and Universal Testing Machine (UTM). The FTIR results and XRD patterns of the composites confirmed that the sodium nitrate salt was dissolved and complexation was observed through a coordination bond and a hydrogen bond with –OH and –CH groups in the host polymer blend, indicating transient cross-linking. Nyquist plot fitting has been performed to evaluate the transport properties and hence the carrier concentration influences the ionic conductivity. The sample complexed with 25 wt.% NaNO3 revealed the conductivity of 1.72×10^{-6} S/cm at room temperature and highest conducting sample exhibited a mechanical strength of 22.27 Mpa calculated using UTM results.

Keywords: Ionic conductivity; Sodium nitrate; Polymer composite; Mechanical strength.

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CMPA- 120

Rural Rubber Wastewater Treatment using A Sequential Coagulation-Flocculation and Ultraviolet Assisted Fenton Oxidation in Presence of Nanoparticle

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Abstract: This study focuses on the characterization of rubber wastewater collected from a rural rubber processing unit and the design of a hybrid treatment scheme employing coagulation-flocculation (CF) and ultraviolet (UV)- Catalytic process using zinc oxide (ZnO) nanomaterial for its effective treatment. The rubber wastewater sample collected from nearby Hebri village in Karnataka shows a high chemical oxygen demand (COD) of 32000 mg/L and a biochemical oxygen demand (BOD)/COD ratio of 0.09. Due to the low BOD/COD ratio, implementation of biological treatment would be a cumbersome option. Therefore, a sequential CF pre-treatment followed by a UV catalytic process was proposed to study its effect on COD removal. The CF pre-treatment was carried out to remove a majority of turbidity and a substantial amount of COD using alum. CF pretreatment was effective in the removal of 61% turbidity and 30% COD from rubber wastewater at an optimum dosage of alum (2 g/L) at pH 5.5. Subsequently, UV-catalytic treatment using ZnO nanomaterial was very efficient in COD removal from the leachate sample and a combination of UV-Fenton in the presence of ZnO nanomaterial could achieve 60% COD at 500 mg/L of ZnO nanoparticle and Fenton reagent (Fe: H_2O_2= (1 g:10mL)/L). There has been an increase in rural small-scale rubber industries around the coastal Karnataka region and its effect on the natural ecosystem has been meagerly studied. This work is an attempt to focus on the rural environment issue and offer a technological solution to it.

Keywords: UV-catalytic AOP, rubber wastewater treatment, ZnO nanomaterial, Hybrid treatment system

CMPA- 121

Metal Sulfide Nanoparticles/PVA Nanocomposite for Optoelectronics Applications

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Abstract: Polymers with adaptable optical and electronic properties are crucial for developing advanced materials in optoelectronics. This study presents the synthesis of Ag-Ag_2S alloy nanoparticles (NPs) via a chemical reduction method integrated within a polyvinyl alcohol (PVA) matrix to create composite polymers with tailored optical characteristics. By varying the NP-to-polymer ratios, the composites displayed distinct optical responses. UV-Vis spectroscopy showed that increasing the concentration of Ag-Ag_2S NPs heightened the Ag absorption peak while decreasing transmittance, indicating enhanced light absorption. Structural analysis using X-ray diffraction (XRD) confirmed Ag_2S crystalline phases, verifying successful alloy incorporation within the polymer matrix. These tunable properties position Ag-Ag_2S/PVA composites as promising candidates for optoelectronic devices, such as photodetectors, sensors, and photovoltaic components. The study demonstrates that adjusting nanoparticle concentration within polymer matrices provides a controlled method to optimize material properties for next-generation optoelectronic devices.

Keyword: Ag-Ag_2S; PVA; Optoelectronics; Matrix

CMPA- 122

Multivariate Central Composite Design Approach for Optimizing Ag-Doped Polypyrrole in Interdigitated Flexible Microsupercapacitors

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Abstract: This study presents the fabrication of interdigitated flexible microsupercapacitors, optimized using Ag-doped polypyrrole as an electrode material through state-of-the-art screen-printing technology. The formulation of conductive ink was prepared by blending Ag-doped polypyrrole with diacetone alcohol and cellulose acetate propionate as binders, yielding a homogeneous, stable ink with well-distributed conductivity. A controlled synthesis process confirmed by XRD, SEM, AFM, and XPS analyses verified the effective integration of Ag nanoparticles into the polypyrrole matrix, enhancing its suitability as an electrode material. The resulting devices demonstrated outstanding electrochemical performance and exceptional areal capacitance. Subsequently, a two-level, two-parameter full factorial design with five central runs using the Central Composite Design approach was incorporated for predicting the effects of varying monomer and binder concentrations on the three response variables (areal capacitance, energy density, and power density). The models exhibited significant R^2 values for all the response variables as displayed by the Analysis of Variance. A post-processing validation was performed using the optimum input values to confirm that the response variables fell within the 95 % confidence interval.

Keywords: Conducting polymer, Flexible asymmetric microsupercapacitor, Functional ink, and Screen-printing technology.

CMPA- 123

Design, Characterization, X-Ray Diffraction and Microbial Study of Tert-Butyl 4-(2-Ethoxy-2- Oxoethyl)-Piperazine-1-Carboxylate and Tert-Butyl 4-(2- Hydrazino-2-Oxoethyl)Piperazine-1-Carboxylate

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Abstract: Two derivatives of N-Boc piperazine, an ester derivative tert-butyl 4-(2-ethoxy-2-oxoethyl)-piperazine-1-carboxylate (1) and, a hydrazide derivative tert-butyl 4-(2-hydrazino-2-oxoethyl)piperazine-1-carboxylate (2) were synthesized and were characterized by FT-IR, ^{1}H & ^{13}C NMR and LCMS spectroscopic studies. The structures of both 1 and 2 were further confirmed by single crystal X-ray diffraction analysis. A detailed analysis of the intermolecular interactions and crystal packing of 1 and 2 via Hirshfeld surface analysis and fingerprint plots was performed. The antibacterial and antifungal activities of both the compounds have been studied against several microorganisms, and were found to be moderately active.

Keywords: Piperazine, Crystal structure, Spectral studies, Hirshfeld surface analysis, Antimicrobial studies.

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CMPA- 124

Optical and Structural Studies of Al_2O_3 Nanoparticle incorporated PVA- $MgCl_2$ Nanocomposite Films

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Abstract: Polymer nanocomposite films have emerged as promising materials for advanced technological applications due to their distinct optical and structural properties. This study focuses on the synthesis, Optical & Structural studies of polyvinyl alcohol (PVA) nanocomposite films, doped with magnesium chloride ($MgCl_2$) with varied concentration (1 wt%, 5 wt%, and 10 wt%) of aluminium oxide nanoparticles (Al_2O_3 NPs). The Al_2O_3 NPs were synthesized using the co-precipitation method, which significantly influenced the properties of the resulting PVA-$MgCl_2$ composite films. X-ray diffraction (XRD) analysis confirmed the crystalline nature of the Al_2O_3 nanoparticles, revealing an average crystallite size of 9.31 nm. Additional structural parameters, including lattice parameter, microstrain, and dislocation density, were calculated to understand their structural impact. Fourier-transform infrared (FTIR) spectroscopy exhibited strong chemical interactions between Al ions and the functional groups within the PVA matrix. Optical studies using UV-Visible spectroscopy revealed an indirect optical bandgap of 1.68 eV for the Al_2O_3 NPs, highlighting their potential for optoelectronic applications. Polymer nanocomposite films were prepared using the solution casting method. XRD analysis indicated an amorphous structure for the pristine PVA film, while doping with $MgCl_2$ and Al_2O_3 NPs induced increased crystallinity. FTIR spectra confirmed successful doping and illustrated characteristic vibrational bonds in the composite films. UV-Visible spectroscopy further demonstrated that films doped with $MgCl_2$ and Al_2O_3 NPs exhibited higher indirect optical bandgaps compared to undoped films, with notable variations in Urbach energy and extinction coefficients depending on the concentration of Al_2O_3 NPs. These findings underscore the potential of PVA-$MgCl_2$-Al_2O_3 nanocomposite films for applications in optoelectronics.

