

# Indo-Europe Joint Conference

Proceedings of the

## Second International Conference on Advancements in Materials Science and Technology – iCAM 2022



Venue:  
*Sathyabama Institute  
of Science and  
Technology, India.*

November 2-4, 2022

*Jointly Organized by*



Editors

*D. Dinesh Kumar*

*T. S. Shyju*

*A.M. Kamalan Kirubaharan*

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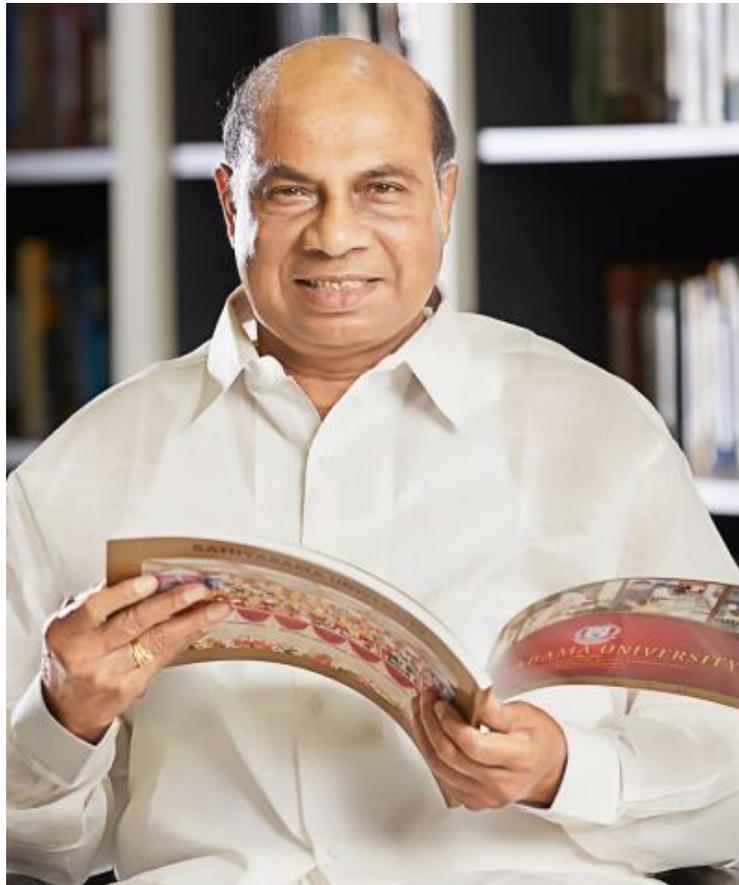
India – Europe Joint Event

Second International Conference on  
**Advancements in Materials Science and Technology**  
(iCAM 2022)



November 02 – 04, 2022

## FOUNDER CHANCELLOR'S VISION



Sathyabama Institute of Science and Technology was established with the goal of providing everyone with access to high quality higher education. Sathyabama Institute was founded on the principles of upholding moral principles, maintaining order, and developing technical talent for the benefit of our society. The goal was to bring the Institution to the fore front in the national and international arena. As a pioneering higher education Institute in the country, Sathyabama has always been an Institution par excellence in contributing to the social and economic development of the nation. Col. Dr. Jeppiaar's vision was that Institute should remain as a true role model to provide opportunity for everybody to succeed both in professional and personal life.

## CHANCELLOR'S DESK



### MESSAGE

I am delighted to learn that the Centre for Nanoscience and Nanotechnology, Centre of Excellence for Energy Research, Sathyabama Institute of Science and Technology is jointly organizing a Second International Conference on “Advancements in Materials Science and Technology” (iCAM-2022), during 02-04, November 2022 in association with Centre for Functional and Surface-Functionalized Glasses, Alexander Dubček University of Trenčín, Slovakia. I am delighted to welcome you all to the iCAM-2022. The purpose of this International conference is to promote research in Materials Science & Technology and focusing research more on ENERGY, GLASS CERAMICS, SURFACE ENGINEERING, FUNCTIONAL MATERIALS, SENSORS, PROCESS and MECHANICAL BEHAVIOR and its applications. I am confident that this conference will offer a special chance for students, young researchers, academicians, and entrepreneurs to participate and learn about developments in the field of materials science and technology. I congratulate the Conference organisers and scientists from Centre for Nanoscience and Nanotechnology and Center of Excellence for Energy Research, for their hard work in organizing this Conference. I wish this conference a great success.

**Dr. MARIAZEENA JOHNSON**

Chancellor

Sathyabama Institute of Science and Technology, Chennai – 600119, India.

## PRESIDENT'S DESK



### MESSAGE

I am glad to note that Centre for Nanoscience and Nanotechnology, Centre of Excellence for Energy Research, Sathyabama Institute of Science and Technology is jointly organizing a Second International Conference on “Advancements in Materials Science and Technology” (iCAM-2022), during 02-04, November 2022, In association with Centre for Functional and Surface-Functionalized Glasses, Alexander Dubček University of Trenčín, Slovakia. It is my pleasure to welcome all of you to the iCAM 2022. In the 21<sup>st</sup> century, nanostructured materials have become a key role in various aspects of science and technology. iCAM2022 highlights the importance of sustainable materials design, development and performance of several systems associated with nanoscience and technology.

I am grateful and express my sincere gratitude to all committee members of the iCAM 2022 for their constant support and hard work that have been envisaged in bringing out good quality research findings from delegates across the globe. In addition, my sincere thanks to eminent speakers from the various parts of globe for spending their valuable time to share their knowledge with the delegates of iCAM 2022. I congratulate the organizers and scientists from Centre for Nanoscience and Nanotechnology, Centre of Excellence for Energy Research on their constant effort and wish the conference a grand success.

**Dr. MARIE JOHNSON**

President

Sathyabama Institute of Science and Technology, Chennai – 600119, India.

## VICE CHANCELLOR'S DESK



### MESSAGE

I welcome all delegates to the Second International Conference on “Advancements in Materials Science and Technology” (iCAM-2022), jointly organized by Centre for Nanoscience and Nanotechnology, Centre of Excellence for Energy Research, Sathyabama Institute of Science and Technology & Centre for Functional and Surface-Functionalized Glasses, Alexander Dubček University of Trenčín, Slovakia during November 02-04, 2022. It is my pleasure to welcome all of you to the iCAM 2022. The iCAM 2022 has the potential to develop a platform for the transformation of research plans and execution of experiments to produce products and start-ups in the most challenging fields of Materials Science and Technology. The scope of the conference theme is quite wide and involves ENERGY, GLASS CERAMICS, SURFACE ENGINEERING, FUNCTIONAL MATERIALS, SENSORS, PROCESS and MECHANICAL BEHAVIOR and their applications. In addition to that emphasis is focused on different approaches and huddles in basic research in the field of Solar Photovoltaics & Solar Thermal, Batteries & Supercapacitors, Photocatalysis & Electrocatalysis, Solid Oxide Fuel Cells, Thermoelectric, Biofuels, Transparent Glass-Ceramics, Glass-ceramic Compositions, Applications of Glass-ceramics, Dental Glass-Ceramics, Bioactive glass-ceramics, Glass Crystallization, Coatings and Thin Films, Corrosion and Erosion, Thermal Barrier Coatings, Optical Coatings, Laser Texturing, Laser Modification, Chemo Sensors, Biosensors, Gas Sensors, Electrochemical Sensors, Wearable Sensors, Piezo Sensors, Crystal Growth, Nanocomposites, Carbon-Carbon Composites, Shape Memory Alloys, Magnetic Materials, Biomaterials, Ceramics and Polymers, Photo/Electrochromic, Metal, Alloys and Superalloys, Welding and Joining, Additive Manufacturing/3D printing, Tribology of Materials, Coatings Tribology, Bio- and Tribo-Corrosion, Bio tribology, Nanomechanical Properties, Implants and Coatings e.t.c, I am very confident that this iCAM 2022 would contribute to the evolution of inter-disciplinary and inter-institutional programmes by exchanging innovative ideas and knowledge. I wish all attendees of the Conference iCAM 2022 to have successful discussions. I wish this Conference a grand success.

**Dr. T. SASIPRABA**

Vice Chancellor

Sathyabama Institute of Science and Technology, Chennai – 600119, India.

## ABOUT THE CONFERENCE (iCAM 2022)

The 2<sup>nd</sup> International Conference on ADVANCEMENTS IN MATERIALS SCIENCE & TECHNOLOGY (iCAM-2022) is held during 02–04, November 2022. The objective of the conference is to highlight the current research in the thrust areas of materials science and technology. The iCAM-2022 is dedicated to bringing up substantial discussions on major sectors of advanced materials processing, characterization techniques, modeling & simulation, material properties, performance and device fabrication in the field of ENERGY, GLASS CERAMICS, SURFACE ENGINEERING, FUNCTIONAL MATERIALS, SENSORS, PROCESS and MECHANICAL BEHAVIOR. This conference shall be a platform and opportunity to learn and share the latest research experience, insights of the research scholars, faculty, scientists and industry professionals and also to offer solutions to the issues in the field of materials science. This Conference also focus on the core thematic areas such as, Solar Photovoltaics & Solar Thermal, Batteries & Supercapacitors, Photocatalysis & Electrocatalysis, Solid Oxide Fuel Cells, Thermoelectric, Biofuels, Transparent glass-ceramics, Glass-ceramic compositions, Applications of glass-ceramics, Dental glass-ceramics, Bioactive glass-ceramics, Glass crystallization, Coatings and Thin Films, Corrosion and Erosion, Thermal Barrier Coatings, Optical Coatings, Laser Texturing, Laser Modification, Chemo sensors, Biosensors, Gas Sensors, Electrochemical Sensors, Wearable Sensors, Piezo Sensors, Crystal Growth, Nanocomposites, Carbon-Carbon Composites, Shape Memory Alloys, Magnetic Materials, Biomaterials, Ceramics and Polymers, Photo/Electrochromic, Metal, Alloys and Superalloys, Welding and Joining, Additive Manufacturing/3D printing, Tribology of Materials, Coatings Tribology, Bio- and Tribo-Corrosion, Bio tribology, Nanomechanical Properties, Implants and Coatings e.t.c, This Conference includes keynote lectures from eminent scientists across the globe, special talks from various companies in advanced instrumentations and their applications at atomic scale and oral presentations by scientists /academicians/scholars/ students on various aspects in Materials Science and Technology. The iCAM 2022 Conference helps in bridging the gap between academia and industries for overall societal development. The selected full-length articles will be published in peer-reviewed Journals such as Materials Today: Proceedings, Special Issue on Coatings: Ceramic Materials and Coatings- Materials to Applications and Special Issue on Ceramic Coatings for High Temperature Applications published by Multidisciplinary Digital Publishing Institute (MDPI).

## ABOUT SATHYABAMA, INDIA

Sathyabama Institute of Science and Technology (Deemed to be University), a pioneer University in engineering, science and technology education for more than three successful decades. Sathyabama offers multi-disciplinary academic programmes in various fields of Engineering, Science, Technology, Law, Dental Science, Pharmacy, Nursing, Management, Arts and Allied Health Sciences. The Institute has established world class research centres with several advanced facilities and equipments to carry out research and development in several frontier areas such as nanoscience and nanotechnology, energy, molecular and nanomedicine, climate change, waste management, remote sensing, etc. The Ministry of Human Resource Development (MHRD), Government of India has declared it as Category 'A' University. The National Institutional Ranking Framework (NIRF), has ranked the University in the Top 50 Universities, consecutively for the past six years which has placed the institute in the elite category in India. Sathyabama has received the maximum five-star ratings for teaching, inclusiveness and facilities and four-star ratings for employability and innovation. The Institute has been awarded the highest Diamond Rating by QS - iGAUGE, a rating for Indian Universities by QS. The Institute has a team of dynamic and outstanding faculties, with innovative pedagogical practices and state-of-the-art research facilities. Funded projects worth of Rs. 300 Crores from various Government and Private agencies and organizations have been sanctioned and many of them have been successfully completed. The institute has been granted 100+ patents and awaiting grant of patents for more than 500+ products and inventions and was ranked among the category Institutions in the country for Innovation by ARIIA Ranking. The Institute has launched the first successful student satellite "SATHYABAMASAT" designed and developed by faculty and students in association with Indian Space Research Organization (ISRO), Government of India. Sathyabama has been organizing National and International Conferences every year in broader areas of Engineering, Science and Technology, which serve as a platform for researchers all over the world, to share and enrich their knowledge. For more details, please visit: [www.sathyabama.ac.in](http://www.sathyabama.ac.in).

## ABOUT CENTRE FOR NANOSCIENCE AND NANOTECHNOLOGY

The Centre for Nanoscience and Nanotechnology was established in January 2006 at the University campus to accomplish the goal of enhancing advanced research in the areas of Nanoscience and Nanotechnology. The leading area of research includes nanomaterials, nanotechnology, composite materials, nanoelectronics and nanofabrication. In addition to research, the centre also conducts training and awareness programme, workshops, national and international conferences on recent trends and developments on various themes of national interests. The Centre is undertaking research and development projects from various national/international funding agencies.

The centre has equipped with many core research facilities for coatings deposition including RF/DC magnetron sputtering, Pulsed Laser Deposition (PLD), E-Beam Evaporation and Thermal Evaporation; and characterization facilities such as High-resolution Transmission Electron Microscopy (HRTEM), Field Emission Scanning Electron Microscopy (FESEM), Atomic Force Microscopy (AFM), Raman Spectroscopy, Glancing Angle X-Ray Diffraction (GIXRD), Linear Reciprocating Tribometer (LRT), Stylus Profilometer, Electrochemical Impedance Spectroscopy (EIS), and Fluorescence spectroscopy etc. Through these cutting-edge research facilities, we are developing innovative technologies for the industrial and social benefits. Please visit: [www.centrefornanotechnology.com](http://www.centrefornanotechnology.com)

## ABOUT THE CENTRE OF EXCELLENCE FOR ENERGY RESEARCH

The Centre of Excellence for Energy Research (CEER) funded by the **Ministry of Human Resource Development (MHRD)**, Govt. of India was inaugurated by His Excellency **Dr. A. P. J. ABDUL KALAM**, Former President of India on December 9th, 2014 in the august presence of **Col. Dr. JEPPIAAR**, Founder and Chancellor of the Sathyabama Institute of Science and Technology. This Centre was generously funded by MHRD, under the scheme of Centre of Excellence in the Frontier Areas of Science and Technology (FAST) for the establishment of “Centre of Excellence for Energy Research (CEER)” to promote research activities in the area of Solar Photovoltaics, Fuel Cells, Supercapacitors, Photocatalysis and Bio-energy etc.

The main objectives of this Centre of Excellence are to promote education, training, research and developmental programmes in the novel and newly emerging areas of energy research and to develop cost effective, efficient and sustainable technologies for the energy needs of the nation. The Centre also aims to enhance the quality and quantity of basic and applied research programs. The Centre organizes workshops/conferences for students, researchers, academic staff, and scientists in India to further strengthen their expertise in the areas of energy research, to accelerate the India’s human development index and to provide energy security.

The Centre is established in the International Research Centre (IRC) with facilities such as Raman Spectroscopy (Renishaw inVia Reflex Raman spectrometer), DEKTAK profilometer from ( Bruker, USA), Potentiostat,- Galvanaostat with Impedance Analyser (Biologic, France), Hall Effect measurement system (Ecopia, South Korea), Raman Spectroscopy (Renishaw, United Kingdom), UV-Visible Spectroscopy (Jasco Analytical Instruments), 50L Biodiesel Pilot plant (Malnad Extraction Industries Bangalore, India), Gas chromatography (YL Instrument South Korea) and Advanced Photoreactor. The major research laboratories established are Photovoltaics, Surface Physics, Energy Materials, Materials Chemistry, Materials Processing and Bio fuels.

# ABOUT FUNGLASS, Alexander Dubček University of Trenčín, Slovakia

CENTRE FOR FUNCTIONAL AND SURFACE-FUNCTIONALIZED GLASSES is the project supported by the 8<sup>th</sup> European Framework programme for Research and Innovation HORIZON 2020. It is based at Alexander Dubček University of Trenčín (Slovakia, coordinated by Prof. Dušan Galusek). Project partners include Friedrich-Alexander University Erlangen-Nürnberg (Germany, with Prof. A. Boccaccini), Friedrich Schiller University Jena (Germany, with Prof. L. Wondraczek), Spanish National Research Council (Spain, with Prof. A. Durán) and University of Padova (Italy, with E. Bernardo).

The scope of the project is the upgrade of existing Centre of excellence for ceramics, glass, and cement, to an internationally recognized Centre for functional and surface-functionalized glasses. The new centre will be specialized in cutting edge research in the area of glasses with special functional properties (luminescence, electric), and in the functionalization of conventional glasses with the aim of modification of their properties, and adding new functionalities. These would comprise reflection, and anti-reflection coatings for solar energy production and optoelectronic applications, increase of glass strength, enhancing the corrosion and leaching resistance of commercially produced glasses, self-cleaning/antibacterial coatings of glasses for medical applications, including modification/enhancement of bioactivity. The research topics would include also utilization of waste materials for production of glasses and glass-ceramic materials with high added value. The project will be aimed at establishment of the Centre as a joint venture of all participating institutions, creation and formalizing the coordination and management structures, upgrading the research infrastructure, expansion of personal capacity of the existing centre to the level facilitating achievement of the critical mass for R&D activities, with special attention paid to hiring high quality researchers and engineers from abroad, in order to create creative international environment, and formation of close ties with regional and European glass industries for efficient knowledge transfer.

## PREFACE

I take immense pleasure in welcoming our patrons, chief guests, distinguished delegates, participants, scientists, research scholars and students for the Second International Conference on “Advancements in Materials Science and Technology” (iCAM-2022), jointly organized by Centre for Nanoscience and Nanotechnology, Centre of Excellence for Energy Research, Sathyabama Institute of Science and Technology & Centre for Functional and Surface-Functionalized Glasses, Alexander Dubček University of Trenčín (Slovakia) during 02-04, November 2022.

The *iCAM-2022* includes basic & advanced research in the fields of Solar Photovoltaics & Solar Thermal, Batteries & Supercapacitors, Photocatalysis & Electrocatalysis, Solid Oxide Fuel Cells, Thermoelectric, Biofuels, Transparent glass-ceramics, Glass-ceramic compositions, Applications of glass-ceramics, Dental glass-ceramics, Bioactive glass-ceramics, Glass crystallization, Coatings and Thin Films, Corrosion and Erosion, Thermal Barrier Coatings, Optical Coatings, Laser Texturing, Laser Modification, Chemo sensors, Biosensors, Gas Sensors, Electrochemical Sensors, Wearable Sensors, Piezo Sensors, Crystal Growth, Nanocomposites, Carbon-Carbon Composites, Shape Memory Alloys, Magnetic Materials, Biomaterials, Ceramics and Polymers, Photo/Electrochromic, Metal, Alloys and Superalloys, Welding and Joining, Additive Manufacturing/3D printing, Tribology of Materials, Coatings Tribology, Bio- and Tribo-Corrosion, Bio tribology, Nanomechanical Properties, Implants and Coatings e.t.c.. I think that this conference provides a forum for young professionals to network with established academics and business leaders and opens the door for them to stay with current developments in the field of materials science and technology.

I also express my deepest gratefulness to the Management, Sathyabama Institute of Science and Technology and our beloved Founder Chancellor Late Col. Dr. JEPPIAAR and our Chancellor Dr. Mariazeena Johnson, President Dr. Marie Johnson and Vice Presidents for providing us great opportunity to conduct the *iCAM 2022*. I salute the advisory committee members, conveners, and organising team members from different institutions who have worked incredibly hard to connect the delegates all around the entire globe.

On behalf of Sathyabama Institute of Science and Technology I thank all the academicians, experts, consultants, researchers, entrepreneurs and industrialists for having accepted our invitation to grace the conference.

**Dr. T. SASIPRABA**

Vice Chancellor & Organizing Secretary

Sathyabama Institute of Science and Technology, Chennai, India.

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Alexander Dubček University of Trenčín.

## PROGRAM SCHEDULE

| DAY 1 (02-11-2022)        |  |
|---------------------------|--|
| TIME                      | SESSION DETAILS  |
| <b>INAUGURATION</b>       |  |
| 10.00 AM - 10.10 AM       | <b>Welcome Address &amp; Highlights of iCAM2022</b><br><b>Dr. P. KUPPUSAMI</b><br>Senior Scientist & Organising Chair<br>Sathyabama Institute of Science and Technology, Chennai, India.   |
| 10.10 AM - 10.20 AM       | <b>Presidential Address</b><br><b>Dr. T. SASIPRABA</b><br>Vice Chancellor & Organizing Secretary<br>Sathyabama Institute of Science and Technology, Chennai, India.  |
| <b>SESSION-I ENERGY</b>   |  |
| <b>10.20 AM - 1.00 PM</b> |  |
| 10.20 AM - 11.00 AM       | <b>Keynote Lecture</b><br><b>Prof. R. JAYAVEL</b><br>Dean, ACTECH, Professor, Crystal Growth Centre, Anna University, Chennai, India.<br><i>Title: Two Dimensional Nanocomposite Functional Materials For Energy Storage Applications</i>  |
| 11.00 AM-11.20AM          | <b>Tech-Talk</b><br><b>Dr. KARTHICK BALASUBRAMANIAN</b><br>Sales Development Manager, India & South Asia Electron Microscopy, Materials and Structural Analysis Division, Thermo Fisher Scientific India Pvt. Ltd.<br><i>Title: Talos S/TEM - Accomplish more with fast, precise, quantitative materials characterization in multiple dimensions</i> |
| 11.20AM-11.30AM           | <b>Tea Break</b>   |
| 11.30 AM - 1.00 PM        | <b>PAPER Presentations</b>   |

|   |   |                            |                            |
|---|---|----------------------------|----------------------------|
|   | Physical (Link-1)<br>EN   | Online (Link-2)<br>EN      | Online (Link-3)<br>EN      |
| <b><u>SESSION-II GLASS-CERAMICS</u></b><br>2.00 PM - 5.00 PM                    |   |                            |                            |
| 2.00 PM - 2.45 PM   | <b>Keynote Lecture</b><br><b>Prof. DUSAN GALUSEK</b><br>Director, Funglass-Alexander Dubček University of<br>Trenčín, Slovakia.<br><i>Title: Aluminate glasses: Why are they so special?</i>  |                            |                            |
| 2.45 PM-3.00PM  | <b>Tea Break</b>  |                            |                            |
| 3.00 PM - 5.00 PM   | <b>PAPER Presentations</b>  |                            |                            |
|   | Physical (Link-1)<br>GC   | Online (Link-2)<br>EN      | Online (Link-3)<br>EN      |
| <b>DAY 2 (03-11-2022)</b>   |   |                            |                            |
| <b><u>SESSION-III PROCESS AND MECHANICAL BEHAVIOR</u></b><br>09.30 AM - 1.00 PM |   |                            |                            |
| 09.30 AM - 10.20 AM   | <b>Keynote Lecture</b><br><b>Dr. M. VASUDEVAN</b><br>Associate Director, Metallurgy and Materials Group,<br>IGCAR, Kalpakkam, India.<br><i>Title: Advanced Welding Techniques for Similar and<br/>         Dissimilar Welding of Nuclear Structural Materials</i> |                            |                            |
| 10.20 AM-10.40 AM   | <b>Tech-Talk</b><br><b>Mr. PRASAD GOSAVI</b><br>National Product Manager, Characterization Division,<br>Anton Paar India Pvt. Ltd.<br><i>Title: Anton Paar Nano-indentation testing</i>   |                            |                            |
| 11.10 AM-11.20 AM   | <b>Tea Break</b>  |                            |                            |
| 11.20 AM - 1.00 PM  | <b>PAPER Presentations</b>  |                            |                            |
|   | Physical (Link-1)<br>MB & SS  | Online (Link-2)<br>MB & SS | Online (Link-3)<br>MB & SS |

| <b>SESSION-IV SURFACE ENGINEERING</b> |  |                               |                               |
|---------------------------------------|--|-------------------------------|-------------------------------|
| <b>2.00 PM - 5.00 PM</b>              |  |                               |                               |
| <b>2.00 PM - 2.45 PM</b>              | <b>Keynote Lecture</b><br><b>Dr. AMIRHOSSEIN PAKSERESHT</b><br>Associate Professor, Alexander Dubček University of<br>Trenčín, Slovakia<br><i>Title: New and Modern Thermal barrier coatings</i>   |                               |                               |
| <b>2.45 PM-3.00 PM</b>                | <b>Tea Break</b>   |                               |                               |
| <b>3.00 PM - 5.00 PM</b>              | <b>PAPER Presentations</b>   |                               |                               |
|                                       | <b>Physical (Link-1)<br/>SE</b>  | <b>Online (Link-2)<br/>SE</b> | <b>Online (Link-3)<br/>SE</b> |
| <b>DAY 3 (04-11-2022)</b>             |  |                               |                               |
| <b>SESSION-V FUNCTIONAL MATERIALS</b> |  |                               |                               |
| <b>09.30 AM - 1.00 PM</b>             |  |                               |                               |
| <b>9:30 AM-10.00 AM</b>               | <b>Invited Lecture</b><br><b>Dr. MANGALARAJA Ramalinga Viswanathan</b><br>Full Professor, Faculty of Engineering and Sciences<br>Adolfo Ibáñez University, Diagonal las Torres 2640,<br>Peñalolén Santiago, Chile.<br><i>Title: Nanotechnology: A path to build a smart world<br/>           with green energy and clean environment</i> |                               |                               |
| <b>10.00 AM - 10.50 AM</b>            | <b>Keynote Lecture</b><br><b>Dr. MANU JAISWAL</b><br>Associate Professor, Graphene & 2D Systems Research<br>Laboratory, IIT Chennai, India.<br><i>Title: Heat Transport in Two-dimensional Crystals: Many<br/>           Twists and Turns</i>  |                               |                               |
| <b>10.50 AM-11.00 AM</b>              | <b>Tea Break</b>   |                               |                               |
| <b>11.00 AM - 1.00 PM</b>             | <b>PAPER Presentations</b>   |                               |                               |
|                                       | <b>Physical (Link-1)<br/>FM</b>  | <b>Online (Link-2)<br/>FM</b> | <b>Online (Link-3)<br/>FM</b> |

| <u>ION-VI SENSORS</u><br>1.45 PM - 3.15 PM |  |
|--|--|
| 1.45 PM - 2.35 PM                          | <b>Keynote Lecture</b><br><b>Dr. VENKATARAMAN JAYARAMAN</b><br>Associate Director, Materials Chemistry & Metal Fuel<br>Cycle Group, IGCAR, Kalpakkam, India<br><i>Title: Hydrogen Sensors - ppb to Percentage Levels</i> |
| 2.45 PM - 3.15 PM                          | <b>VALEDICTORY FUNCTION</b>  |

## PAPER PRESENTATIONS SCHEDULE

## DAY 1 (02/11/2022)

## SESSION I: ENERGY

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| 1.    | <b>Electrically conducting Nitrogen and Boron co-doped nanocrystalline diamond nanowires for efficient UV light Photocatalytic dye degradation</b><br><i>Salila Kumar Sethy, Kamatchi Jothiramalingam Sankaran*, Mateusz Ficek, Surya Kanta Ghadei, Ajit Dash, Ramasamy Sakthivel, Robert Bogdanowicz</i> | OP-EN-042   | 24          |
| 2.    | <b>Enhanced Electrochemical Performance of All-Solid-State Lithium Ion Batteries</b><br><i>A. Gayathri, S. Kiruthika, K. Mahalakshmi, B. Muthukumaran</i>   | OP-EN-044   | 25          |
| 3.    | <b>Synthesis and Characterization of Luminescent WS<sub>2</sub> Nanosheets through One-step Liquid Phase Exfoliation</b><br><i>Srishti Agarwal, Shivam Tyagi, Dharendra Sahoo*, and Bhaskar Kaviraj</i>   | OP-EN-049   | 26          |
| 4.    | <b>Facile Synthesis of MnCo<sub>2</sub>O<sub>4</sub> Nanostructures for High Performance Supercapacitor</b><br><i>Panchshila S. Pawar, Pragati A. Shinde, A. P. Torane</i>  | OP-EN-052   | 27          |
| 5.    | <b>Insight on Structural, Mechanical, Optoelectronic and Thermoelectric Properties of Perovskite AgBaCl<sub>3</sub> by an Ab-Initio for Solar-cells and Renewable Energy</b><br><i>Arti Saxena, Aparna Dixit, Debidatta Bahera, Jisha Annie Abraham, Ramesh Sharma*, Sanat Kumar Mukherje</i>             | OP-EN-060   | 27          |

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| 6.  | <b>Photocatalytic Conversion of CO<sub>2</sub> to Methanol over Titanium Nanofibers under visible light radiation</b><br><i>Karan Gehlot, Sangeeta Tiwari</i>  | OP-EN-061 | 28 |
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| 9.  | <b>Crystal structure, morphology and photoluminescence properties of Er<sup>3+</sup> activated NaBi(MoO<sub>4</sub>)<sub>2</sub> phosphor for solid state lighting applications</b><br><i>Pranjali Sharma, Muskan, M. Jayasimhadri</i> | OP-EN-068 | 31 |
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# **KEYNOTE LECTURE**



## KEYNOTE LECTURE (SESSION I)

**Prof. R. JAYAVEL**

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**Two-Dimensional Nanocomposite Functional Materials for Energy Storage Applications**

Two dimensional Nanostructures are emerging futuristic materials for energy storage devices because of their unique properties with excellent functionality. The study of decorating the 2D nano sheets with inorganic functional materials such as metals, metal oxides and metal sulfides is now becoming a promising and challenging area for energy storage devices. In this study, reduced graphene metal-oxide composites with SnO<sub>2</sub>, CeO<sub>2</sub>, have been synthesized by homogeneous co-precipitation method. Multi-layered composite structures with 1 D carbon nanotubes integrated with 2 D graphene structures with the addition of 3 D bulk nanoparticles were prepared with improved properties. The structural properties of natural graphite, graphene oxide, graphene-metal oxide composites were studied. The electrochemical properties of Graphene-metal oxide composites reveal that these materials can be effectively used for supercapacitor application with improved specific capacitance, higher power density, energy density and cyclic stability. Heterostructures of different 2D materials have been fabricated to improve the electrochemical performance. Large area graphene films have also been fabricated and their functional devices.

## KEYNOTE LECTURE (SESSION II)

**Prof. DUŠAN GALUSEK**

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**Aluminate glasses: Why are they special?**

Aluminate glasses represent a specific group of materials which, in terms of the conventional rules of glass forming and structure, contain no typical glass former. Their structure is also specific, comprising  $AlO_x$  polyhedral structural units, which can be four-, five-, or six-coordinated, and connected not only through their vertices, but also through their edges and faces. As such, these glasses are rather difficult to prepare, due to their high melting temperatures and high tendency to crystallization, which require specific melting procedures ensuring high cooling rates at the level of  $10^3 \text{ K.s}^{-1}$ , and no contact with the walls of melting container to prevent heterogeneous nucleation. For that purpose, we developed a method of flame synthesis of these glasses, one of the few methods facilitating their preparation in technologically relevant amounts. The method yields aluminate glasses of various compositions in the form of microspheres, which can be further used as received, or sintered by viscous flow to obtain bulk glasses, glass-ceramic or ceramic materials.