Keywords: Polymer Nanocomposite films, co-precipitation, Solution Casting, Optical Bandgap Urbach energy, Extinction coefficient

CMPA- 125

Morphological, Structural, and Optical Properties of Al Doped ZnO Thin Film Prepared by Spray Pyrolysis Technique

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Abstract: This study uses spray pyrolysis to create zinc oxide (ZnO) nanostructured thin films doped with aluminium (Al) at different concentrations (0, 2, 4, 6, 10, and 15 weight percent) on a glass substrate at a substrate temperature of 450^{o}C. The effects of aluminium on zinc oxide thin films were examined using Hall effect measuring instruments, UV-Vis spectroscopy, and XRD. The pure ZnO investigation revealed a hexagon-shaped wurtzite structure with a desirable orientation of (101). As doping concentration increased, crystalline size decreases. Al doping causes variations in surface roughness. As the concentration of aluminium increases, the thin-film grain size changes. Al doping led to a decrease in transmittance, according to the optical measurements. The refractive index and absorption coefficient underwent a systematic change when aluminium was added to the deposits. The presence of many defect orientations in the films was shown by photoluminescence spectra.

Keywords: $Zn_{1-x}Al_xO$ thin films; Spray pyrolysis technique; Nonlinear optics; Susceptibility; Optical properties.

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CMPA- 126

ZnO Decorated rGO Nanocomposite for Efficient Organic Dye Degradation under UV and Visible Light Irradiation

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Abstract: The environmental and biological impact of dye-contaminated wastewater necessitates effective treatment methods for contaminant-free water. Various techniques have been explored for industrial wastewater treatment, with photocatalysis emerging as a cost-effective approach that minimizes secondary pollutant formation. In this study, a novel and environmentally sustainable sol-gel synthesis was employed to synthesize zinc oxide (ZnO) nanoparticles (NPs) using Averrhoa bilimbi (A. bilimbi) fruit extract as a natural reducing agent. The same fruit extract was also used to reduce graphene oxide (GO). A sonochemical method was followed to prepare rGO/ZnO nanocomposite (NC). Comprehensive characterizations were conducted via microscopic and spectroscopic techniques. X-ray diffraction (XRD) analysis revealed crystallite sizes of 27.60 nm for ZnO NPs and 25.89 nm for rGO/ZnO NC, respectively. Upon NC formation, the optical band gap decreased from 3.23 eV for ZnO NPs to 2.83 eV for rGO/ZnO NC, indicating enhanced optical properties. Photocatalytic assessments demonstrated that 30 mg of rGO/ZnO NC achieved complete degradation of 5 ppm methylene blue (MB) dye in 90 minutes under UV light (254 nm, 8 W) and 73% degradation under visible light irradiation. These findings highlight the potential use of rGO/ZnO NC synthesized through green chemistry for efficient dye-contaminant remediation in wastewater treatment applications.

Keywords: Sonochemical method; Zinc oxide NPs; rGO/ZnO NC; Bilimbi fruit extract

CMPA- 127

Metal Organic Framework Based on Zinc Nitrate and Recovery Terephthalic Acid for Battery Application

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Abstract: A gram-scale synthesis of a metal-organic framework (MOF) based on zinc and terephthalic acid (TPA) was accomplished using both precipitation and hydrothermal methods. Dimethylformamide (DMF) was used as the solvent, with TPA serving as the organic linker. The resulting MOF was characterized using X-ray diffraction (XRD), infrared (IR) spectroscopy, and scanning electron microscopy (SEM). zinc complexes and TPA were the key chemical components in the fabrication of this MOF, which was specifically engineered to improve battery performance. Furthermore, preliminary tests on the MOF's use as an anode material in lithium-ion batteries demonstrated better specific capacity and stability in a half-cell configuration compared to currently reported Zn-MOF electrodes

Keywords: Zinc; TPA; Metal-Organic Framework; Li-ion Batteries.

CMPA- 128

Synthesis of Metal Doped Cathode Material for Sodium Ion Battery by Hydrothermal Method

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Abstract: The development of advanced cathode materials for sodium-ion batteries (SIBs) is essential for improving their performance and viability for large-scale energy storage. In this study, we report the synthesis of a novel cathode material for SIBs using a hydrothermal method, followed by post-annealing to optimize the electrochemical properties. The material was extensively characterized using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), ultraviolet-visible (UV-Vis) spectroscopy and electrochemical impedance spectroscopy (EIS), Galvanostatic charge-discharge cycling and cyclic voltammetry (CV). XRD and FTIR confirmed the high crystallinity and favorable phase formation, while SEM revealed a highly porous nanostructure that facilitates efficient ion transport. UV-Vis analysis indicated strong light absorption properties that contribute to improved charge/discharge dynamics. EIS measurements demonstrated low charge transfer resistance and fast ion diffusion, indicating excellent conductivity and electrochemical stability. Galvanostatic charge-discharge and cyclic voltammetry (CV) tests showed high initial discharge capacity, outstanding rate capability, and excellent cycling stability with minimal capacity fading after 1000 cycles. Furthermore, application studies in energy storage devices demonstrated the material's potential for real-world use, highlighting its efficiency in prototype sodium-ion batteries. The results indicate that the synthesized cathode material offers significant promise for practical SIB applications, with enhanced performance, durability, and scalability.

CMPA- 129

Phase Dependentent Sensing Behaviour of TiO_2 for H_2 Sensor

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Abstract: Hydrogen is becoming increasingly important in light of the world's growing energy needs due to its efficiency and environmental friendliness. However, because of its flammability, there are safety concerns, and necessitates early detection at various ppm levels (from ppb to 10%) at ambient temperatures and humidity. The present study investigated the phase engineering of TiO_2 for H_2 gas sensing behaviour; to establish this, TiO_2 sensors with different phases (pure anatase, pure rutile, bi-phase (anatase and rutile), and tri-phase (anatase, rutile, and brookite)) and their Pd-modified counterparts opted. It is interesting to observe that, at room temperature (25^0C), the TiO_2 sensor with pure anatase phase (A-100) is more active (better response time and % response) compared to the sensor with the dominant rutile phase (A-0) that has no response. On the other hand, at 25^0C, after Pd sensitization, the A-0 sensor exhibited the best performance (response time and % response) among the others, emphasizing the importance of synergy between crystalline phases of support (TiO_2) with metal (Pd) and thus underscores the strong metal support interaction (SMSI). The present investigation on phase engineering of TiO_2 sensors unveils new scientific knowledge to design and develop efficient and stable sensors that work under ambient (preferably 25-100^0C) temperatures, different humidity conditions and a wide range of analyte concentration of different hazardous gases.

Keywords: H_2 sensor, Phase engineering, TiO_2, Photo-deposition, Pd sensitization

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CMPA-130

Fabrication and characterization of MOF-Polyaniline-based Flexible thermoelectric generator for low-temperature applications.