The lecture gives an overview of our recent research activities in the processing and characterization of aluminate glasses in the system  $Y_2O_3-Al_2O_3$ , also with the addition of small amounts of various additives, which modify their optical and mechanical properties. Ce-doped glass with the composition equivalent to pseudo-binary eutectic in the system  $Al_2O_3-Y_3Al_5O_{12}$  (YAG) exhibits upon excitation by the NUV or blue light a strong tunable emission, ranging from blue, via white, to yellow/orange depending on the conditions of subsequent heat treatment and resulting phase composition (content and type of crystalline phases, composition of residual glass). Replacing rare earth elements in the glass by transition metals, such as Mn, offers an interesting

opportunity for the preparation of cost-effective luminescent materials with tunable luminescence.

Viscous flow pressure assisted sintering under strictly controlled conditions offers an interesting opportunity to prepare alumina glasses in bulk. This is demonstrated by the preparation of Ce-doped  $\text{Al}_2\text{O}_3\text{-Y}_3\text{Al}_5\text{O}_{12}$  glass with luminescent properties, by the preparation of a translucent bulk glass of the YAG composition at the temperature as low as 900 °C, translucent YAG polycrystalline ceramics at the temperature of 930 °C, as well as by the preparation of  $\text{Al}_2\text{O}_3\text{-Y}_3\text{Al}_5\text{O}_{12}$  and  $\text{Al}_2\text{O}_3\text{-Y}_3\text{Al}_5\text{O}_{12}\text{-ZrO}_2$  composites with eutectic microstructures at the temperatures up to 1600 °C, and with interesting mechanical properties (Vickers hardness (HV),  $18.1 \pm 0.7$  GPa and indentation fracture resistance of  $4.9 \pm 0.3$  MPa·m<sup>1/2</sup>).

### **Acknowledgment**

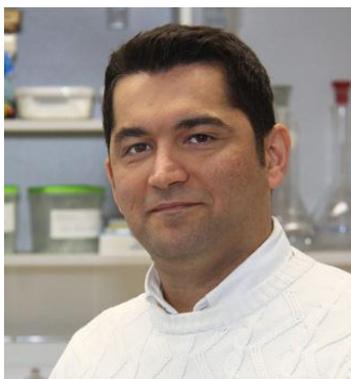
This paper is a part of dissemination activities of project FunGlass. This project has received funding from the European Union's Horizon 2020, research and innovation programme under grant agreement No 739566. The financial support of this work by the projects APVV-19-0010 and VEGA 2/0028/21 is gratefully acknowledged.

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**KEYNOTE LECTURE (SESSION III)****Dr. M. VASUDEVAN****Associate Director****Materials Development and Technology Group****Metallurgy and Materials Group****Indira Gandhi Centre for Atomic Research, Kalpakkam, India.****Email: [dev@igcar.gov.in](mailto:dev@igcar.gov.in)****Advanced Welding Techniques for Similar and Dissimilar Welding of Nuclear Structural Materials**

Welding is the main fabrication method employed for producing the structural components in the nuclear industry. There is an ever-increasing demand for improving the quality, reliability and life of the welded components. Using advanced welding techniques can only lead to significant improvement in the quality and the life of the welded components for the intended applications in the nuclear industry. The present lecture focus on the use of advanced welding techniques such as Activated TIG welding, Laser welding, Hybrid Laser-arc welding, electron beam welding and Friction Stir welding for similar welding of 316 LN stainless steel and dissimilar welding of 316 LN SS and Ferritic-martensitic steels. The weld joints were evaluated for their microstructure, mechanical properties and residual stresses. The following aspects related to the evaluation of the weld joints will be discussed; (i) The effect of the advanced welding techniques on the microstructure and mechanical properties such as strength, toughness and creep behaviour of weld joints (ii) Use of small specimen testing for evaluating zone wise strength and creep behaviour of weld joints (iii) Numerical simulation of the effect of advanced welding techniques on the residual stresses of 316 LN stainless steel pipe weld joints.

## KEYNOTE LECTURE (SESSION IV)

**Dr. AMIRHOSSEIN PAKSERESHT**

Associate Professor

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**New and Modern Thermal Barrier Coatings**

Most engineering products exposed to high temperatures and harsh environments are prone to failure due to thermal shock issues, which cause system and component degradation and eventual failure during thermal cycles. Surface modification by depositing various types of coatings have been used in industrial sectors to improve system efficiency. Thermal barrier coatings (TBCs) have recently become one of the high temperature industries' top priorities. This type of coating is typically applied using EB-PVD or thermal spray methods. Plasma spray (PS) is a popular thermal spray method for producing ceramic coatings as an alternative to traditional coating methods. PS has been widely used in the industrial sector to produce erosion resistance, thermal insulation, and protect metallic substrates from hot corrosion.

It should be noted that ceramic oxide is the most commonly used ceramic coating. Because of its unique properties,  $ZrO_2$  as a structural ceramic material has a significant capability for engineering applications. TBCs are subjected to high-temperature oxidation, hot corrosion, and thermal shock under high-temperature operating conditions. As a result, this type of coating is critical in improving the efficiency and performance of metallic substrates in harsh environments. High-temperature oxidation, the formation and un-uniformly growth of a thermally grown oxide (TGO) layer, and the infiltration of harmful substances like molten salts that cause spalling during thermal cycling are all important factors that influencing TBC lifetime.

There is a growing interest in the use of novel TBC due to the need to increase the efficiency of gas turbine engines and energy generating systems. TBCs that are new and modern have been developed to solve problems associated with traditional ones while also increasing their efficiency. New and modern TBCs are classified into several categories, including TBCs with new materials and structures, nano TBCs, and self-healing TBCs. In this lecture, new TBCs as well as the effect of splat morphology on the final structure of plasma sprayed coatings will be discussed.

**Keywords:** New TBCs, Splat morphology, Degradation mechanism, High temperature coatings.

**Acknowledgment:**

This work is a part of dissemination activities of project FunGlass. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 739566. The authors also gratefully acknowledge the financial support from the project VEGA no. 1/0171/21.

## KEYNOTE LECTURE (SESSION V)

**Dr. MANU JAISWAL**

Associate Professor

Department of Physics, IIT Madras.

Email: [manu.jaiswal@iitm.ac.in](mailto:manu.jaiswal@iitm.ac.in)**Heat Transport in Two-dimensional Crystals: Many Twists and Turns**

Heat dissipation is among the most critical obstacles hindering the miniaturization of nanoscale circuits. Like Moore's law for transistor scaling, the power density associated with the heat dissipated in nanoelectronics has been rising year on year and today reaches values exceeding  $100 \text{ W/cm}^2$ . High thermal conductivity materials with good interfacial properties are urgently needed to extract the heat efficiently. Two-dimensional (2D) materials, led by graphene, have emerged as strong candidates for thermal management applications. In this lecture, I will provide an overview of the phononic thermal properties of 2D materials. There are significant challenges in the theoretical understanding of the mechanism of heat transport in these systems. The story of heat transport in graphene has seen many twists and turns, including identifying the dominant heat carrier. Different 2D materials can be stacked on top of each other to produce new artificial materials known as Van der Waals heterostructures. How this arrangement affects heat transport will be presented. Further, the effects of layer number, strain, and defects will also be discussed. Graphene has the highest known thermal conductivity of all materials. Industrially scalable techniques such as chemical vapor deposition frequently result in rotational stacking faults associated with twist angles between successive layers. These multiple twist angles and local curvature in the form of wrinkles are important factors that influence thermal transport. 2D materials are helpful for efficient heat extraction and, interestingly, can also serve as thermal super-insulators – the other end of the heat transport spectrum. The talk will conclude by providing a roadmap for applying these materials across a range of thermal management applications.

## KEYNOTE LECTURE (SESSION VI)

**Dr. VENKATARAMAN JAYARAMAN**

Associate Director

Materials Chemistry and Metal Fuel Cycle Group

Indira Gandhi Center for Atomic Research, Kalpakkam 603 102.

Email: [vjram@igcar.gov.in](mailto:vjram@igcar.gov.in)**Hydrogen Sensors – ppb to Percentage Levels**

Hydrogen, the first element in the periodic table of elements is considered as the source of energy in the present and future. It is also considered as a clean source of energy. It can be obtained through several sources, viz. natural fermentation process, biomass gasification of bio-wastes, by-product from industrial processes, evolutions from lead acid battery storage systems by electrolysis of water, radiolysis of water, etc. As hydrogen has low density, high diffusivity, wide explosive limits, etc., it poses challenges in its purification, transportation and storage.

Apart from the sources, hydrogen is also being employed in several industrial processes, fuel for vehicles, etc. Therefore, hydrogen sensors are the inevitable requirement for safe and smooth operations of the production processes, industrial by-products and fuel. The type of sensor needed for a particular deployment will also depend on the concentration level of hydrogen encountered. Thus, the concentration level can range from a few tens of parts per billion (ppb) to percentage (%) level. The sensing methodology for ppb levels can be utilization of a mass spectrometer, ion pump, electrochemical, gas chromatography, etc. The methods like, fuel cells, surface conductivity of semiconducting oxides, pellistors, gas chromatography, etc., can be deployed for parts per million (ppm) and percentage level sensing.

The proposed talk will deal with a brief literature review of different methodologies for sensing hydrogen from ppb to % levels. Further, the talk will highlight the development of hydrogen sensors for monitoring in sodium and argon cover gas along with their application in cold trap regeneration process of sodium circuits.



# **INVITED LECTURE**



## INVITED LECTURE 1

**Dr. MANGALARAJA Ramalinga Viswanathan**

Full Professor

Faculty of Engineering and Sciences, Adolfo Ibáñez University  
Diagonal las Torres 2640, Peñalolén Santiago, CHILE.Email: [mangal@uai.cl](mailto:mangal@uai.cl)**Nanotechnology: A path to build a smart world with green energy and clean environment**

Nanotechnology and its microscopic universe offer gigantic possibilities for contemporary science and industry. The field of nanotechnology, which flourished between the 1960s and 1980s, has exploded in the last two decades, with a booming global market whose value will surpass 125,000 million dollars in the next five years, claims the Global Nanotechnology Market (by Component and Applications) report by Research & Markets, which offers forecasts for 2024. This field of technology modifies the molecular structure of materials to alter their inherent qualities and obtain new ones with ground-breaking uses. The insightful growth in nanostructure materials has flourished the field of energy-environment-nexus research, especially, solar cells, fuel cells (energy conversion), supercapacitors (energy storage), and wastewater treatment (environmental remediation) as an answer to worldwide energy issues. At the nanoscale level, numerous physical and chemical mechanisms have been developed that potentially enhance the transmission and processing of energy and environment systems. A new generation of high-performance materials can now be developed and incorporated in the field of energy and environment which includes solar cells, fuel cells, supercapacitors, hydrogen energy generation, and wastewater treatment. A range of potential strategies have been explored in order to increase the possibilities in an environment where competition for green energy and clean environment options is expanding. The making of intelligent/smarter devices or systems with greater efficiency using nanostructured materials has demonstrated

remarkable potential for addressing the world's expanding energy and environmental concerns. This technology has grown into a multi-billion-dollar industry with a variety of uses in the energy and environmental sectors. In this talk, the insights into nanostructured materials and the potential usage of developed materials in the energy conversion/storage, and environmental remediation will be addressed with the provoke of building green energy and clean environment.

## INVITED LECTURE 2

**Dr. PANCHANATHAN MANIVASAGAN**

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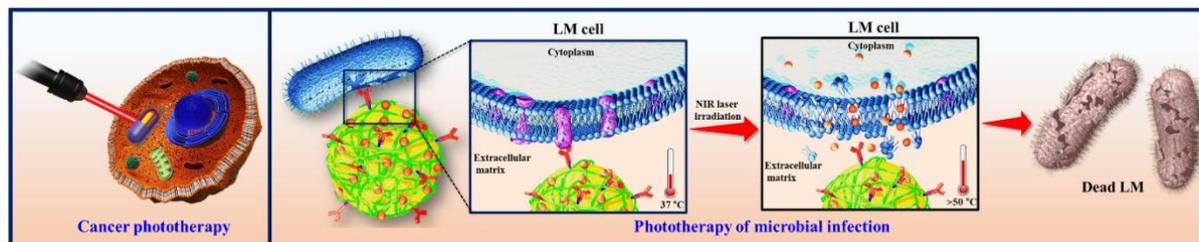
**Multifunctional conjugated polymer nanomaterial-based phototherapy for fighting cancer and microbial infection**

*Panchanathan Manivasagan and Eue-Soon Jang*

Cancer and microbial infection is a major public health problem worldwide, and exploiting conjugated polymer nanomaterial-based phototherapy is an urgent requirement for the treatment of cancer and microbial infection. In this work, we developed new conjugated polymer nanomaterials as all-in-one phototheranostic agents for multimode imaging-guided combination phototherapy. Phototherapy can be divided into two major types: photothermal therapy (PTT) and photodynamic therapy (PDT). Conjugated polymers are a versatile class of biomaterials, possessing diverse structures and functionalities for biomedical applications, owing to their excellent biocompatibility, stability, and easily modifiable surface properties. Recently, different types of NIR photothermal materials, such as metal, graphene, and tungsten-based nanomaterials, have been extensively explored for PTT. However, these nanomaterials have various drawbacks, including ease of aggregate formation in physiological media, long-term in vivo biocompatibility concerns, and latent cytotoxicity. To date, conjugated polymer-based nanomaterials have emerged as highly efficient photothermal coupling agents because of their good biocompatibility, versatile surface modification, ease of preparation, low cost, and photothermal stability. Therefore, many researchers propose that conjugated polymer-based nanomaterials could potentially be used as candidate materials for

phototherapy. Conjugated polymer nanomaterial-based phototherapy will offer a better platform for future cancer and microbial infection theranostics.

**Keywords:** Polymer; Nanomaterials; Phototherapy; Cancer; Microbial infection.



**Fig. 1.** Schematic representation of the killing process on cancer and microbial infection by conjugated polymer nanomaterials with laser irradiation.

### References

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2. P. Manivasagan, S. Bharathiraja, M.S. Moorthy, Y.-O. Oh, H. Seo, J. Oh, *Polym. Rev.* 57(4): 631-667.

# **SPONSOR LECTURE**



**SPONSOR LECTURE 1****Talos S/TEM - Accomplish More with Fast, Precise, Quantitative Materials Characterization in Multiple Dimensions****Dr. KARTHICK BALASUBRAMANIAN**

Sales Development Manager, India & South Asia,  
Electron Microscopy,  
Materials and Structural Analysis Division,  
Thermo Fisher Scientific India Pvt. Ltd.

Email: [karthick.balasubramanian@thermofisher.com](mailto:karthick.balasubramanian@thermofisher.com)

**ABSTRACT**

Breakthroughs in materials science research depend on fast, reliable high-resolution information that allows scientists to optimize the material's performance. True understanding of material function and behavior requires advanced visualization and testing alongside compositional and structural data in 2D and 3D, giving materials scientists the information, they need to predict the behavior of the material.

The Thermo Scientific Talos F200S G2 200 kV Field Emission Scanning/ Transmission Electron Microscope (S/TEM) combines fast, multichannel, high resolution S/TEM imaging and precise compositional analysis to enable dynamic microscopy applications. With innovative features designed to increase throughput, precision and ease of use, Talos is ideal for advanced research and analysis across academic, government and industrial research environments. High resolution imaging for better-quality data The Thermo Scientific™ Talos™ F200S G2 S/TEM combines outstanding high-resolution STEM and TEM imaging with industry-leading energy dispersive X-ray spectroscopy (EDS). A Smart Scanning engine with four-channel integration of multiple STEM detectors achieves significantly improved STEM image quality and throughput.