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Abstract: In energy storage and conversion, Metal-Organic Frameworks (MOFs) garner increasing attention due to their low thermal conductivity, high surface area, and tailorable structure. These attributions make MOFs promising candidates for thermoelectric applications. However, to enhance its electrical conductivity, the addition of conductive particles is important. While rigid TEGs have demonstrated noteworthy performance, they have drawbacks such as limited flexibility, brittleness, high cost, and lower efficiency. In this study, a hybrid screen printing ink consisting of nanocomposite of polyaniline (PANi), synthesized through chemical oxidative polymerization, and Zirconium MOF (MOF-801), synthesized through solvothermal method is prepared, and Flexible thermoelectric generator is screen printed on a polyethylene terephthalate substrate. The influence of individual compositions of the formulated ink and structural parameters on the thermoelectric performance is investigated and reported.

Keywords: Metal-Organic Frameworks; Conducting Polymer; Screen Printing; Thermoelectricity

CMPA-131

Synthesis, Characterization, Computational and Single Crystal X-ray Studies of Novel Isatin Derivative of Biological Interest

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Abstract: An eminent challenge in contemporary medicine and pharmacy is the identification of powerful, biologically active, and anti-bacterial drugs. The objective of this work is to synthesize novel isatin derivative to investigate its properties using different spectroscopic methods. The crystal structure of the compound is determined using single-crystal X-ray diffraction methodology. Hirshfeld surface analysis was employed to evaluate the impact of intermolecular interactions on crystal packing. The interactions were visually depicted using 2D fingerprint plots, which highlighted the specific surface area associated with each interactant. Indications suggest that the crystal packing is mostly governed by C-H…O and C-H…H interactions, resulting in the formation of various supramolecular synthons, which greatly improve crystal stability. Density functional theory (DFT) was employed to better examine the structural and electrical characteristics. Computations were conducted at the 6−311+G (d,p) level to determine the optimal geometry, total energy, HOMO-LUMO gap, and vibrational spectra. The results suggested a moderate amount of stability. Bader et al. employed reduced density gradient (RDG) techniques and topological analysis, taking into account the quantum theory of atoms in molecules (QTAIM), to examine noncovalent interactions. Additionally, the molecule satisfies Lipinski's rule of five and exhibits encouraging pharmacokinetic activities. Additional in-silico investigations, including molecular docking, were conducted to explore its biological properties.

CMPA-132

Ipomoea purpurea Derived Carbon Dots for Efficient Bisphenol-A Degradation

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Abstract: The presence of organic contaminants in potable water is a significant global environmental concern. Bisphenol-A (BPA), a harmful compound, poses serious health risks even at low concentrations, making its removal crucial for a sustainable future. Traditional water treatment methods such as adsorption, ozonation, and oxidation are often insufficient for effectively removing BPA and can harm ecosystems. Photocatalysis, which utilizes light to generate reactive oxygen species capable of degrading organic pollutants,[1] offers a promising alternative. However, conventional photocatalysts have limitations, leading to the exploration of more efficient materials. Carbon dots (CDs), a class of nanomaterials derived from renewable sources, show great promise for photocatalysis due to their excellent properties with minimal by-product generation.[2] Biomass-derived CDs are particularly eco-friendly and do not require surface functionalization.[3] The *Ipomoea purpurea* (IP) plant, a fast-growing weed commonly found in warm climates, presents a viable source of carbon for synthesizing CDs, turning a common weed into a valuable resource. Top of Form In this study, we report the synthesis of CDs from IP leaves using a two-step microwave and hydrothermal process to achieve the desired size and properties. The phase and vibrational characteristics of the CDs were confirmed through XRD and FT-IR analysis. The synthesized CDs emitted green light, and their photocatalytic performance was tested for BPA degradation under visible light. The best degradation efficiency of 82.7% was achieved with a catalyst concentration of 2 mg/mL at pH 8.4 after 90 minutes, likely due to enhanced hydrolysis reactions in mildly alkaline conditions. This approach offers a promising solution for overcoming the limitations of traditional methods, with improved BPA removal efficiency and potential for recycling.

Keywords: Carbon dots; Bisphenol-A; Water-treatment; Photocatalysis

CMPA-133

Elucidating the Effect of 2,3,5,6-Tetrafluoro-tetracyanoquinodimethane (F_4TCNQ) on the Performance of Green OLEDs

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Abstract: In this study, we have explored the effect of 2,3,5,6-tetrafluoro-tetracyanoquinodimethane (F_4TCNQ) thickness (0-8 nm), on the performance of thermally evaporated multilayer organic light-emitting diodes (OLEDs) utilizing tris(8-hydroxy-quinolinato)aluminium (Alq_3) as the green electroluminescent material. Notably, a device featuring an 8nm thick F_4TCNQ layer as hole-injection layer (HIL) exhibited a high current density, approximately 100 times higher than a device without an F_4TCNQ layer. The current density increased as the thickness (0-8 nm) of the F_4TCNQ layer increased for a given applied voltage. In contrast to the trend observed in current density, luminance increased as the F_4TCNQ thickness to 6nm, beyond which a decrease in luminance was observed. Correspondingly, the device efficiency demonstrated enhancement with increasing F_4TCNQ layer thickness up to 6nm, beyond which a decline in efficiency was observed. Specifically, the current efficiency of the device with a 6nm F_4TCNQ layer was found to be four times greater than that of the device without an F_4TCNQ layer. These findings suggest that a thin F_4TCNQ layer (6nm) is essential for effectively injecting holes in OLEDs.

Keywords: Hole-injection layer; OLEDs; F_4TCNQ; Charge-injection

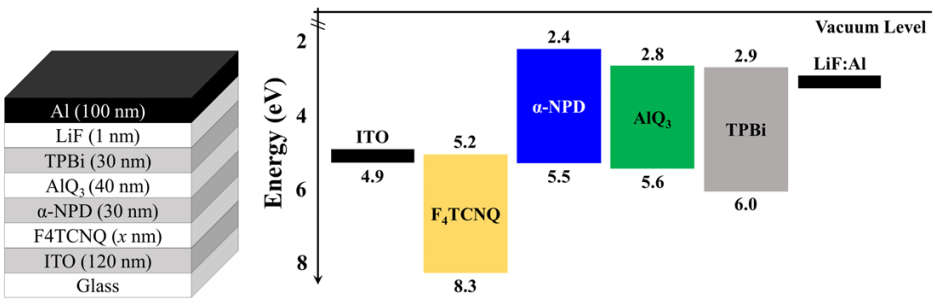

Figure. Configurations of OLEDs with different thicknesses of the F_4TCNQ modification layer, where *x* is 0-8 nm. Energy diagram of OLEDs with the F_4TCNQ modification layer is also exhibited.

CMPA-134

Hydrothermally Synthesized Al-Doped $BiVO_4$ as a Potential Antibacterial Agent Against Methicillin-Resistant *Staphylococcus Aureus*

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Abstract: A one-pot hydrothermal route was employed to synthesize aluminum-doped $BiVO_4$ (Al:$BiVO_4$) at two reaction durations: 4 hours and 8 hours. Aluminum doping was achieved by adding 1% (w/v) aluminum oxide powder to the precursor mixture. The synthesized materials were characterized using various techniques, revealing significant morphological changes and a notable reduction in bandgap energy of the scheelite monoclinic $BiVO_4$ matrix upon Al modification at both reaction durations. Antibacterial studies against methicillin-resistant *Staphylococcus aureus* (MRSA) were conducted under visible light to exploit the photo-oxidation properties of Al-doped $BiVO_4$ and compare them with undoped $BiVO_4$. The minimum inhibitory concentration (MIC) of the synthesized materials was determined. The results demonstrate that Al doping significantly enhances the photocatalytic antibacterial activity of $BiVO_4$, with Al:$BiVO_4$ synthesized at 8 hours exhibiting superior sunlight-driven photocatalytic performance compared to the 4-hour variant.

Keywords: Bandgap Energy, Hydrothermal Method, Methicillin-Resistant *Staphylococcus aureus*, Photo-Oxidation, Selective Doping

CMPA-135

Micromechanical Response of Carbon Fibers under Compressive Load

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Abstract: Most carbon fibres are heterogeneous, anisotropic and small in size, determining their mechanical properties is difficult. The objective of this study is to investigate the compressive behaviour of two different carbon fibres using in situ compression tests on micropillars in scanning electron microscopy (SEM). The mode of failure is observed to be axial splitting. Also, large hysteretic loops are observed, associated with crack development, but significantly less or no permanent deformation is visible. The compressive properties, such as modulus and strength of these pillars, are lower than the tensile properties of the fibres (128 GPa and 2.38 for UTS50, respectively and 110 GPa and 2.36 GPa for HR40, respectively). The mechanisms involved are studied and compared with those of other experimental techniques. The core-shell structure of the fibres is at the origin of these inferior properties (the pillar is associated with the core). The nano-buckling scenario of crystalline carbon stacks constrained by the shear stiffness of the fibre agrees with our moduli and strength results.

Keywords: Compression, Carbon fibres, Strength, Modulus

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CMPA-136

CHARACTERIZATION oF La DOPED CuO THIN FILMS GROWN bY SPRAY PYROLYSIS TECHNIQUE.

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Abstract: Copper oxide in thin film form is a very good candidate for enhancing the electrical properties due to its right band gap, minimal cost and large abundance[1]. Doping is one of the methods used to enhance properties of a semiconducting thin film [2]. To enhance the optoelectrical properties of CuO thin films lanthanum was doped with different dopant concentrations (2, 4, 6, 8and 10 at %). These films were deposited using spray pyrolysis technique. These thin films were prepared on glass substrates at 350^{o}C temperature. The changes in structural properties of the CuO thin films on doping were analyzed using XRD and Raman spectroscopy techniques. And the band gap of the prepared samples were analyzed using UV- Vis spectroscopy.

Keywords: Copper Oxide; Spray pyrolysis; XRD; Thin films; Band gap; Raman spectroscopy.

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CMPA-137

Enhanced Electrochemical Performance of Pr-Doped $NiFe_2O_4$ for High-Efficiency Supercapacitors

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Abstract: This study investigates the structural and electrochemical properties of Praseodymium(III) (Pr) doped $NiFe_2O_4$ for high-performance supercapacitor applications. $NiFe_{2-x}Pr_xO_4$ (where x=0, 0.005, 0.01, 0.015 and 0.02) was prepared using a combustion method and focused on electrochemical performance. X-ray diffraction(XRD) analysis reveals that Pr^{3+} doping induces structural changes, with crystallite size increasing initially but decreasing at higher Pr^{3+} concentrations. Electrochemical studies show a significant improvement in specific capacitance, particularly for $NiPr_{0.01}Fe_{1.99}O_4$ which exhibits the highest specific capacitance of $69.2 Fg^{-1}$ at a current density of $0.1 Ag^{-1}$. Pr^{3+} doping enhances electron transfer, charge storage, and stability, making Pr^{3+}-doped $NiFe_2O_4$ a promising candidate for next-generation supercapacitors. The optimal doping level of Pr^{3+} enhances both energy density and power density, providing a flexible approach for material optimization in energy storage technologies.

Keywords: $NiFe_2O_4$, Supercapacitors, Specific capacitance, Electrochemical performance, XRD

CMPA-138

Influence of Oxygen Flow Rates on Properties of Cu-Doped Tio_2 Thin Films Grown by DC Magnetron Sputtering

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Abstract: We report the deposition and property evaluation of Cu-doped TiO_2 thin films on glass substrates using reactive DC magnetron sputtering, by varying oxygen flow rates. Structural, morphological, and Optical studies of the films are systematically investigated. According to the XRD analysis of Cu-doped titanium dioxide, it was observed that all the samples exhibited amorphous nature. Optical study reveals that, after doping with copper the energy band gap was substantially decreased from 3.60 eV 1.59 eV with an increased oxygen flow rate. SEM analysis reveals that all the samples exhibited uniformly distributed and tightly packed grains, demonstrating robust adhesion to the substrate, and had no signs of pinholes and cracks. AFM analysis revealed a smooth surface, and the roughness of the film decreased with increasing oxygen flow rate from 3.76 nm to 1.51 nm. The choice of argon and oxygen ratio with the combination of annealing temperature of metal oxide films could further enhance parameters that will be beneficial for numerous applications

Keywords : DC magnetron sputtering, XRD, Morphology, Optical properties

CMPA-139

Identification of Potential Inhibitors of SARS-CoV-2 Through Virtual Screening, Crystallography, DFT, Docking and Molecular Dynamics Simulation Approach

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Abstract: In the realm of chemical research, the study of molecular structures with their properties is a cornerstone. The present study delves with the comprehensive structural investigations of Thiazole derivative (**TT7**) by employing a multifaceted approach. The *N-(4-methoxyphenyl)-4-phenylthiazole-2-carboxamide* (**TT7**) obtained via cyclization of *methyl 2-((4-methoxyphenyl)amino)-2-oxoethanedithioate* with α-haloketone and then characterized by 1H-NMR and 13C-NMR spectroscopy, and single crystal X-ray diffraction method. The crystallographic analysis yielded a precise 3D structure of the grown single crystal with Monoclinic crystal system under *C*2/c space group. The structure unveiled with the significant intermolecular interactions like C-H…O, C-H…π, C-O…π, and π…π interactions help to stabilize the compound **TT7**. The weak interactions formed in the solid structure of the compound **TT7** were meticulously investigated using theoretical approach like Hirshfeld surface analysis using crystallographic information file (.cif). Further, the density functional theory calculations have been performed to obtain the optimized geometry of the structure, and to explore the electronic properties of the molecule. The charge distribution on the molecular surface is analyzed by the molecular electrostatic potential (MEP) map. Quantum Theory of Atoms In Molecule (QTAIM) and Reduced density gradient (RDG) analyses were done to explore the weak interactions (intramolecular) in the compound **TT7** in the gaseous phase. Furthermore, the work ventures into potential biological significance by investigating the compound's antiviral property against SARS-CoV-2 main protease. *In silico* molecular docking analysis were performed to anticipate the most favourable binding configuration of the **TT7** within the active site of the receptor. Molecular dynamics simulations confirmed the inhibitory action of the newly synthesized compound (**TT7**). The binding free energy and contributed energies were determined using the MM-GBSA technique. The 6LU7-ligand complex has the highest binding free energy, with considerable contributions from covalent and van der Waals interactions.

CMPA-140

Optical Studies of ZnO/CuO Nanocomposite

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Abstract: In this study, ZnO/CuO (ZC) nanocomposite were synthesized by using the sol-gel method[1]. The samples were characterized using UV-Visible and Photoluminescence spectroscopy. The UV-spectra of the ZC nanocomposite showed the absorption peak at the wavelength of 400nm[2]. The calculated energy band gap for ZC nanocomposite using Taus's plot is 1.74 eV. Further, the photoluminescence (PL) spectral analysis at photoexcitation of 400 nm, showed the emission peak at the wavelength at 594 nm[3], with characteristic emission from the pure ZnO-CuO nanocomposite in the green region corresponding to a band gap of 2.07 eV[4].