Talos includes a patented, integrated EDS system with two silicon drift detectors (SDD) for superior sensitivity and elemental mapping capabilities of up to 105 spectra/sec. Integration with the X-TWIN objective lens maximizes collection efficiency while delivering outstanding output count rates for a given beam current— even for low intensity EDS signals.

The Talos makes imaging and analysis workflows accessible to a broader community of scientists, with a friendly digital user interface and class-leading ergonomics. Fast image acquisition combined with the easy-to-use operating platform allows even less-experience operators to collect results quickly. It offers a full remote operation for greater ease of use and enhanced environmental stability.

This talk will highlight some of the key benefits of a Talos F200S to accelerate materials characterization under a TEM.

## SPONSOR LECTURE 2

### Anton Paar Nano-indentation Testing

Mr. PRASAD GOSAVI

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#### ABSTRACT

Instrumented indentation testing is a very important yet very sophisticated and expensive method to determine a material's hardness and elastic properties. Hit 300 is a premium and highly affordable nanoindentation instrument built for every user and every type of environment.

The simplified user interface is intuitive, automation enables high resolution nano-indentation measurements, and active anti-vibration damping ensures accuracy in all environments. Due to its compact size and the anti-vibration damping, it can be directly placed on the production-site. Thanks to its user-oriented design, real products, from small to big, can be measured without any complex preparation. A unique laser-targeting system additionally assists the user in targeting the sample with an accuracy of <1mm.

The instrument is also made for training all the material scientists of tomorrow. Hit 300 – a delightful fusion of simplicity and power.

**Hit 300. Simple. Powerful.**



# **1. ENERGY**

## **PAPER PRESENTATIONS**

## OP-EN-042

## Electrically conducting Nitrogen and Boron co-doped nanocrystalline diamond nanowires for efficient UV light Photocatalytic dye degradation

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### ABSTRACT

Origin of one-dimensional diamond nanowires (DNWs) in substrate temperature of 850°C diamond thin films with their surface-to-volume ratio enhancements by increasing the growth time makes DNWs possible to control and enhance the conducting properties of diamond.<sup>1</sup> DNWs can be synthesized by microplasma chemical vapor deposition (MPCVD) techniques. Here, nitrogen-incorporated boron-doped nanocrystalline diamond (NB-NCD) films with a substrate temperature of 850°C grown for 5 minutes contain spherical NCD grains. The morphology changes to one-dimensional nanowire films grown for 10-25 minutes. NB-NCD films grown for 25 minutes possess one-dimensional nanowire-like morphological grains with higher lengths. These nanowire-like NB-NCD films contain the co-existence of the  $sp^3$ -diamond phase and  $sp^2$ -graphitic phase, where  $sp^2$ -graphitic phases border diamond nanowires at grain boundaries. Because of the presence of the  $sp^2$  graphitic phase in the grain boundaries, DNWs show electrically conducting properties and enhance the photocatalytic degradation of different dyes.<sup>2</sup> An elaborated study on the photocatalytic activity of the electrically conducting nature of DNW structures may attract upcoming researchers to work toward various sensor applications (e.g., dye degradation).

**Keywords:** Diamond nanowires, photocatalytic dye degradation, conductivity, graphitic phase.

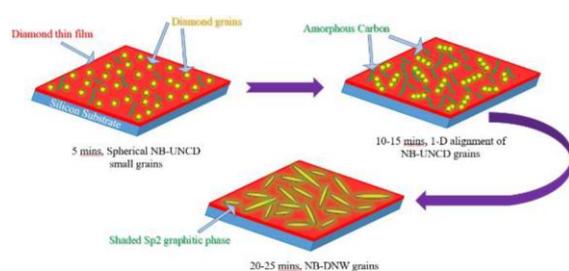


Fig.: Growth Mechanism of Nitrogen Incorporated Boron Doped One Dimensional Diamond Nanowire

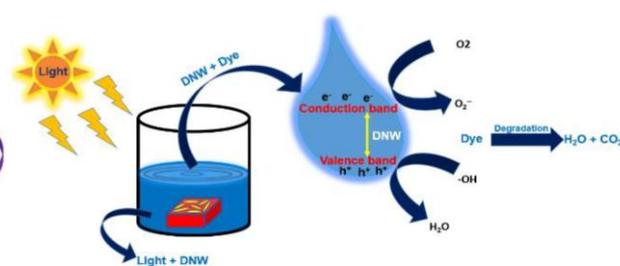


Fig.: Photocatalytic degradation of dye by one Dimensional Diamond Nanowire thin films

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OP-EN-044

## Enhanced Electrochemical Performance of All-Solid-State Lithium Ion Batteries

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### ABSTRACT

Energy storage devices are the most important areas for the portable power application of renewable energy. However, it is urgent to develop high efficiency and eco-friendly energy devices based on electrochemistry. All-solid state batteries have received a lot of interest recently as potential replacements for the current lithium metal batteries with liquid based electrolytes. In this study, we developed a straightforward solution-casting technique to create a poly(ethylene oxide) (PEO)-LiClO<sub>4</sub>-Li<sub>7</sub>La<sub>3</sub>Zr<sub>2</sub>O<sub>12</sub> (LLZO) composite solid electrolyte (CSE) membrane. It exhibits a high Li ion conductivity (10<sup>-3</sup> S cm<sup>-1</sup>), superb mechanical and electrochemical capabilities. The CSE membrane of PEO-50 wt% LLZO, Li metal anode, and LiCoO<sub>2</sub> cathode were used in the fabrication of all-solid-state lithium batteries. The ionic conductivity of the CSE membrane is enhanced at 75°C, and the produced solid-state batteries interfacial resistance is significantly decreased. The all-solid-state battery has outstanding cycle performance and extraordinary rate capabilities. A capacity of 108.5 mAh g<sup>-1</sup> is maintained at 1C even after 400 cycles. Furthermore, a flexible pouch cell is put together using the CSE membrane. The discharge capacity of the pouch cell stays more than 100 mAh g<sup>-1</sup> at a current density of 0.2C, and it can operate effectively in a variety of bending states. These findings offer a viable method for creating high-performance all-solid-state batteries.

**Keywords:** All-solid-state lithium batteries, Li<sub>7</sub>La<sub>3</sub>Zr<sub>2</sub>O<sub>12</sub>, Composite solid electrolyte, LiCoO<sub>2</sub>, Solution-Casting, Ionic conductivity.

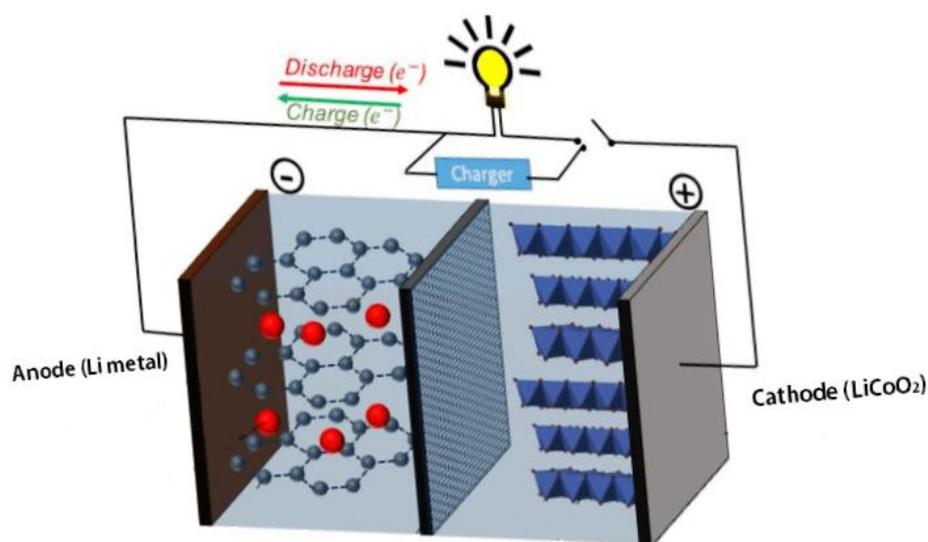


Fig.1: Schematic Diagram of Solid State Lithium Ion Batteries.

OP-EN-049

## Synthesis and Characterization of Luminescent WS<sub>2</sub> Nanosheets through One-step Liquid Phase Exfoliation

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### ABSTRACT

Exfoliating transition metal dichalcogenides (TMDs) from liquid phase precursors is a suitable synthesis method for large-scale production. It is still challenging to produce TMD nanosheets on a large scale for a variety of industrial applications. We report a one-step LPE process to produce luminescent WS<sub>2</sub> nanosheets in organic solvents that have less mismatch in surface energy, viz. Acetone, isopropanol, N-Methyl-2-Pyrrolidone (NMP), ethanol, and dimethyl formamide (DMF) with no pre-refining process. Our research differs from previous reports in the ease and eco-friendliness of bath sonication at a controlled temperature and the low concentration of powdered WS<sub>2</sub>. UV-Visible spectroscopy, photoluminescence (PL), Raman spectroscopy, and scanning electron microscopy (SEM) were used to determine optical, vibrational, and morphological properties of our as-prepared samples. We have successfully synthesized highly blue luminescent WS<sub>2</sub> nanosheets using our eco-friendly, one-step synthesis method. On a large scale, this study can be extended to synthesize other layered and non-layered 2D materials.

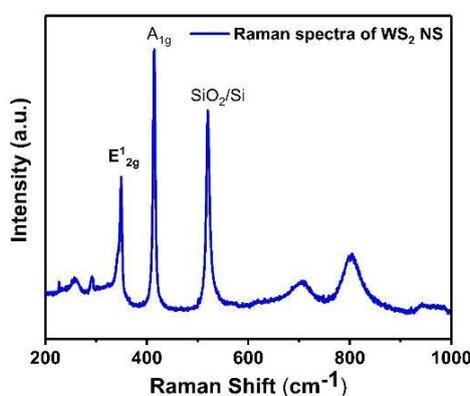


Fig.1: Raman spectra of as-synthesized WS<sub>2</sub> nanosheets.

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**OP-EN-052**

## Facile Synthesis of MnCo<sub>2</sub>O<sub>4</sub> Nanostructures for High Performance Supercapacitor

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### ABSTRACT

In present study we have deposited cubic spinel oxide i.e. MnCo<sub>2</sub>O<sub>4</sub> by simple and inexpensive hydrothermal method. X-Ray Diffraction (XRD) and Raman Spectroscopy results confirm pure cubic spinel oxide structure of MnCo<sub>2</sub>O<sub>4</sub>. The Scanning Electron Microscopy reveals porous and flower-like morphology which may help in ion intercalation. About 39.25 m<sup>2</sup>g<sup>-1</sup> specific surface area was measured. Eventually electrochemical performance of hydrothermally prepared MnCo<sub>2</sub>O<sub>4</sub> is measured and results shows good performance. In present study 248.16 Fg<sup>-1</sup> capacitance at 1 Ag<sup>-1</sup> current density is observed for an optimized sample prepared at 8-hour reaction. High stability around 93.8 % are observed after 2000 cycles. These results reveal that it is possible to fabricate electrochemical supercapacitor by using MnCo<sub>2</sub>O<sub>4</sub> which has good capacitance along with high stability.

**Keywords:** Mn-Co oxide Nanostructure, Hydrothermal, Cyclic Stability**OP-EN-060**

## Insight on Structural, Mechanical, Optoelectronic and Thermoelectric Properties of Perovskite AgBaCl<sub>3</sub> by an Ab-Initio for Solar-cells and Renewable Energy

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### ABSTRACT

Perovskite solar cells have gained popularity in recent years due to their benefits, including their high conversion efficiency, straightforward manufacturing method, and inexpensive

cost. They have also become a significant area of study for novel energy batteries. This study used the Full potential linearized augmented plane wave (FP-LAPW) approach within the framework of the generalised gradient approximation (PBE-GGA) to examine the geometric characteristics, mechanical properties, electrical properties, optical properties, and thermoelectric properties of Barium-based perovskites. The tolerance factor, formation energy, and cohesive energy calculations indicate the thermodynamic and structural stability of AgBaCl<sub>3</sub>. The band structure and density of states are estimated for electronic properties, indicating the semiconducting nature, with indirect band gap values of 1.068 eV for PBE-GGA. For the analysis of elastic characteristics, elastic constants, Pugh's ratio, bulk modulus, Poisson's ratio, and anisotropy factor are explored. The ductile nature of the compounds is described by the Pugh's ratio, and the ionic nature is established by the assessed Cauchy pressure. Optical properties including dielectric function, extinction coefficient, refractive index, absorption coefficient, reflectivity, and optical conductivity are determined in the energy range of 0–12 eV. The thermal properties are consistent with the thermal stability. Finally, the chemical potential and temperature (100-1200K) have been compared to the thermoelectric characteristics. The investigated halides are more in demand for optoelectronic devices and energy harvesting device applications due to their narrow band gap and high UV absorption.

**Keywords:** DFT, Perovskites, Structural properties, Opto-electronic properties, Mechanical properties, Thermoelectric properties.

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**OP-EN-061**

## Photocatalytic Conversion of CO<sub>2</sub> to Methanol over Titanium Nanofibers under Visible Light Radiation

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### ABSTRACT

A fast developing sustainable method for reducing CO<sub>2</sub> and producing renewable fuels is photocatalytic CO<sub>2</sub> reduction. Solar CO<sub>2</sub> conversion to hydrocarbon fuels appears to hold promise for reducing global climate change and enhancing sustainability. Direct sun irradiation, which is a form of solar energy, is abundant and should be used to produce solar fuel. Many solar light conversion and application domains place a high value on the development of high-efficiency TiO<sub>2</sub> photocatalysts; the needed high efficiency can be attained by using carefully managed nanoarchitectures. Due to its potential use in photocatalysis for the creation of solar fuel and environmental clean-up, TiO<sub>2</sub> has drawn a lot of attention. This study involves successful synthesis, from dispersed TiO<sub>2</sub> powder in viscous polymer solution to create well-ordered and aligned electrospun TiO<sub>2</sub> nanofibers (TiO<sub>2</sub>-NF), which were then calcined. As for comparison, the same TiO<sub>2</sub> powder is also used to synthesize TiO<sub>2</sub> nanoparticles (TiO<sub>2</sub>-NP) via calcination. The fabricated samples were thoroughly characterized by SEM, TEM UV-spectroscopy and XRD. The resulting product was analysed

for CO<sub>2</sub> conversion to solar fuels using HPLC, leading to the detection of methanol. TiO<sub>2</sub>-NF demonstrated much higher photocatalytic activity than TiO<sub>2</sub>-NP, according to a photocatalytic comparison between the two materials. The effective nanoparticle alignment that might result in efficient charge separation through interparticle charge transfer along the nanofiber framework is suggested to be the reason of the enhanced photocatalytic performance of TiO<sub>2</sub>-NF.

**Keywords:** Photocatalytic CO<sub>2</sub> reduction, TiO<sub>2</sub>-Nanofibers, TiO<sub>2</sub> nanoparticles, Solar fuel, Polymer.

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### OP-EN-062

## Synthesis of Hydrothermally Grown TiO<sub>2</sub> Nanostructures: Effects of Reaction Time and Acidic Medium

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#### ABSTRACT

In recent years, Titanium dioxide (TiO<sub>2</sub>) has emerged as one of the leading semiconductors photocatalyst due to its excellent photocatalytic activity, non-toxicity, chemical stability and low cost. The photocatalytic properties and optical band gap of TiO<sub>2</sub> nanostructures can be further enhanced by altering their size, shape, composition and morphologies.