Keywords: Nanoparticles, nanocomposites, zinc oxide nanoparticle, copper oxide nanoparticle.

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CMPA-141

3D Printed Biodegradable Polymer-Based Drug Delivery Implants for A Drop Free Post Cataract Surgery Magement

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Abstract: Cataracts affect millions of people globally, with surgery and intensive post-operative care being the standard treatment approach. However, the presence of ocular barriers often limits the effectiveness of drug delivery, potentially hindering recovery. This study explores a novel solution by developing a biodegradable, controlled-release implant using 3D printing technology as an alternative to eye drops in post-cataract surgery care. The implant is designed for placement into the capsular bag during surgery and utilizes Poly (lactic-co-glycolic acid) (PLGA) as a drug carrier. It delivers a combination of drugs including Dexamethasone, Moxifloxacin, and Nepafenac, directly into the eye. A two-step fabrication process involving hot-melt extrusion and 3D printing were employed to prepare the implants. Two types of implants were developed: one containing all three drugs and another containing only Moxifloxacin and Nepafenac, catering to patients unable to tolerate steroid medications. The implants were characterized, and their thermal behavior was studied. *In vitro* drug release profiles aligned with clinically prescribed regimens, while *in vivo* studies using a rabbit model demonstrated complete implant degradation between the fifth and sixth week. Recovery was observed, with intraocular pressure levels comparable to those in the positive control group which were treated with conventional eye drops. By integrating surgical and post-operative care, it reduces complications and offers an efficient, patient-friendly solution for managing post-cataract surgery treatment. Using this approach the patient can be 'Eye drop free' after cataract surgery.

Key words: PLGA implant; post cataract treatment; ocular drug delivery; 3D printed implant.

CMPA-142

Zinc Phthalocyanine-Based Composite for Photocatalytic Remediation of Methylene Blue Dye

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Abstract: Photocatalysis is an effective advanced oxidative process for degrading organic pollutants. The design and synthesis of effective molecular catalysts are essential for efficiently removing contaminants from water bodies. Due to the adjustable metal site, zinc phthalocyanines are well-known photosensitizers for various organic, inorganic, and biomolecular analytes. In this study, peripherally tetra-substituted zinc phthalocyanine was functionalized with multi-walled carbon nanotubes (MWCNT) and zinc oxide (ZnO) nanoparticles to investigate the photocatalytic activity against methylene blue under visible light irradiation. The structural, physical, and morphological properties of the newly developed composite were investigated by Ultra-Violet Visible spectrophotometer (UV-Vis), Fourier-Transform Infra-Red spectroscopy (FT-IR), and X-ray diffractometer (XRD), Field Emission Scanning Electron Microscopy (FESEM), and Energy-Disperse Spectroscopy (EDS). It was found that 91% of 100 ml of 10 ppm MB dye was removed using 0.4 g/L of the catalyst at pH 9 in 120min.

Keywords: Composites; Pollutant; Photochemical remediation; Metal complex.

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CMPA-143

Solid-State Lighting Properties of Samarium-Doped $SrAl_2O_4$ Phosphors

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Abstract: In this study, $SrAl_2O_4$ phosphors doped with various concentrations of samarium were synthesized via the solid-state reaction method to investigate their solid-state lighting (SSL) properties. The structural characteristics of the synthesized phosphors were analyzed using X-Ray Diffraction (XRD). Morphological features were further examined through Scanning Electron Microscopy (SEM). Photoluminescence (PL) studies were conducted to explore their optical properties. The study reveals that samarium-doped $SrAl_2O_4$ phosphors exhibit good orangish light emission, making them highly suitable for LED and other solid-state lighting applications.

CMPA-144

Development of Hydrogel-Based Facial Masks Incorporating Natural Antimicrobial Extracts for Skin Care

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Abstract: Facial skincare products often rely on synthetic ingredients that may cause irritation or harm sensitive skin. This research work focuses on developing an eco-friendly hydrogel facial mask that offers superior hydration and antimicrobial benefits, catering to the increasing demand for natural and sustainable skincare solutions. The hydrogel is synthesized using biodegradable polymers, primarily cellulose extracted from rice husk, combined with natural extracts such as aloe vera, neem, honey, and green tea. These extracts provide moisturizing, antioxidant, and antimicrobial properties, ensuring enhanced skincare without harmful chemicals. The hydrogel synthesis employs advanced 3D printing technology is used to fabricate precise molds for the hydrogel, allowing for personalized mask designs tailored to various facial contours. This approach enhances product usability and user experience. The final masks undergo extensive characterization to assess mechanical strength, cytocompatibility, and swelling behavior in different solutions. These tests ensure structural stability, safety for skin application, and effective ingredient release. The resulting product addresses common issues such as dry and dull skin, acne, and environmental skin damage, while avoiding potentially harmful ingredients found in conventional products. The expected outcome is a biocompatible and biodegradable hydrogel mask that provides prolonged hydration, soothing effects, and protection against skin damage, meeting consumer needs for effective and sustainable skincare products.

Keywords: Hydrogel; hydration; polymers, 3D printing; biocompatible.

CMPA-145

Advanced PVA-PPy Based Composite Materials for High-Efficiency Triboelectric Nanogenerators

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Abstract: Triboelectric nanogenerators (TENGs) have emerged as a promising technology for sustainable energy harvesting and powering small scale electronics. This study explores the fabrication and performance of polyvinyl alcohol (PVA)-based composites, which combines the inherent flexibility and processability of PVA with the enhanced triboelectric properties imparted by Polypyrrole (PPy) fillers. The PVA-PPy composite was synthesized by solution casting method. A systematic evaluation of the triboelectric output was conducted, focusing on the influence of filler concentration, material morphology, and electrical responses. It is observed that incorporation of PPy into PVA, increased the surface area by forming porous or rough structures of the composite film. The resulting PVA-PPy composite TENG demonstrated a peak output voltage of 248 V and a current of 12.21 μA, outperforming pure PVA-based device. Furthermore, the device was utilized to power 60 LEDs and to charge electrolytic capacitors and exhibited excellent mechanical robustness and stability. This work highlights the potential of PVA composites as an eco-friendly, scalable, and relatively efficient material for TENG applications, providing a pathway towards sustainable energy solutions for wearable electronics.

CMPA-146

Adsorption and Photocatalytic degradation of Emerging pollutants from aqueous phase

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Abstract: Emerging pollutants are diverse contaminants, including pharmaceuticals, personal care products, endocrine-disrupting chemicals, pesticides, and industrial chemicals that have increasingly appeared in aquatic ecosystems in the past few decades. Emerging pollutants may be present only in trace amounts but they can bioaccumulate and contribute to the disruption of the marine ecosystem and pose risks to the health of living beings. There is a need to eradicate these emerging pollutants for water resource protection purposes, environmental sustainability, and protection of public health. Hence, advanced treatments like adsorption and photocatalysis have been developed to counter the growing necessity of such ends. The present work focuses on studying spinel ferrite nanostructures' morphology-dependent catalysis. An economically viable sol-gel method was used to synthesize this nanoparticle. The synthesized sample was characterized by powder X-ray diffraction (XRD), Fourier Transform infrared (FTIR), Scanning electron microscopy (SEM), and UV–visible spectrophotometer. The results confirmed the formation of desired morphologies of cubic spinel ferrite with a narrow band gap (1.92 eV). It suggested the use of spinel ferrite nanostructure as potential visible light photocatalysts. Therefore, the application of synthesized nanostructure was studied in the photocatalytic degradation of emerging pollutants from the aqueous phase.