In this study, Titanium Dioxide (TiO<sub>2</sub>) nanostructures are grown via sol-gel hydrothermal hybrid method. The influence of hydrothermal reaction time (12h, 18h and 24h), acid types (HCl, HF and HNO<sub>3</sub>) and molar concentrations (0.3M, 0.5M and 0.8M) are investigated systematically for the structural, morphological and optical properties of TiO<sub>2</sub> nanostructures. Optical absorption studies reveal that the absorption edge shifts towards longer wavelength with increase in hydrothermal reaction time. X-ray diffraction results indicate that the TiO<sub>2</sub> forms anatase when the hydrothermal time is 12 h, however it shows mixed phase of anatase and rutile when the hydrothermal time is 24 h. The scanning electron microscope images reveal the formation of TiO<sub>2</sub> nanostructure. Moreover as synthesized TiO<sub>2</sub> nanostructures are further employed for the photo-catalytic degradation of Methylene Blue (MB).

**Keywords:** Titanium Dioxide, Hydrothermal synthesis, Acid concentrations, Reaction time, Photocatalysis.

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**OP-EN-067****Comparative Study of Lithium ion Dynamics in PEO, PVDF and PMMA Based Blended Polymer Electrolyte Systems**Revathy C<sup>1</sup>, Sunitha V R<sup>2\*</sup>, Benson K Money<sup>2</sup> and S Radhakrishnan<sup>3</sup><sup>1</sup>Department of Electrical & Electronics Engineering, PES University, Bangalore.<sup>2</sup>Department of Sciences and Humanities, Christ (Deemed to be University), Bangalore.<sup>3</sup>Department of Science and Humanities, PES University, Bangalore.\* **Corresponding Author:** [sunitha.vr@christuniversity.in](mailto:sunitha.vr@christuniversity.in).**ABSTRACT**

Blended Polymer Electrolyte Systems (BPES) were prepared by mixing high molecular weight PEO ( $m_w = 1 \times 10^6$ ) and low molecular weight PEO ( $m_w = 1 \times 10^5$ ) with PVDF ( $m_w = 5.25 \times 10^5$ ) and PMMA ( $m_w = 1.5 \times 10^4$ ) respectively, keeping the lithium perchlorate (LiClO<sub>4</sub>) salt concentration constant. The main objective of this work is to investigate the ionic conductivity and ion transport properties of Lithium ions in BPE systems in the temperature range of 303K – 318K. The transport studies were carried out using impedance spectroscopic technique in the frequency range 0.1-10<sup>6</sup> Hz. Studies reveal that the inclusion of low molecular weight polymers into the high molecular weight PEO matrix enhances the lithium-ion conductivity for both BPES. The variation of DC conductivity with temperature follows Arrhenius relation for the two systems. At 303K, the maximum conductivity of  $6.44 \times 10^{-4} \text{ Scm}^{-1}$  was observed for PEO (94wt%) - PEO (3wt%)/PVDF (3wt%) - LiClO<sub>4</sub>, (PEO<sub>94</sub>-PEO<sub>3</sub>-PVDF<sub>3</sub>-Li) films and  $1.89 \times 10^{-4} \text{ Scm}^{-1}$  for PEO (96 wt%)-PEO (2wt%)/PMMA (2wt%) – LiClO<sub>4</sub>, (PEO<sub>96</sub>-PEO<sub>2</sub>-PMMA<sub>2</sub>-Li) films. The conductivity dependency of frequency follows the Jonscher Power Law for all compositions. Various conduction parameters like ions mobility ( $\mu$ ), charge carrier density ( $n$ ), hopping frequency ( $\omega_H$ ), and relaxation time ( $\tau$ ) in the BPE films were estimated from frequency dependent dielectric studies. The ion transport parameters  $\mu$ ,  $n$ ,  $\omega_H$  and  $\tau$  at ambient temperature were found to be  $3.41 \times 10^{-10} \text{ cm}^2\text{V}^{-1}$ ,  $1.18 \times 10^{25} \text{ cm}^{-3}$ ,  $1.85 \times 10^9 \text{ rad s}^{-1}$ ,  $1.67 \times 10^{-6} \text{ s}$  respectively for PEO<sub>94</sub>-PEO<sub>3</sub>-PVDF<sub>3</sub>-Li films and  $1.09 \times 10^{-11} \text{ cm}^2\text{V}^{-1}$ ,  $1.08 \times 10^{26} \text{ cm}^{-3}$ ,  $5.90 \times 10^7 \text{ rad s}^{-1}$ ,  $1.24 \times 10^{-6} \text{ s}$  respectively for PEO<sub>96</sub>-PEO<sub>2</sub>-PMMA<sub>2</sub>-Li films. All these parameters were found to increase with increase in temperature.

OP-EN-068

## Crystal Structure, Morphology and Photoluminescence Properties of Er<sup>3+</sup> Activated NaBi(MoO<sub>4</sub>)<sub>2</sub> Phosphor for Solid State Lighting Applications

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### ABSTRACT

In the present work, NaBi(MoO<sub>4</sub>)<sub>2</sub> (NBM) phosphor has been synthesized successfully by doping with 1.0 mol% of Er<sup>3+</sup> using the high-temperature solid state reaction route. As-synthesized NBM: 1 mol% Er<sup>3+</sup> sample was characterized to explore crystal structure, morphology, photoluminescence (PL) and colorimetric properties using various techniques. The X-ray diffraction pattern of the as-synthesized phosphor are well matched with the standard JCPDS (card no. 79-2240) pattern. The morphological studies of the sample have been analyzed through FE-SEM images. From the photoluminescence emission spectra, it has been observed that the intense peak has been observed in the green region at 552 nm under the excitation of near UV (n-UV) region. Colorimetric properties of the Er<sup>3+</sup> activated NBM samples were analyzed and calculated CIE coordinates corresponding to NBM:1 mol% Er<sup>3+</sup> are located in the green region. The aforementioned characteristics demonstrate that the NaBi(MoO<sub>4</sub>)<sub>2</sub>: 1 mol% Er<sup>3+</sup> phosphors have great potential in the area of solid state lighting applications.

**Keywords:** Solid state lighting, Molybdates, Phosphors, Morphology, PL.

OP-EN-079

## Layered Double Hydroxide as Promising Electrode Material for Supercapacitor Applications

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### ABSTRACT

Layered double hydroxides (LDHs) are unique types of 2D layered materials that are considered potential materials for use in supercapacitors. LDHs are preferred as an electrode material due to their morphology, cost, environment friendliness, composition, structure, incomparable redox reaction and excellent anion inclusion which leads to greater specific

capacitance. Although there are various reports on the different properties like structural composition and electrode fabrication of LDHs, the effects of different modification approaches on the structure and performance of LDHs in the supercapacitor are not summarized yet. The use of LDHs as electrodes in supercapacitors consist of rapid and continuous charging-discharging with the transfer of electrolyte ion. However, there are some problems with LDHs such as unfulfilled internal stability, poor conductivity, and limited capacitance with severe agglomeration leading to structural collapse. The latest research is focused on the fabrication of electrode materials with improved performance via modifications in the structure, properties and composition.

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### OP-EN-083

## Synthesis and Photocatalytic Activity of Hydrated Tungsten Oxide Nanostructures

Jaspreet Kaur, Naresh Kumar and Rajesh Kumar\*

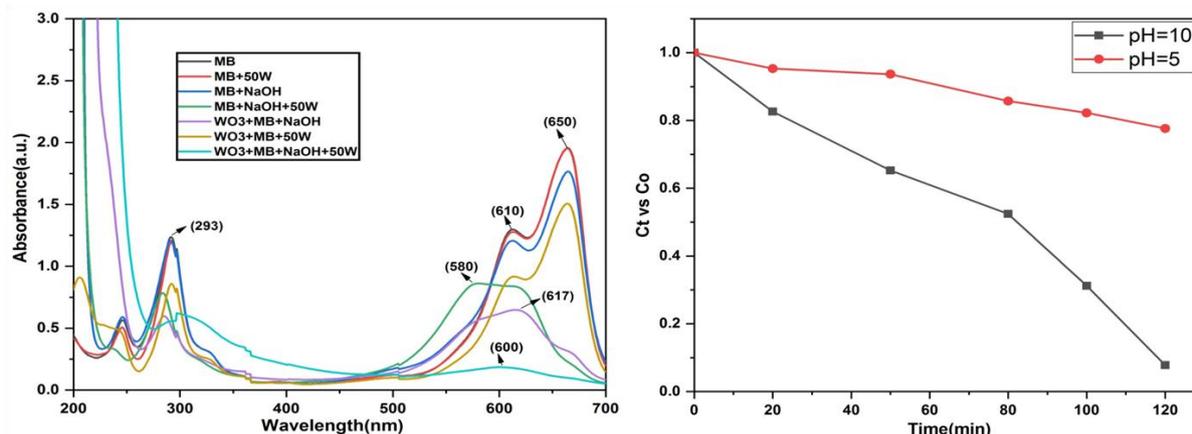
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### ABSTRACT

The photodegradation of methylene blue (MB) had received a lot of attention due to the tungsten oxide nanostructure's configurable band-gap. The co-precipitation approach, which is straightforward and inexpensive, was used to produce the tungsten oxide nanostructures, with SDS surfactant serving as the stabilising agent. Through the use of X-ray Diffraction and UV-Vis Spectroscopy methods, the structural and optical properties were examined. The XRD technique verified that the Tungstite ( $\text{WO}_3 \cdot \text{H}_2\text{O}$ ) phase had formed. By detecting the discoloration of MB solutions when exposed to UV-visible light in an alkaline media, the photocatalytic activity was assessed. Alkaline media was preferred over acidic medium, as evidenced by the increased photodegradation efficiency of  $\text{WO}_3 \cdot \text{H}_2\text{O}$  nanostructures at pH (9-10).

**Keywords:**  $\text{WO}_3 \cdot \text{H}_2\text{O}$ , Surfactant, X-ray Diffraction, UV-Vis Spectroscopy, Methylene Blue, Photodegradation.



### OP-EN-084

## Tuning Band Gap, Structure and Optical Properties of Tin Selenide Nanoparticles by Alkali Metal Doping

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### ABSTRACT

Two-dimensional (2D) materials have in recent times shown dynamic consideration because of their novel properties and tremendous applications in thermoelectrics, energy storage devices, i.e., solar cells, different ion batteries, supercapacitors, fuel cells, phase change memory devices and catalysts. The layered mono chalcogenide semiconductor, Tin Selenide (SnSe) is the very dominant nominee among them. In this work, we synthesised SnSe by a simple hydrothermal method in low temperature range using Sodium borohydride ( $\text{NaBH}_4$ ) as a reducing agent for the single phase formation of SnSe Nanoparticles (NPs). Composition and structure of the prepared sample were investigated by EDS and X-ray diffraction (XRD) spectroscopy respectively. Fourier transform infrared (FTIR) has been done so far to study the functional groups present in the SnSe. Study of optical properties has been done by ultraviolet-visible (UV-Vis) of the range 200-900 nm and photoluminescence (PL) spectroscopies to estimate the bandgap values. Further, the properties and structure of SnSe were modified by doping of alkali metals. Doping of Sodium and Potassium has been done to form  $\text{Na}_x\text{Sn}_{x-1}\text{Se}$  and  $\text{K}_x\text{Sn}_{x-1}\text{Se}$  respectively, which further decreases the band gap of the host material. Moreover, optical properties of these materials help in getting essential information about the interaction of light with matter. Refractive index, dielectric properties, extinction coefficient, direct and indirect bandgap values depend upon photonic interactions and were determined by UV-Vis spectroscopy. An effort has been made to summarize all these parameters for concluding these materials for fundamental applications.

**Keywords:** Nanoparticles, Hydrothermal method, X-ray diffraction, Chalcogenides, Doping, Alkali-metal.

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## OP-EN-088

### Reduced Graphene Oxide Supported NiCo<sub>2</sub>O<sub>4</sub> Nanoparticles for the Catalytic Reduction of p-Nitrophenol in Water

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#### ABSTRACT

p-Nitrophenol (PNP) is a refractory organic pollutant commonly found in industrial wastewater. The reduction of PNP to less toxic p-Aminophenol (PAP), using NaBH<sub>4</sub>, is considered as a clean and feasible method for its removal [1]. The reduction of PNP is restricted by the kinetic barrier between the negatively charged PNP and BH<sub>4</sub><sup>-</sup> ions. So, the application of a suitable catalyst is necessary for the feasibility of the reaction [2]. In the present work reduced graphene oxide supported NiCo<sub>2</sub>O<sub>4</sub> nanoparticles (RGNCO) were prepared using a simple two step method and employed as a proficient reusable catalyst in the reduction of PNP. The systematic characterization of the RGNCO composite confirmed the successful anchoring of NiCo<sub>2</sub>O<sub>4</sub> nanoparticles on graphene sheets and revealed the creation of surface oxygen vacancies on NiCo<sub>2</sub>O<sub>4</sub>. The prepared RGNCO catalysts exhibited excellent activity for the reduction of PNP. The activity factor (356.5 min<sup>-1</sup>g<sup>-1</sup>) obtained was greater than the highest value reported in literature for NiCo<sub>2</sub>O<sub>4</sub> based catalysts. The catalysts were reused for five times without much loss in the activity. The influence of various reaction parameters like temperature, catalyst dosage, reactant concentrations, and presence of different anions on the catalytic activity were analysed in detail. The enhanced catalytic activity was due to the synergistic action of the reduced graphene oxide sheets and oxygen vacancy rich NiCo<sub>2</sub>O<sub>4</sub> nanoparticles. Based on the experimental results and literatures a plausible mechanism for the reduction of PNP in the presence of RGNCO catalyst was proposed.

**Keywords:** Reduced graphene oxide, NiCo<sub>2</sub>O<sub>4</sub>, Oxygen vacancy, p-Nitrophenol, Catalytic reduction.

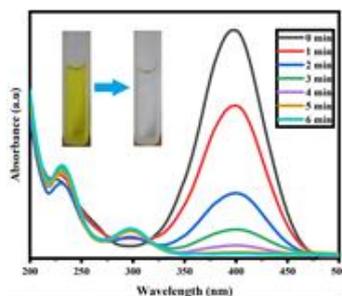


Fig.1: UV-Visible spectra of PNP catalytic reduction over RGNCO

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## OP-EN-091

### Green Synthesis of Photo catalyst nHAp Doped TiO<sub>2</sub>/ GO Ternary Nano Composites for Removal of Methylene Blue Dye

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#### ABSTRACT

Waste water treatment due to dyes is always a challenge.

The present work was very unique and highly interesting because HAp was derived from waste oyster shells, a biogenic source composed of calcium carbonate. HAp is used in various biomedical fields because of its bioactive and biocompatible material, as well as in the field of waste water treatment. The semiconductor metal oxide TiO<sub>2</sub> and GO were chosen to show an effective photocatalytic performance with a synergistic effect. TiO<sub>2</sub> is most widely used as a photocatalyst for the degradation of organic compounds in the presence of sunlight, which has profound application in solving many environmental problems because of its high catalytic efficiency, stability and reasonable cost. Graphene oxide is an oxidised form of graphene that is cheap and abundant. HAp from oyster shells is converted into nano HAp to be used in vast areas. First of all, nHAp alone shows poor adsorption towards dye removal. It further increased its excellency towards MB by doping with TiO<sub>2</sub> by the simple wet chemical precipitation method. It was sonicated with graphene oxide to make a ternary nano composite by the Hummers method. The synthesised composites were characterised by using FTIR, Raman Shift, XRD, AFM, SEM, and EDX techniques to identify the purity and size of the composites, whereas UV-visible study indicates, nHAp/TiO<sub>2</sub>/GO that the ternary nano photocatalyst degrades the dye from waste water in different time intervals from 30 min to 360 min. From the OD values, it was observed that 98% effective removal of MB dye. The

prepared ternary nanocomposites have an excellent photocatalytic efficiency and high adsorption affinity for the removal of dye.

**Keywords:** Hydroxy apatite, Titanium oxide, Graphene oxide, Nanocomposites, photo catalyst, Removal of MB Dye, Antibacterial activity.

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**OP-EN-092**

## Tuning the Band Gap of Layered MoS<sub>2</sub> Nanosheets and Evaluation of Photocatalytic Property

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### ABSTRACT

Molybdenum disulfide (MoS<sub>2</sub>) which belongs to the class of transitional metal dichalcogenides has received greater attention due to its unique physico-chemical properties [1]. Especially, the tuneable bandgap energy of MoS<sub>2</sub> between 1.2 eV and 1.9 eV opens up avenues in optoelectronics, photovoltaic, electrochemical storage devices and photo catalytic applications [2]. Layered MoS<sub>2</sub> nanosheets can be synthesized using different methods. In the present study, a top-down approach, liquid phase exfoliation of bulk MoS<sub>2</sub> is followed as it is found to be straightforward, cost effective and eco-friendly to produce layered MoS<sub>2</sub> nanosheets [3]. The optical bandgap energy was optimized with different time intervals and solvents (water and dimethylformamide (DMF)). The bulk and exfoliated MoS<sub>2</sub> were characterized using UV-Vis spectroscopy for absorption studies, scanning electron microscopy for morphological analysis, Fourier transform infrared spectroscopy for functional group analysis and Raman spectroscopy to study the number of layers. The bandgap of the prepared MoS<sub>2</sub> layers was calculated using Tauc plot. The band gap energy was found to increase from 1.33 eV to 2.15 eV in DMF and 1.44 eV to 3.57 eV in water for bulk and layered MoS<sub>2</sub> respectively. As the band gap energy value has a significant bearing on the photocatalytic property of MoS<sub>2</sub>, photodegradation studies were carried out using methylene blue under sunlight irradiation, to evaluate the photocatalytic ability of the bulk and synthesised MoS<sub>2</sub> nanosheets. Among the three types of MoS<sub>2</sub>, MoS<sub>2</sub>nanosheets exfoliated with water showed higher efficiency (95.21%) towards the dye degradation in accordance with the increased band gap energy values.

**Keywords:** Molybdenum disulfide, Layered nanosheets, Exfoliation, Band gap energy, Photocatalysis, Dye degradation.

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OP-EN-096

## Simplest Synthesis and Characterization Study of Flower-like $\text{Cu}_2\text{ZnSnS}_4$ Thin Films

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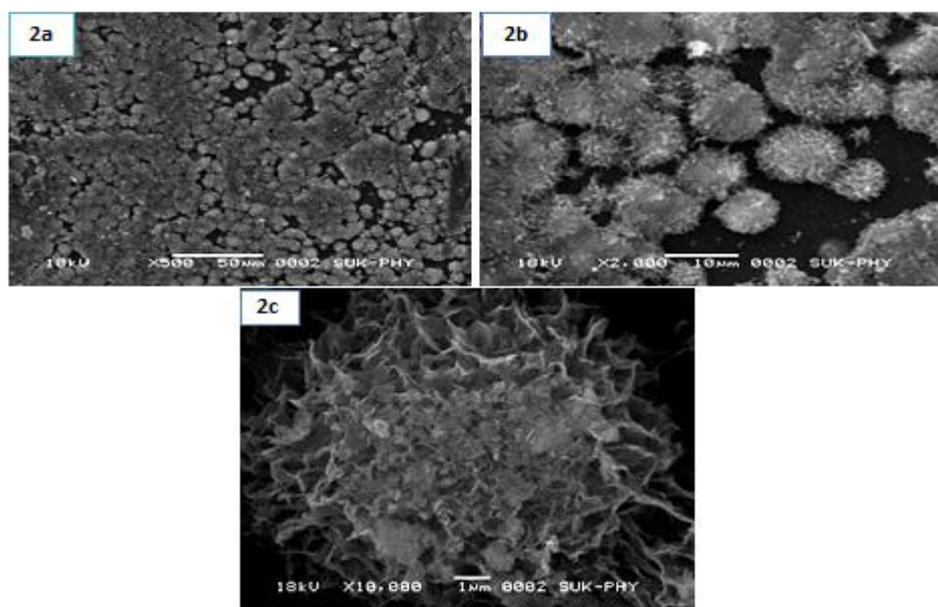
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### ABSTRACT

Nowadays  $\text{Cu}_2\text{ZnSnS}_4$  (CZTS) thin film is most reliable as economical and eco-friendly semiconductor material due to having advantageous properties likes high absorption coefficient and optimum band gap. Addition to these CZTS has nontoxic elements and naturally abundant readily available. Here we used low lost simplest chemical bath deposition technique for synthesis of  $\text{Cu}_2\text{ZnSnS}_4$  thin films. The films were characterized by present techniques like X-Ray diffraction, Raman scattering, UV-Visible spectroscopy, electrical conductivity, scanning electron microscopy, EDS techniques by which we report poly-crystalline CZTS thin films having stable kasterite structure in a excellent stoichiometric with 1.5 eV as ideal band gap and its SEM reports uniform typical flower -like morphology.

**Keywords:** CZTS, Electrical conductivity, Photoluminance; Kasterite, Solar cells.



**Fig.1:** Scanning electron micrographs of a flower morphology of CZTS.

## OP-EN-100

## Lemon Peel Assisted Synthesis of Copper Oxide Nanoparticles for Photocatalytic Degradation

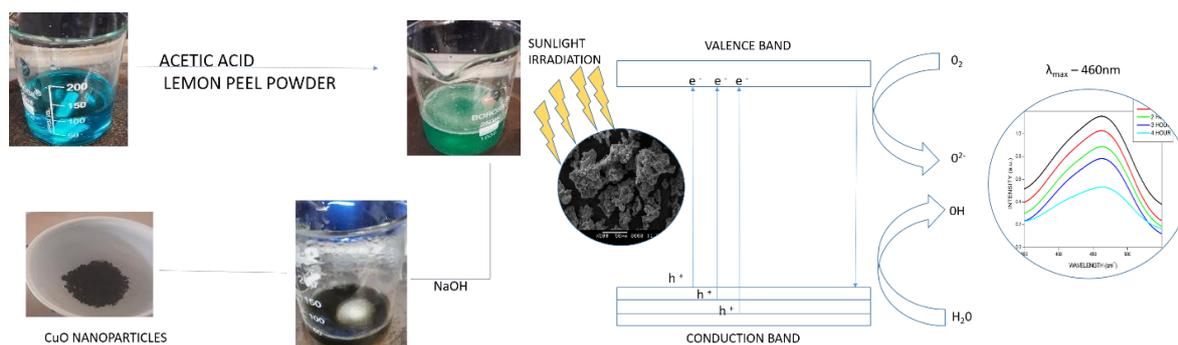
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### ABSTRACT

Water resources are becoming more confined in the world. Recycling waste water has become mandatory for the sustainable maintenance of water resources. Water processing can be done by various methods among which photocatalytic degradation is one of the effective treatment processes to be adopted<sup>1</sup>. The current work focuses on the synthesis of CuO nanoparticles by bio-template assisted method and testing the nanoparticles' degradation efficiency against methyl orange under sunlight. The FT-IR of the synthesized sample shows characteristic peaks at  $521\text{cm}^{-1}$ ,  $474\text{cm}^{-1}$  confirming the presence of CuO nanoparticles<sup>2</sup>. The crystalline size of the sample was found to be  $27.99\text{nm}$ <sup>3,4</sup>. The degradation of methyl orange under sunlight using CuO in 240 minutes attested the efficiency of the synthesized CuO nanoparticles<sup>5,6</sup>.

**Keywords:** Photocatalysis, CuO nanoparticles, Lemon peel.



**Fig. 1:** Synthesis of CuO nanoparticles

**Fig. 2:** Photo-catalysis of CuO nanoparticles in methyl orange degradation

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OP-EN-107

## Enhanced Structural, Optical, Magnetic and Spin Resonance Properties of $\text{Co}_{0.8}\text{Mn}_{0.2}\text{Fe}_2\text{O}_4$ Nano-Ferrites: a Annealing Dependent Study for High Density Storage Devices

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### ABSTRACT

Recent year Mixed ferrites based MNPs have a great potential application in the development of the high-density memory devices, optical devices, EMI shielding and biomedicine. In the present work we have investigated the effects of post annealing (400, 600, 800 & 1000°C) on structural, optical, magnetic and spin resonance properties of the oleic acid coated magnesium doped cobalt ( $\text{Co}_{0.8}\text{Mn}_{0.2}\text{Fe}_2\text{O}_4$ ) ferrites MNPs synthesized by cost effective and environmentally friendly one pot hydrothermal method. In order to investigate the annealing induced effects on their various physical and chemical properties, the prepared samples have been annealed at 400, 600, 800 & 1000°C in the inert atmosphere and then compared with as-prepared sample. X-ray diffraction (XRD) patterns of as prepared and annealed samples at various temperatures exhibit single phase spinel structure. The annealing has also greatly influenced the morphology and grain size of prepared MNPs. The single crystalline cubic phase structure and crystallite size (15-37nm) in all annealed samples was observed from XRD. The Field emission scanning electron microscopy (FESEM) showed the uniform spherical shape of the nanoparticles and the calculated average particle size varied from 20 to 40 nm on increasing annealing temperature from 400 to 1000°C. FTIR spectroscopy revealed about molecular dynamics and the formation of cubic spinel phase of frequency bands at 530  $\text{cm}^{-1}$  and 420  $\text{cm}^{-1}$  respectively and also other frequency band at higher vales represents different functional group which gives the evidences that oleic acid are present on the surface of MNPs. The UV-Visible measurement gives the estimate of the band gap of the materials which lies between (2.3 to 3.8 eV) of the all the sample obtained from optical absorption spectra fitting by Tauc plot method. Room temperature static magnetic measurements suggest the transition from a single domain to multi domain particle at high annealing temperature (600°C). The saturation magnetization ( $M_s$ ) as well as the ' $M_r/M_s$ ' ration were increased from 42.75 to 70.15 emu/g and 0.02 to 0.32, respectively. The room temperature spin resonance behaviour of all samples have been investigated by ferromagnetic resonance (FMR) study. The FMR spectra revealed that the resonance field and the linewidth increased at higher annealing temperature due to strong dipole-dipole interaction. The Increase in annealing temperature resulted in broader FMR spectra, higher spin concentration and large magneto-crystalline anisotropy of samples.

**Keywords:** FMR, Magnetic nanoparticles (MNPs),  $\text{CoFe}_2\text{O}_4$ , Spin dynamics.

**OP-EN-136****Nanoscopic Bismuth-based Electrodes for Aqueous Aluminum-ion Battery**

Shyamal K Das

*Department of Physics, Tezpur University, Assam, India.***ABSTRACT**

The global research efforts for identification of electrode materials for high energy and high power density rechargeable aqueous/non-aqueous aluminum-ion batteries have gained unprecedented momentum in contemporary times. Bismuth-based materials have the immense potential as an electrode material for aqueous aluminum-ion battery. However, it is challenging to work with bulk bismuth-based materials due to electrode pulverization. While investigating the electrochemical performance of bismuth-based materials, we demonstrate a unique method to simultaneously enhance the storage capacity and long-term stability of bismuth oxide and bismuth oxychloride as an electrode material for rechargeable aqueous aluminum-ion battery. In this presentation, the  $Al^{3+}$  ion electrochemistry of bismuth oxide and bismuth oxychloride for aluminum-metal battery will be discussed in detail

**Keywords:** Bismuth oxide, Battery, Energy storage.

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**OP-EN-156****Study of ZnO nanosheets Growth Parameters Effect on the Performance of the Triboelectric Nanogenerator**

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*Energy Materials and Devices Lab, Department of Physics, National Institute of Technology-Warangal, India-506004.***ABSTRACT**

Herein, we report the effect of ZnO morphology on the performance of the triboelectric nanogenerator (TENG) device. The ZnO nanostructures were synthesized by a hotplate-assisted method, which is a facile, cost-effective, low-temperature, and fast-synthesis process. We used ZnO film and PET as frictional layers in the fabrication of the TENG device. The output performance of the TENG has been tested with ZnO films synthesized at different growth temperatures and growth durations. It was observed that TENG output increased with ZnO films synthesized at higher growth temperatures and growth duration. This enhancement in the output may be due to a change in the effective contact area of the ZnO film with PET. The TENG maximum output voltage and current of ~10 V and 12.1  $\mu$ A were

observed for ZnO films synthesized at a growth temperature of 90°C for 4 hours. The resulting TENG exhibits stable current output over ~598 cycles, which confirms the high stability of the TENG.

**Keywords:** Energy harvesting, Triboelectric nanogenerator, ZnO nanosheet array, ITO/PET, Self-powered devices.

### OP-EN-164

## High Performance Energy Storage and Conversion Efficiency of Carbon Quantum Dots Ornamented MoS<sub>2</sub> Nanoflowers on rGO Sheets Towards Integrated Photo Capacitor Applications

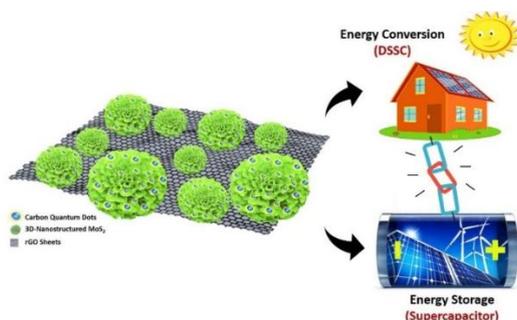
B. Arjun Kumar, G. Ramalingam

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### ABSTRACT

In the current technological era, energy is the most precious and essential in day-to-day life. The world is still looking for the finest, cost-effective and simple methods for generating and storing energy. The grouping of energy generation and energy storage under one platform is the most wanted technology to satisfy the modern technical world. This work focuses on satisfying both energy storage and conversion efficiency using a single material which applied to the dye-sensitized solar cells and supercapacitor application. We successfully prepared Carbon Quantum Dots bedecked 3D Nanostructured MoS<sub>2</sub> on rGO Sheets using the simple and facile synthesis of the hydrothermal method. Prepared nanocomposite placed in the counter electrode for DSSC and asymmetrical Supercapacitor applications it performed with high efficiency. DSSC Provides 6.78 % of photoconversion efficiency with good lifetime stability and the supercapacitor provides the highest storage efficiency and fine capacitive retention after 5000 cycles. Both devices were integrated using a wired connection and measured the overall efficiency and overall storage efficiency.

**Keywords:** DSSC, Supercapacitors, MoS<sub>2</sub> Nanoflowers, Quantum dots, Photo capacitors.



OP-EN-167

## Thienoisindigo Containing Quinoidal Small Molecules for High-Performance n-type Organic Field-Effect Transistors

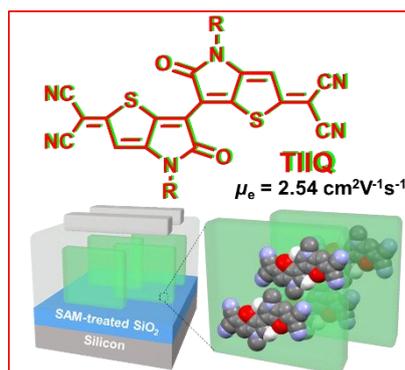
Arulmozhi Velusamy, Ming-Chou Chen\*

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### ABSTRACT

A novel quinoidal thienoisindigo (TII)-containing small molecule family with dicyanomethylene end-capping units and various alkyl chains is synthesized as n-type organic small molecules for solution-processable organic field effect transistors (OFETs). The molecular structure of the 2-hexyldecyl substituted derivative, **TIIQ-b16**, is determined via single-crystal X-ray diffraction and shows that the **TIIQ** core is planar and exhibits molecular layers stacked in a “face-to-face” arrangement with short core intermolecular distances of 3.28 Å. The very planar core structure, shortest intermolecular N···H distance (2.52 Å), the existence of an intramolecular non-bonded contact between sulfur and oxygen atom (S···O) of 2.80 Å, and a very low-lying LUMO energy level of -4.16 eV suggest that **TIIQ** molecules should be electron transporting semiconductors. The physical, thermal, and electrochemical properties as well as OFET performance and thin film morphologies of these new **TIIQs** are systematically studied. Thus, air-processed **TIIQ-b16** OFETs exhibit an electron mobility up to **2.54 cm<sup>2</sup> V<sup>-1</sup> s<sup>-1</sup>** with a current ON/OFF ratio of 10<sup>5</sup>–10<sup>6</sup>, which is the first demonstration of TII-based small molecules exhibiting unipolar electron transport characteristics and enhanced ambient stability. These results indicate that the construction of quinoidal molecules from TII moiety is a successful approach to enhance n-type charge transport characteristics.