CMPA-147

Bismuth Vacancy Induced Pseudo Cubic Structural Phase Transition in Rhombohedral $La_{0.7}Ba_{0.3}MnO_3$: A Scope for Magnetic Hyperthermia

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Abstract: The major objective of this scientific inquiry was to revisit first reported Lanthanum based colossal magneto resistive manganite (LaBa)MnO_3 and substitute it with bismuth to tune its magnetic transition temperature steadily to different temperature regimes. The exercise was expected to result in structural, morphological and magnetic modification owing to Lewis acid nature of Bi^{3+} ion and due to the large diffusivity of Bi_2O_3 at high processing temperatures. Unexpectedly a whole new spectrum of physical properties was observed in an attempt of Bi3+ substitution to La^{3+} in $La_{0.7}Ba_{0.3}MnO_3$. A substitution induced structural transition from $R\bar{3}c$ to Pm-3m is manifested at 20% of Bi substitution. The reversal to high symmetry structure upon Bi substitution in La-based manganites is first of kind, so a root for concentration dependent phase change is investigated meticulously using X-ray diffraction, Fourier transformed infrared spectroscopy and x-ray photoelectron spectroscopy. A-site cationic vacancies generated due to the Bi segregation from the lattice is found responsible for structural transitions. The temperature dependent magnetization study revealed Bi assisted steady tuning of curie temperature from 333K to room temperature (293K) in going from 0 to 10% substitution. The exceptional occurrence of transition temperature at 315K and outstanding magnetic entropy change of 70×10^{-3} $J.kg^{-1}.K^{-1}$ at magnetizing intensity of just 0.05T in 5% Bi substituted samples opens window of scope to be exploited in medical application; magnetic hyperthermia based cancer therapy. A qualitative discussion on suitability of a magnetic specimen for magnetic hyperthermia using a temperature dependent magnetization features and phenomenological model is carried out.

Keywords: Mixed Valent Manganites; Perovskites; X-ray Photoelectron Spectroscopy; Magnetic Hyperthermia.

CMPA-148

Structural and Optical Properties of Tb^{3+} DOPED $Ba_2ZnSi_2O_7$ Phosphors For Solid State Lighting Applications

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Abstract: In the present work, we have successfully synthesized Akermanite structured $Ba_2ZnSi_2O_7$ (BZS) doped Tb^{3+} phosphor using high temperature solid state reaction method. Using $BaCO_3$, ZnO, SiO_2 and Tb_4O_7 precursors in their stoichiometry ratio grounded well and heated at 1200°C for 6 hours [[1]]. With the use of several characterization procedures, the produced phosphor is analysed. For the purpose of confirming the compound's synthesis, the sample's X-Ray diffraction patterns were collected and compared to a reference powder diffraction pattern. Fourier Transformed Different bonds in the sample were identified using infrared spectroscopy. Using the prepared phosphors photoluminescence spectra, optical characteristics were investigated. It was observed that BZS has an emission peak at uv region for an excitation wavelength of 240 nm [[2], [3]]. Diffused reflectance spectra were utilised to calculate the material's band gap. All of these findings demonstrate that phosphor can be produced via the high temperature solid state reaction technique. Additionally, BZS delivers good optical qualities and strong thermal stability, making it a good choice of matrix for potential applications in solid state lighting applications.

Keywords: Phosphors, Optical, Lighting, Green light

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CMPA-149

Chiroptical Switching in Peptide Self-assembly with Tunable Piezoelectric Behavior Through Pathway Complexity

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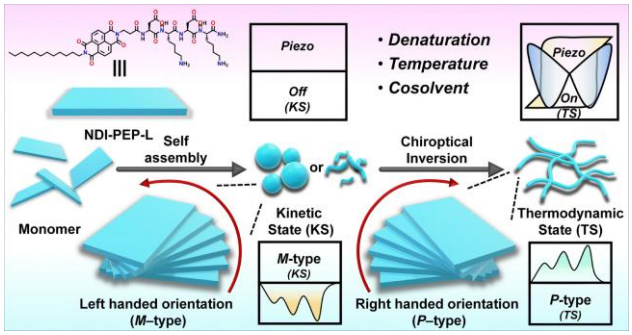
Abstract :



In recent years, piezoelectric materials have garnered significant attention due to their potential in advanced sensing, actuation, and energy-harvesting applications. However, achieving precise control over piezoelectric properties in molecular systems remains a key challenge. Here, we investigate the supramolecular self-assembly of naphthalene diimide (NDI)-conjugated tetrapeptides, NDI-PEP-L and its enantiomer NDI-PEP-D, as a novel strategy to dynamically control and modulate piezoelectric responses through pathway complexity. These peptides, synthesized via solid-phase Fmoc chemistry, exhibit chirotopical switching driven by temperature, denaturation processes, and cosolvent composition. The switching mechanism transitions the self-assembled structures from kinetically stable M/P-type helical nanoparticles to thermodynamically stable P/M-type helical nanofibers, enabling the dynamic tuning of piezoelectric properties. This "on-off" piezoresponsive behavior, validated across both enantiomers, demonstrates the potential for controlling molecular organization to enhance piezoelectric functionality. This work advances the understanding of peptide-based piezoelectric materials, offering a platform for designing dynamic, tunable systems with applications in next-generation smart materials and devices.

Scheme 1. Schematic representation of chiral switching of NDI-PEP-L through pathway complexity and the switchable piezoresponse

Keywords: Self-assembly, chiroptical, piezoelectric

CMPA-150

Peptide-Based Supramolecular Systems with Tunable Spacers for Conductivity and Piezoelectric Applications

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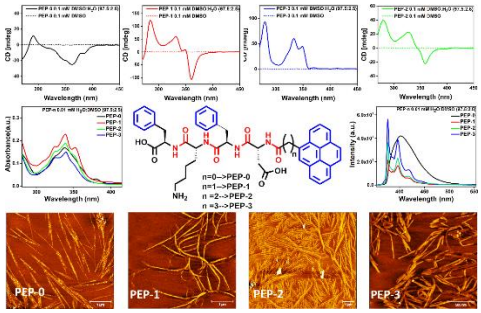
Abstract: Natural self-assembling systems have inspired the design of artificial supramolecular structures with applications spanning biomaterials, optoelectronics, and mechanical elastomers. This study investigates peptide-based supramolecular systems by systematically varying the linker length between a pyrene chromophore and an FKFD peptide motif to elucidate the role of spacer length in self-assembly behavior. Spectroscopic and microscopic analyses revealed that subtle structural modifications significantly impact π-stacking interactions, secondary structures, and nanostructure formation. Atomic force microscopy identified 1D fibrillar nanostructures in all derivatives, with variations in fibril length and flexibility arising from differences in molecular packing dictated by the chromophore-peptide angle.



Enhanced π-stacking interactions resulting from optimized linker lengths improve charge transport, highlighting the potential of these nanostructures in conductivity applications such as organic semiconductors and biosensors. Additionally, the tunable fibrillar architectures and their inherent anisotropy suggest their utility in piezoelectric materials. This work underscores the significance of linker design in engineering multifunctional supramolecular systems with tailored properties for advanced applications in conductivity and piezoelectricity.

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

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CMPA-151

Temperature Dependent Luminescent Properties of Tungstate Phosphor

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Abstract: In this study, we have synthesized $Ca_2MgWO_6:Eu^{3+}$ phosphors and meticulously optimized the activator dopant concentration via photoluminescence emission spectroscopy. Comprehensive characterizations were conducted to probe the structural, optical, and thermal attributes of the optimized phosphor material. Additionally, temperature-dependent photoluminescence (TDPL) spectroscopy was employed to investigate the optical performance of the phosphor under up to 210°C. The findings revealed that the phosphor retained robust emission stability, exhibiting only a negligible reduction in luminescence intensity even at elevated temperatures. Owing to these remarkable properties, the optimized tungstate phosphor demonstrates significant potential for temperature sensing applications.

Keywords: Phosphor; Tungstate; TDPL; Optical properties

References:

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CMPA-152

Suberoylanilide Hydroxamic Acid with Novel Nano-Carriers for Drug Delivery and Brain Disease Treatment across the Blood-brain Barrier

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Abstract: The treatment of brain diseases faces many challenges, because of the impermeability of the blood-brain barrier (BBB). This will limit the efficiency of the current therapeutic. Advancements in drug delivery systems have enabled more effective treatments for brain diseases, by overcoming the challenge of the blood-brain barrier (BBB). Suberoylanilide hydroxamic acid (SAHA), a potent histone deacetylase inhibitor, has shown significant potential in treating neurological disorders such as neuroAIDS and Alzheimer's disease. This review aims to examine novel therapeutic approaches utilizing advanced nanocarriers and SAHA for effective drug delivery and neuroprotection in neuroAIDS and Alzheimer's disease. The methodology involved a comprehensive search across three major databases: PubMed, Scopus, and Google Scholar, across all the years. Search keywords included "SAHA", "Vorinostat", "Zolinza", "nanocarriers", "brain diseases", and "Blood-Brain Barrier". The SAHA-based different nano-carriers for drug delivery and brain disease treatment across the BBB were evaluated. Layer-by-layer (LbL) nanocarriers and polymeric systems are studied, which enhance the stability, bioavailability, and sustained release of SAHA. These systems were co-encapsulated with other therapeutic agents, such as antiretrovirals and neuroprotective drugs, to improve efficacy in treating Central Nervous System based disorders. This review highlights the potential of nano-carrier systems to revolutionize brain disease treatments by enhancing drug delivery and therapeutic. This study underscores the potential of advanced nanocarrier systems and chemically innovative compounds in addressing the challenges of neuroAIDS and Alzheimer's disease. This review will delve into SAHA with different nanocarriers in drug delivery and brain disease treatment across the BBB.

Keywords: Blood-brain barrier, Brain disease, Nanocarriers, SAHA.

CMPA-153

Production of Pyro-Oil and Its Transformation Into A Range of Valuable Products.

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Abstract: Environmental challenges, particularly global warming, have emerged as significant consequences of the industrialization of coal and the utilization of fire. Consequently, there is an increasing necessity for cleaner and more sustainable energy sources. Advanced techniques such as hydrothermal liquefaction (HTL) and pyrolysis facilitate the conversion of biomass, which is derived from organic materials, into usable fuels. The process of biomass pyrolysis yields hydrogen-rich gases and bio-oil, both of which can be refined for fuel applications. HTL is considered a more efficient approach in this context. Biomass is characterized by its abundance, versatility, and ability to utilize photosynthesis to mitigate CO_2 emissions. Furthermore, catalytic steam reforming can be employed to produce hydrogen from bio-oil, although challenges such as catalyst deactivation remain. Computational tools, including ASPEN Plus, play a crucial role in optimizing biomass conversion for industrial purposes. Biomass represents a viable and sustainable alternative to fossil fuels. ASPEN models the conversion of biomass into bio-oil, char, and gases through pyrolysis or gasification, using kinetic and lumped models to calculate energy balances, product yields, and economic feasibility based on parameters like temperature, pressure, and residence time. Pyrolysis, a thermal process at 300°C–900°C without oxygen, decomposes organic materials into gases, bio-oil, and char. Bio-oil can be used as a fuel such as hydrogen or feedstock, while char may enhance soil. The process aids in waste management and material recovery but requires careful energy and emission control. Bio-oil is pre-processed to remove impurities before being steam-reformed at high temperatures to produce hydrogen, carbon monoxide, methane, and carbon dioxide. A water-gas shift reaction increases hydrogen yield, which is then purified using Pressure Swing Adsorption (PSA) or similar methods, making it suitable for fuel cells, chemical synthesis, or renewable energy storage.

CMPA-154

Synthesis, Characterization and Photo luminescence Properties of $ZnAl_2O_4$: x %Eu^{3+}, A^{n+} (x=7mol%, A^{n+} = Na^{+}, Mg^{2+}, Bi^{3+}, n=1,2,3) Phosphors for LED Applications.

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Abstract: $ZnAl_2O_4$, $ZnAl_2O_4$:xEu^{3+}(x=1-11 mol%) and $ZnAl_2O_4$: x %Eu^{3+}, A^{n+} (x=7mol%, A^{n+} = Na^{+}, Mg^{2+}, Bi^{3+}, n=1,2,3) phosphors were successfully synthesized by nitrate-citrate solution combustion method, calcinated at 900 ^{o}C for 4 hours. All physiochemical characterizations of the samples were done using Powder X-ray diffraction (PXRD), diffuse reflectance spectra (DRS), Fourier Transform Infra red spectroscopy (FTIR), Field emission scanning electron microscopy (FESEM) with energy dispersive spectroscopy (EDS), High resolution transmission electron microscopy (HRTEM) with SAED, X-ray photoelectron spectroscopy(XPS) and Photo luminescence (PL) techniques. All the samples were crystallized in a cubic phase, *Fd-3m* space group. The optimized $ZnAl_2O_4$:Eu^{3+} (7mol%) phosphors exhibits maximum PL intensity at the excitation of 278 nm and 393 nm. PL Spectra of co-doped $ZnAl_2O_4$: x%Eu^{3+}, A^{n+} (x=7mol%, A^{n+} = Na^{+}, Mg^{2+}, Bi^{3+}, n=1,2,3) phosphors excited at 393 nm shows the maximum emission for Mg^{2+} co-doped phosphor. Life time measurements and the CIE chromaticity coordinates of these reveals that, Eu^{3+} doped $ZnAl_2O_4$ and $ZnAl_2O_4$: x %Eu^{3+}, A^{n+} (x=7mol%, A^{n+} = Na^{+}, Mg^{2+}, Bi^{3+}, n=1,2,3) co-doped phosphors could be employed as a potential red light-emitting phosphor for LED applications.

Keywords: Red-emitting phosphor, combustion Cubic phase, Photoluminescence, doping and co-doping

CMPA-155

WO_3 Bio-Nanocomposite for Fabrication of Flexible Memristor Device

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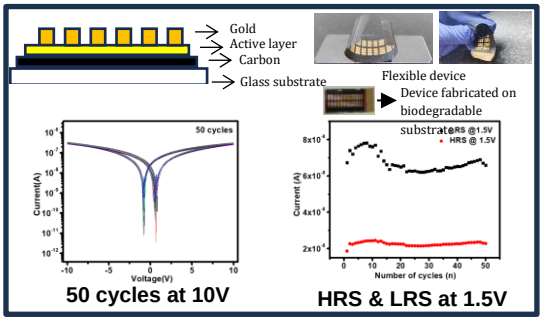
Abstract: Memristors play a vital role in the field of electronic devices and memory storage. These b devices find attractive applications as efficient information storage and therefore will be part of next-generation computing technologies. Researchers are exploring various materials for their optimum 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 the present work, we have synthesized WO_3 nanoparticles employing a simple wet chemical method characterized by XRD, Raman Spectroscopy, FESEM, UV-DRS, and FTIR to study their properties. In particular, we have chosen WO_3 with a sheet-like morphology having orthorhombic crystal structure for further studies. The nano WO_3 conjugated with a biomaterial is synthesized and utilized as the active material for the resistive switching device. The resistive switching device was fabricated on a biodegradable substrate having 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 $>10^1$ 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. This work also demonstrates the feasibility of flexible memristor device thus bridging the gap between sustainable material and advanced functionality.