**Keywords:** Organic field-effect transistors, Organic semiconductors, Quinoid, Solution-shearing, Thienoisindigo.



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OP-EN-172

## Hoisting the Photovoltaic Performance of Perovskite BaSnO<sub>3</sub> Nanoparticles Wrapped Reduced Graphene Oxide: Efficient Photoelectrode for Dye-sensitized Solar Cells

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### ABSTRACT

The ABX<sub>3</sub> type perovskite nanostructure photoanode plays a crucial role in dye-sensitized solar cells to gathering photo-excited electrons from the sensitizer. In general, the photoelectric-conversion efficiency of photoanode is hindered by photogenerated electron-hole pair recombination. To avoid this, modification of BaSnO<sub>3</sub> perovskite nanoparticles with reduced graphene oxide nanosheets has been attempted a facile one step synthesis of RGO loaded BaSnO<sub>3</sub> (RGO-BaSnO<sub>3</sub> NC) by simple solution route. The prepared perovskite composite were characterized using adequate techniques such as by X-ray diffraction (XRD), diffuse reflectance spectroscopy (DRS), Raman, high-resolution transmission electron microscopy (HRTEM), field emission scanning electron microscopy (FESEM) techniques. The photovoltaic performances of RGO-BaSnO<sub>3</sub> NC based photoanode in dye-sensitized solar cells (DSSCs) employing N719 dye, Pt/FTO counter electrode and imidazole-based liquid electrolyte have been studied under standard simulated solar light illumination of 100 mW cm<sup>-2</sup>. It was found that RGO-BaSnO<sub>3</sub> NC composite show strong dye adsorption to facilitate the light absorption and efficient electron transport due to the less surface trapping sites compared with unmodified BaSnO<sub>3</sub> NPs. The results demonstrate that the DSSC fabricated with RGO-BaSnO<sub>3</sub> NC photoanode delivered overall photoelectric conversion efficiency of 6.7%, which is 30% higher than that of DSSC fabricated unmodified BaSnO<sub>3</sub> photoanode. The optimization of RGO over the BaSnO<sub>3</sub> composites photoanode DSSCs is in under process.

**Keywords:** Perovskite BaSnO<sub>3</sub>, Reduced graphene oxide, Perovskite photoanode, Dye-sensitized solar cells, Perovskite type photoanode.

OP-EN-182

## Performance Study of Waste Toner Material derived Fe<sub>3</sub>O<sub>4</sub> Electrodes for Supercapacitor Applications

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### ABSTRACT

Energy storage solutions have been one of the most important parameters for manufacturers of broad range electronics. In this context, supercapacitors are said to be a potential replacement for conventional batteries. In the present work, we demonstrate use of Fe<sub>3</sub>O<sub>4</sub> as electrode material. The working material Fe<sub>3</sub>O<sub>4</sub> were procured via recovering waste toner material from printers, followed by magnetic separation a few times and annealing process to obtain final product as Fe<sub>3</sub>O<sub>4</sub>. The obtained material is used in an electroactive manner and then deposited on a Ni-foam substrate. The physico-chemical characteristics and electrochemical investigations of the prepared electrodes were characterized by XRD, FTIR, UV-Vis and AFM and CV, EIS and GCD respectively. The specific capacitance of electrode was calculated and found to be 250 F/g at 10 mV/s within the potential range of -0.6 to 0.8 V. Moreover, the electrochemical stability of Fe<sub>3</sub>O<sub>4</sub> electrode remains to be 96 % after 1000 cycles. This shows recycled Fe<sub>3</sub>O<sub>4</sub> still possesses good properties as electrode material for supercapacitor applications and may encourage repurpose of waste toner in order to curb electronic pollution.

**Keywords:** Supercapacitors, Fe<sub>3</sub>O<sub>4</sub>, Waste toner, High specific capacitance.

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OP-EN-183

## The Doping Effects of Si in $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> Structure on Its Electrical, Optical and Magnetic Properties

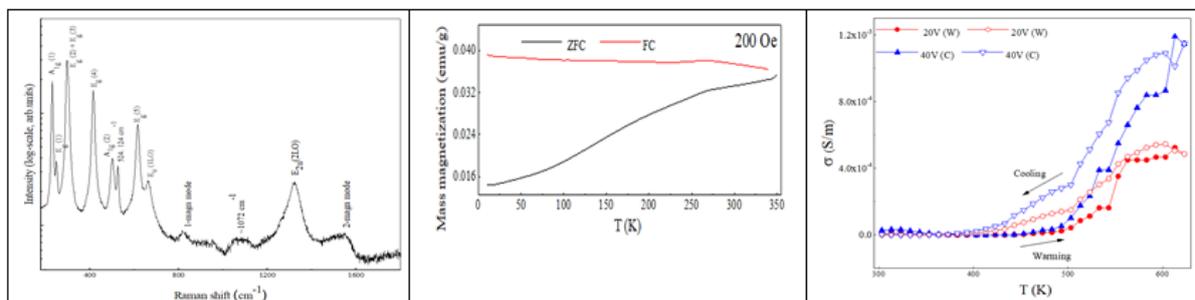
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### ABSTRACT

The Si doped hematite (Si: $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>) system has been prepared by mechanical alloying. The composition Fe<sub>1.93</sub>Si<sub>0.067</sub>O<sub>3</sub> (6.7mol% Si) has been confirmed from Energy Dispersive X-ray Analysis. The structure is stabilized after heat treatment of the as-alloyed sample at 550 °C and average crystallite size is found to be 18.5 nm. The structural phase stabilization of Si: $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> is also confirmed from Raman spectrum (785 nm diode laser source, 0.5 mW). A peak at  $\sim$ 525 cm<sup>-1</sup> corresponding to the vibration of Si-O bonds has been observed in our Si: $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> system, confirming the doping of Si at the Fe sites of hematite structure. Temperature dependent magnetization curves at applied field of 200 Oe displayed a separation between the zero field-cooled (ZFC) and field-cooled (FC) curves below 350 K. This indicates canted antiferro/ferromagnetic behavior of the sample, which also displayed magnon-magnon contribution ( $\sim$ 819 cm<sup>-1</sup>,  $\sim$ 1544 cm<sup>-1</sup>) in the Raman spectrum. The magnetization value of Si: $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> increased on increasing the magnitude of the applied magnetic field upto 50 kOe. However, there is no saturation of magnetization within the field of 50 kOe within the measurement temperature 350 K. The sample was found to be a direct band gap (2.87 eV) semiconductor. The tetravalent Si doping in the Fe<sub>2</sub>O<sub>3</sub> structure has significantly enhanced the electrical conductivity, which is found in the range of 10<sup>-4</sup> S/m-10<sup>-6</sup> S/m for the temperature range 300 K-600 K. The enhancement of electrical, optical and magnetic properties marks Si: $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> system as a potential candidate for the applications in low power consuming spintronic devices.

**Keywords:** Si doped  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>, Magnon-magnon mode, Canted AFM, Direct band gap, Temperature dependent conductivity.



**Fig.1:** Raman spectra, M-T curves at 200 Oe and  $\sigma$  (T) curves (warming and cooling modes) of Si: $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> system.

OP-EN-184

## First-principles Investigations into the Electrochemical Behavior of Mg based Intermetallics

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### ABSTRACT

Magnesium (Mg) alloys have been the center of attention in many engineering industries owing to their excellent properties like low density, high specific strength, and high ductility making them especially useful in the transportation sector as a lightweight material that subsequently reduces energy consumption and CO<sub>2</sub> emission. The room temperature ductility and mechanical properties of Mg are usually enhanced by alloying additions. Based on the thermomechanical processing, the presence of critical concentration of alloying element typically leads to the formation of stable binary intermetallic phases with Mg thereby, distinctly altering the microscopic electrochemical properties of the alloy. However, the secondary intermetallic phases in Mg alloys are typically of sub-micron size, thus accurate electrochemical characterization is a challenging issue. Using first-principles calculations, the electrochemical behavior of various Mg intermetallics was comprehensively quantified. Based on the predicted corrosion potential, apart from Mg<sub>2</sub>Ca which behaves as an anode to the Mg matrix, the rest of the Mg based intermetallics act as a cathode. The electrochemical polarization behavior of the intermetallics was strongly dependent on surface-mediated properties (surface energy and work function) and chemical bonding characteristics. Finally, the computational framework provides an accurate screening tool that can assist in alloy design and development of coatings.

**Keywords:** First-principles, Mg alloys, Mg intermetallics, Electrochemical behavior.

OP-EN-186

## Transport Property and Thermal Stability of the CsH<sub>2</sub>PO<sub>4</sub>/NaH<sub>2</sub>PO<sub>4</sub>·2H<sub>2</sub>O Composite Electrolytes for Fuel Cells

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### ABSTRACT

Solid acid composite electrolytes CsH<sub>2</sub>PO<sub>4</sub>(CDP)/NaH<sub>2</sub>PO<sub>4</sub>·2H<sub>2</sub>O (SDP·2H<sub>2</sub>O) were prepared and observed the structural, thermal, and transport properties by Fourier Scanning Electron Microscopy, Energy Dispersive X-Ray Analysis, X-ray Diffraction, Differential Scanning

Calorimetry, Fourier Transform Infrared Spectroscopy, and conductivity measurement. We have investigated the superprotonic phase transition from monoclinic to cubic phase at 235°C in CDP, at which the conductivity increased up to 2 to 3 orders of magnitude. The initial dehydration event in CDP occurs at 260°C. The performance of CDP was increased due to the addition of  $\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$  in the form of conductivity and stability. Thermal characterization showed that introducing the additives, dehydration behaviour shifted to the lower at the higher temperature. The conductivity is also increased above the temperature of 250°C up to 1.5 orders of magnitude which were found in the composite electrolytes. The electrodes were prepared by a vacuum coating unit of silver paste.

**Keywords:** Cesium dihydrogen Phosphate, Sodium dihydrogen Phosphate, Electrolyte, Conductivity, Fuel Cell.

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**OP-EN-190**

## Investigation of Photocatalytic Properties of $\text{g-C}_3\text{N}_4/\text{TiO}_2$ as Nanocatalyst using Real-time Industrial Dye Effluent

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### ABSTRACT

The photocatalytic studies using real-time industrial dye effluents have lot of opportunities in research. In this study, a hydrothermally synthesized  $\text{g-C}_3\text{N}_4/\text{TiO}_2$  nanocatalyst has been investigated for photocatalytic activities by degrading methylene blue (MB) and industrial dye effluents under visible light exposure. Samples were characterized via X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), HRTEM, and UV-vis absorption spectroscopy. In recent studies, graphitic carbon nitride ( $\text{g-C}_3\text{N}_4$ ) has gained remarkable attention in photocatalysis as a metal-free visible-light-driven, tunable bandgap structure, high adsorption affinity toward organic substances, and suitable for environmental pollution and energy crisis. However, pure  $\text{g-C}_3\text{N}_4$  shows poor catalytic performance in the practical application of dye degradation due to its low surface area and less charge separation. Thus,  $\text{g-C}_3\text{N}_4/\text{TiO}_2$  nanohybrid has been chosen with the goal of enhancing wastewater quality using photocatalytic technology. XRD studies confirmed the crystalline nature, HRTEM revealed the morphology of the prepared sample in the nanometer range, and PL data confirmed the more charge carrier separation in  $\text{g-C}_3\text{N}_4/\text{TiO}_2$  nanocatalyst. Photocatalytic results exhibit the highest degradation efficiency of MB is ~96 % with the presence of  $\text{g-C}_3\text{N}_4/\text{TiO}_2$  due to improved chemical bonds and charge separation at their interface. Thus,  $\text{g-C}_3\text{N}_4/\text{TiO}_2$  nanocatalyst can be utilized as an efficient candidate for diverse photocatalytic processes in energy and environmental applications.

**Keywords:** Industrial dye effluents, Wastewater treatment, Dye degradation, Photocatalysis.

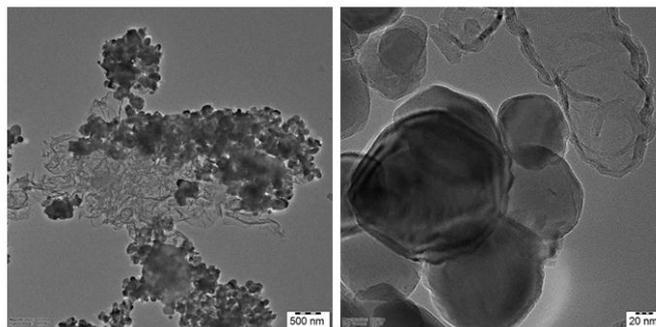


Fig.1: HRTEM morphograph of g-C<sub>3</sub>N<sub>4</sub>/TiO<sub>2</sub> at 500 nm (left) and 20 nm (right)

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## OP-EN-208

### Influence of Oxalic Acid on the Structural and Optical Properties of Tungstenoxide Nanoparticle

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#### ABSTRACT

Tungsten oxide, the well-known transition metal oxide gained much attention during the last decade owing to its good electro chromic, photo catalytic, gas sensing and antibacterial applications. It is an N type semiconductor with band gap energy about 2.8 eV. Herein, we report the synthesis and characterisation of tungsten oxide nanoparticles by co-precipitation and oxalic acid assisted co-precipitation methods with sodium tungstate dihydrate as precursor. On the basis of TGA/DTA analysis, different annealing temperatures are systematically selected viz. 300°C and 400°C for oxalic acid assisted tungsten oxide and 700°C and 800°C for the other and the samples are coded as WO300, WO400, W700 and W800 respectively. The influence of oxalic acid and annealing temperature on the structural and optical properties have been characterised by X-Ray diffraction, UV-Visible and photoluminescence spectroscopy measurements. High crystallinity of the samples is revealed from the intense and narrow X-ray diffraction peaks. The monoclinic crystal structure is unaffected by the addition of the oxalic acid. The average crystallite size measured using Debye-Scherrer equation is obtained as 25.78 nm, 39.07 nm, 7.49 nm and 8.51 nm for the samples W700, W800, WO300 and WO400 respectively. The oxalic acid tungsten oxide samples showed a considerable reduction in the crystallite size compared to the other. Crystallite size also increased with increase in annealing temperature. The Williamson-Hall analyses of the samples are carried out assuming uniform deformation model. The optical band gap energy, calculated by Kubelka-Munk relation, showed an increase with annealing

temperature and the values are obtained 2.11 and 2.51 eV for the samples W700 and W800. But in the case of oxalic acid assisted samples WO300 and WO400, the band gap energy values are obtained as 2.25 and 1.85 eV respectively, showing a decrease with increase in annealing temperature. The photoluminescence studies carried out at an excitation wavelength of 350 nm, showed that PL emission peak positions do not change with addition of surfactant or annealing temperature. The main advantage of the oxalic acid assisted co-precipitation synthesis is the reduction in the crystallite size and optical band gap energy of the nanostructured tungsten oxide samples.