Keywords: metal oxide; bio-nanomaterial composite; resistive switching; flexible.

Graphical abstract:



HRS- High resistance state

LRS- Low resistance state

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CMPA-156

Investigation on Thermoelectric Properties of Ni-Doped n-type $Bi_{1.8}Sb_{0.2}Te_3$ Alloy

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Abstract: The study explores the effect of Ni doping on the thermoelectric properties of the $Bi_{1.8}Sb_{0.2}Te_3$ alloy. The $Bi_{1.8}Sb_{0.2}Te_3$/x% Ni ($0 \leq x \leq 5$) sample is prepared via the solid-state reaction method yielding homogeneous dense compounds with a rhombohedral crystal structure and a granular morphology seen in the doped samples. Electrical resistivity increased with temperature, attributed to Ni atoms promotes carrier scattering and affects the carrier mobility thereby increasing the resistivity for doped samples. Negative Seebeck coefficients suggested electron-dominant charge carriers, with similar trends across doping concentrations due to minor effect of Ni on the effective mass and density of states. the highest Seebeck coefficient was found to be 185 μV/K for the $Bi_{1.8}Sb_{0.2}Te_3$/3%Ni sample. The lattice thermal conductivity dominates in total thermal conductivity exhibits the Umklapp process and the addition of Ni into the matrix of the alloy decreases the lattice thermal conductivity at higher temperatures was attributed to the intrinsic excitation. The electronic thermal conductivity predominates at higher temperatures and the lowest thermal conductivity of 19 mW/cm-K at 350K exhibits for pure sample. The highest power factor ~1.5 mW/mK^2 is almost similar for 3 samples x = 0, 1 and 3% Ni at 350 K due to the combination of electrical conductivity and the Seebeck coefficient. The highest ZT was found to be 0.26 for the pristine sample at 350 K.

Keywords: Thermoelectric; Doping.

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CMPA-157

Crystalline Perfection and Thermoelectric property investigation of Melt-grown Sb, Se co-doped Bi_2Te_3 single crystals

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Abstract: Thermoelectric (TE) materials have found uses in various industries. Due to its extraordinary thermoelectric capabilities, bismuth telluride (Bi_2Te_3) stands out among these materials as a well-known and thoroughly investigated thermoelectric material. Bi_2Te_3, a thermoelectric material known for its exceptional performance at low temperatures, is used in Peltier coolers and refrigeration devices that operate under similar conditions. This research focuses on generating Bi_2Te_3 single crystals utilizing a highly efficient Melt-growth process. Powder XRD is used to determine the crystal structure and lattice properties. The crystalline quality of the samples is determined by High Resolution-XRD, which confirms a layered structure. Raman spectroscopy reveals three distinct peaks typical of bulk Bi_2Te_3. In addition, particle size analysis is performed to ascertain the precise crystallite size of the materials. The present work emphasizes the study of the Thermoelectric properties of Sb and Se-doped Bi_2Te_3 single crystals in the 10-400 K temperature range. The thermoelectric performance shows significant enhancement as the Seebeck coefficient increases to 253μV/K in $Bi_2Te_{2.7}Se_{0.3}$ and 211μV/K in $(Bi_{0.98}Sb_{0.02})_2Te_{2.7}Se_{0.3}$ which is equivalent to required value for Thermoelectric modules getting used in present cooler applications. Comparatively, the electrical conductivity rises by a factor of 3 for $Bi_2Te_{2.7}Se_{0.3}$ and 2.5 times for $(Bi_{0.98}Sb_{0.02})_2Te_{2.7}Se_{0.3}$ crystals at 400 K, in contrast to Bi_2Te_3. Moreover, the power factor experiences a remarkable 30-fold and 20-fold improvement for $Bi_2Te_{2.7}Se_{0.3}$ and $(Bi_{0.98}Sb_{0.02})_2Te_{2.7}Se_{0.3}$, respectively. Furthermore, the figure of merit values exhibits a significant enhancement by 28.5 times for $Bi_2Te_{2.7}Se_{0.3}$ and 14 times for $(Bi_{0.98}Sb_{0.02})_2Te_{2.7}Se_{0.3}$, compared to pristine Bi_2Te_3. The overall result implies a significant enhancement in the thermoelectric parameters of melt-grown Bi_2Te_3 single-crystal material.

Keywords: single crystal, particle size analysis, crystalline perfection, melt-growth

CMPA-158

Effect of Sputtering Pressure on The Preferred Orientation of Aluminum Nitride (Aln) Thin Films Deposited using RF Magnetron Sputtering.

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Abstract: Since the development of MEMS technology, piezoelectric thin films have been the material of interest for both transduction and sensing applications. Aluminium nitride (AlN) thin films have gained a lot of attention as a potential candidate material due to their unique properties such as CMOS compatibility, high-temperature resistance and hardness, etc. [1] . However, AlN's piezoelectric coefficient depends on the crystal structure and growth direction. Generally, (002) orientation yields good piezoelectric response in AlN. In this study, the effect of sputtering pressure on the orientation of AlN films on sapphire substrates was analyzed. The films were deposited using radio frequency magnetron sputtering at a substrate temperature of 300 °C, Ar/N_2 concentration of 3:1, RF power of 175 W, and target-to-substrate distance (TSD) of 8 cm. It was observed from the XRD plots that highly (002) oriented films, along with minute (101) and (100) peaks, were grown at lower pressures. With the increase in the sputtering pressure, the intensity of (101) peaks goes on increasing at the expense of the intensity of (002) peak, which is attributed to the decrease in the mean free path of sputtered particles at higher sputtering pressures, causing the sputtered particles to lose most of their kinetic energy before reaching the substrate surface. Consequently, the atoms on the surface find it difficult to rearrange into the close-packed (002) plane, which has a higher formation energy. Higher sputtering pressure favors the formation of the (100) plane because there is less bombardment of ejected Al atoms on the growth layer [2], [3], [4]. Therefore, decreasing pressure is beneficial for the preferential growth of the closely packed (002) plane, while higher sputtering pressure leads to the deterioration of the (002) orientation.

Keywords: AlN thin films; RF magnetron sputtering; sputtering pressure.

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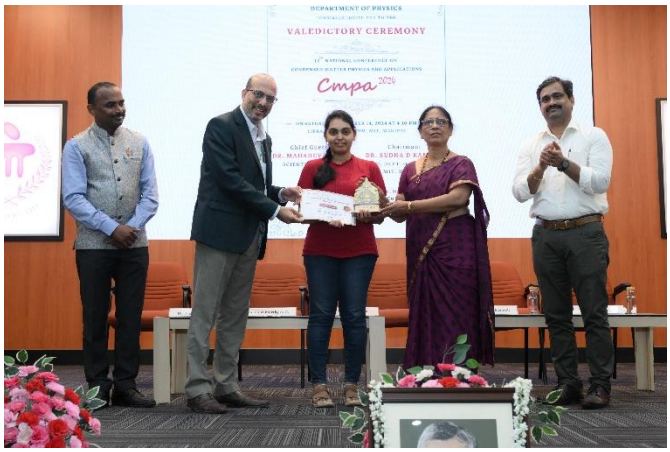

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