**Keywords:** Tungstenoxide nanoparticle, Oxalic acid, Annealing temperature.

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**OP-EN-209**

## ZnO Nanoparticles Elctrophoretically Deposited Over Layer-by-layer Electro-deposited rGO/PANI Hetero-structure for Super Capacitor Applications

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### ABSTRACT

The combination of carbon nanomaterials, conducting polymers, and metal oxides provides a superior combination of high-quality supercapacitor (SCs) materials. The presence of an electric double layer capacitance and pseudocapitance helps to obtain a higher specific capacitance. In this study, reduced graphene oxide (rGO), polyaniline (PANI), zinc oxide (ZnO) were combined. This hybrid material is expected to exhibit superior electrochemical properties and be environmentally friendly. We used electrodeposition routes to prepare a hybrid material on an indium tin oxide (ITO) substrate. The morphologies and quality of the samples were analysed using scanning electron microscopy, Raman spectroscopy and X-ray diffraction techniques.

**Keywords:** Reduced graphene oxide, Polyaniline, Zinc oxide, Electrodeposition.

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**OP-EN-217**

## Preparation of Cylindrical Activated Carbon Pellets and Their CO<sub>2</sub> Adsorption Properties

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### ABSTRACT

The usability of activated carbon (AC) pellets in functional adsorption units depends on important factors such as mechanical strength and thermal stability. The present study

elaborates the preparation of AC pellets using a hybrid binder consisting of carboxymethyl cellulose (CMC) and bentonite. CMC gives plasticity, which helps in extrusion process and provides mechanical strength to the pellets. On the other hand, bentonite improves thermal stability of the pellets. Hence, two sets of pellets were prepared with AC (in-house prepared) with a binder ratio of 95:5 and 96:4 (wt:wt) by extrusion method. The as prepared pellets of size 2mm x 6mm (dia. x length) were characterized for their mechanical strength, thermal stability as well as CO<sub>2</sub> adsorption capacity. The pellet composition, 95:5 showed higher mechanical strength as well as thermal stability as compared to 96:4. Furthermore, the corresponding CO<sub>2</sub> adsorption capacities were determined to be 127.94 mg/g and 137.60 mg/g respectively. These studies revealed that the increase in the binder composition enhanced both mechanical strength and thermal stability, however reduced the CO<sub>2</sub> capture capacity of the pellets which may be attributed to the drop in the porosity as well as surface area.

**Keywords:** Activated carbon, CMC, Bentonite, Binder, CO<sub>2</sub> adsorption.

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### OP-EN-225

## L-ascorbic acid-Reduced Graphite Oxide as Active Material for Supercapacitors

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### ABSTRACT

A facile, environment friendly technique to synthesize reduced graphite oxide (rGO) by the chemical reduction of graphite oxide (GO) is discussed in this work. A non-toxic biocompound, L-ascorbic acid, was employed as the reducing agent to synthesize rGO for supercapacitor applications. The reduction of GO yielded a two-dimensional structure of stacked layers, with an interlayer spacing comparable with that of graphite. The reduction was more prominent on the surface functionalities as inferred from X-ray photoelectron spectroscopy and elemental analysis. A symmetric supercapacitor, fabricated using neutral aqueous electrolyte, exhibited an energy density of 19 Wh kg<sup>-1</sup> and a power density of 1120 W kg<sup>-1</sup>. The material manifested a dominant capacitive behavior with prominent contribution from the surface processes. The variations in the contribution of surface and insertion processes with scan rates were analyzed. The good cycling stability of 93% after 1000 cycles and the considerable energy density values are corroborative of employing L-ascorbic acid to synthesize rGO for supercapacitor applications.

**Keywords:** Reduced graphite oxide, L-ascorbic acid, Green synthesis, Supercapacitor.

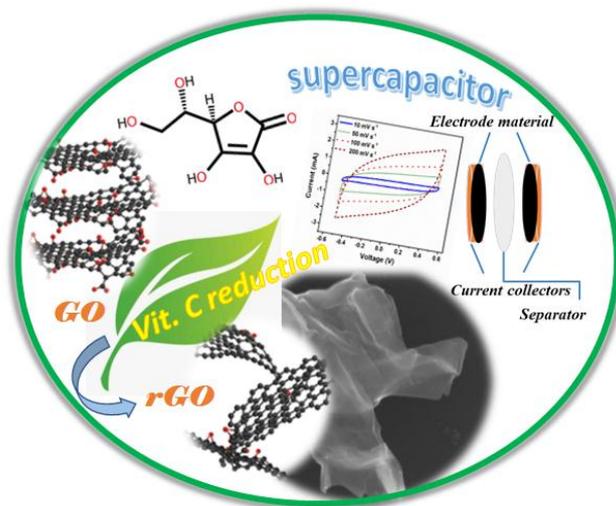


Fig. 1: Graphical abstract

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### OP-EN-232

## Study the Physical Properties of n-type Orthorhombic $\alpha$ -SnSe Thin Film for Optoelectronic Applications

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### ABSTRACT

Tin selenide (SnSe) shows immense application possibilities in optoelectric device application due to electric and optical properties tunability. A facile temperature-assisted mechanochemical method is used to synthesize tin selenide at a relatively low temperature of 350°C. Powder Energy Dispersion Spectra analysis reveals that the synthesized nano powder exhibits a slightly Sn-rich SnSe phase. Using the reaction product as source material, SnSe films is deposited on normal glass substrates by thermal evaporation technique. Single phase and polycrystalline film with high preferable (111) orientation exhibiting orthorhombic structure is observed in XRD pattern. The homogenous, crackles, and nano-porous surface is visible in SEM images. The phase purity of the SnSe thin film is verified by Raman measurements. Optical characteristics of thin film exhibits good absorption and an optimum direct band gap (1.54 eV). According to Hall measurements, n-type SnSe has an extremely low resistance ( $3.3 \times 10^{-2} \Omega \text{ cm}$ ) and a high carrier concentration up to  $4.63 \times 10^{19} \text{ cm}^{-3}$ . n-SnSe thin film opens up new possibilities to the fabrication of homojunction SnSe-based photovoltaic devices.

**Keywords:** SnSe, Thin film, Thermal evaporation, Optoelectronic applications.

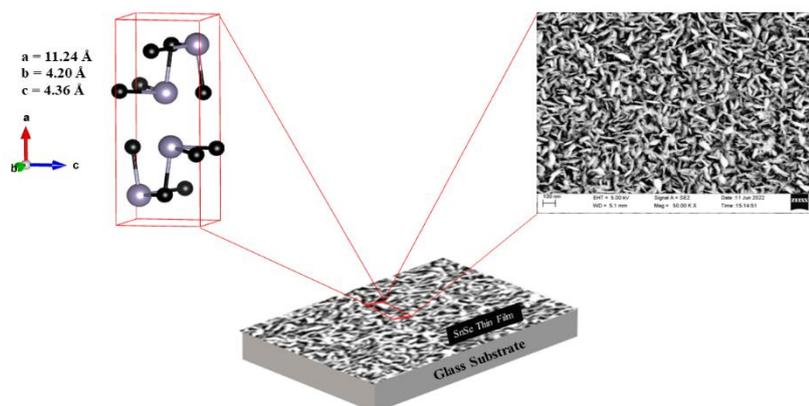


Fig. 1: Graphical presentation of Tin monoselenide thin film

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### OP-EN-361

## LLDPE based Alkaline Anion Exchange Membrane through Microwave-assisted Graft Copolymerization for Fuel Cell

### Applications

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### ABSTRACT

Energy conversion and storage system research is moving more quickly now than it ever has because of the surging demand for sustainable energy resources and increased awareness of environmental issues. In this respect, the polymer electrolyte-based fuel cells are of immense importance due to their enormous advantages over other fuel cells due to the capability to selectively permeate ions between the anode and cathode. Two types of Polymer membranes for fuel cell applications are being investigated by the researchers across the globe, Proton Exchange Membranes (PEM) and Alkaline Anion Exchange Membrane (AAEM). Herein, Anion Exchange Membranes were made and characterized for application in Anion Exchange Membrane Fuel Cells. 1-vinylimidazole and 4-vinyl pyridine monomer were chemically grafted using Azobisisobutyronitrile (AIBN) as initiator, onto a Linear Low-Density Polyethylene (LLDPE) film in water as the solvent system. The grafting reaction was performed using a Microwave synthesizer in a very limited time. Ferrous salts were added as inhibitors. The prepared membranes exhibit good ion exchange capacity along with improvement in water uptake.

**Keywords:** Microwave irradiation, Graft polymerization, Anion Exchange Membrane, radiation-induced grafting, Functional Materials, Clean Energy.



**Fig. 2:** Different stages of membrane synthesis

### OP-EN-418

## Study of Temperature Dependent Electrical Properties of Antimony Tungstate Nanoparticles

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### ABSTRACT

Layered Aurivillius oxides have attracted research interest due to their unique structural characteristics and outstanding performance in ferroelectric dielectrics [1]. Antimony tungstate (SWO) is a well-known member of Aurivillius family due to its efficient photocatalytic properties and battery applications. Further it is an interesting material due to its intrinsic multiferroic properties [2]. Herein, SWO is prepared by the microwave assisted hydrothermal process which crystallize in triclinic form with space group P1, conformed by XRD data and the morphology of the sample is studied by the FESEM images. Further, dielectric constants of SWO sample measured at different frequencies while varying its temperature starting from the room temperature up to 200°C and their correlation are studied. Moreover, the AC electrical conductivity of the sample is also calculated with a LCR meter with an oscillator voltage of 500 mV with a frequency in the range 50 Hz to 50 MHz. The temperature dependences of permittivity and loss tangent ( $\tan\delta$ ) are also calculated simultaneously. Interestingly it has been observed that the electrical impedance of the sample decreases with increase in the frequency. The frequency-dependent electrical data are also analysed for temperature dependence of real ( $M'$ ) and imaginary part ( $M''$ ) of electric modulus.

**Keywords:** Antimony tungstate, Dielectric, Impedance, Loss tangent.

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OP-EN-420

## Influence of Lanthanum ions on Structural and Magnetic Properties of Mn - Co based Nanoferrites

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### ABSTRACT

The spinel nanoferrites were the best advisable materials used for absorption of electromagnetic radiation (EMR) in different ways. Electromagnetic interference (EMI) has got most challenging applications in telecommunication system such as computers, radar systems, and mobile phones. The EMI affects the electronically controlled system and also damage human health. To overcome these EMI troubles EMR has the ability of absorbing unwanted electromagnetic signals [1]. Rare earth doped nanoferrites have unique and important applications in electronic devices, transformer cores, magnetic recordings, radar signals, high frequency circuits and telecommunication [2]. Lanthanum doped manganese - cobalt nanoferrites with series ( $x=0.00,0.02,0.04,0.06,0.08$ ) were prepared. Obtained nanopowders were then calcined at 1000°C for 24 hrs. The sol-gel method was a best combination of combustion and chemical gelation process. The advantage of sol-gel method was a good stoichiometric control and results in ultra-fine nano particles, which overcomes the drawbacks in the coprecipitation method. X-ray diffraction revealed a cubic spinel structure for prepared nanoferrites, where the crystallite size decreases with increase of La<sup>3+</sup> ions. Whereas lattice constant increases with increase of La<sup>3+</sup> ions, due to ionic radius of prepared nanoferrites [3]. Magnetic saturation decreases with increases of lanthanum ions. An overview of these properties promotes that prepared spinel nanoferrites were favourable for magnetic storage applications.

**Keywords:** Spinelferrites, Sol-gel, Structural, magnetic properties, Saturation.

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**OP-EN-421**

## Study on Optical Conductivity of Green Synthesized CuO Nanoparticles by UV Spectroscopy

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### ABSTRACT

This study is written considering the optical properties of green synthesized CuO prepared by sol-gel method. These green as-synthesized CuO nanoparticles were subjected to three different temperatures and analyzed for electrical conductivity. For this, green CuO nanoparticles were analyzed by XRD, FTIR, UV-Spectra, band gap, absorption coefficient, Refractive Index and optical conductivity properties, and its band gap was between 1.82 and 1.89. Using these UV spectra and band gap has further examined the CuO nanoparticles to explore the possibility of using them as a material for applications such as solar cell and photovoltaic cell.

**OP-EN-422**

## Explore the Molar Effects on Physiochemical Behaviours of Cobalt Oxide Nanoparticles and Their Ameliorated Charge Storage Potential

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### ABSTRACT

In the wake of recent developments, supercapacitors are actively being employed as a superior energy storage material and are being regarded as a viable alternative to traditional battery technologies. Supercapacitors' high-power density and fast charging/discharging potential have made them increasingly appealing, and a significant percentage of the science community has constantly been working on this problem. Because of their high specific capacitance, transition metal oxides have gained much interest as electrode materials for flexible supercapacitors; as a result, multifunctional cobalt oxide is one of the most versatile and crucial materials for advances in energy storage. This study proposed the synthesis of cobalt oxide nanoparticles at varying molarities using a facilitated hydrothermal method. The physicochemical properties of the synthesised products were explored using X-Ray diffraction, FT-IR, UV-Visible, SEM, and a charge storage potential was significantly investigated. The formation of single-phased cobalt oxide nanoparticles is revealed by structural investigation, with the estimated crystallite size increasing proportionally to the concentration of cobalt ions. Significantly, the crystalline parameters of cobalt oxide are

greatly influenced by the molar ratio changes. Morphological studies strikingly demonstrated the porous-like structures of particle dispersion over the samples. During investigations, the cobalt oxide demonstrates an efficient charge storage ability, implying that the cost-effective synthesised cobalt oxide's considerable capacitance capability complies with and supports the energy storage demands.

**Keywords:** Cobalt oxide, Hydrothermal, Supercapacitor, Charge storage, Energy demand.

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**OP-EN-423**

## Development of Phase Pure $\text{Cu}_2\text{ZnSiSe}_4$ via Solid State Synthesis for Energy Applications

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### ABSTRACT

The  $\text{Cu}_2\text{ZnSiSe}_4$  semiconductor, with its wurtz-stannite structure, stands out as one of the most promising choices for PV technologies. In this study, we developed a simple and efficient approach for producing single-phase  $\text{Cu}_2\text{ZnSiSe}_4$  bulk material using dry ball milling from elemental precursors (Cu, Zn, Si and Se). X-Ray Diffraction (XRD) and Raman Spectroscopy investigations were performed after every two hours of the dry milling process to examine the progression towards single phase  $\text{Cu}_2\text{ZnSiSe}_4$  and the concomitant secondary phase depletion. The strong diffraction peaks demonstrate the emergence of  $\text{Cu}_2\text{ZnSiSe}_4$  materials that crystallize in an orthorhombic system of wurtz-stannite structure with the space group of  $\text{Pmn}2_1$ . Utilizing UV-Vis spectroscopy, the optical characteristics of the materials were examined. The linear and nonlinear optical constants of the  $\text{Cu}_2\text{ZnSiSe}_4$  films were determined using the transmittance and reflectance data. Additionally, it is convenient to analyse solid-state characteristics, including refractive index, extinction coefficient, dielectric constant, and optical conductivity. The optical characteristics showed excellent optical conductivity and absorption in the visible range. This shows its applicability as an absorber layer in photovoltaic solar cells and leads to the achievement of a favourable optical band gap of 1.2 eV. The materials were then subjected to the Hall Measuring technique in order to understand their electrical properties, and this produced a p-type semiconductor which is well suited for the semiconductor and solar industries. The results obtained indicate the good characteristics of the quaternary semiconductor nanocrystals made using a single-route mechanosynthesis from resources found on earth.

**Keywords:** Quaternary Chalcogenide, Mechanochemistry, Orthorhombic, Optoelectronic behavior.

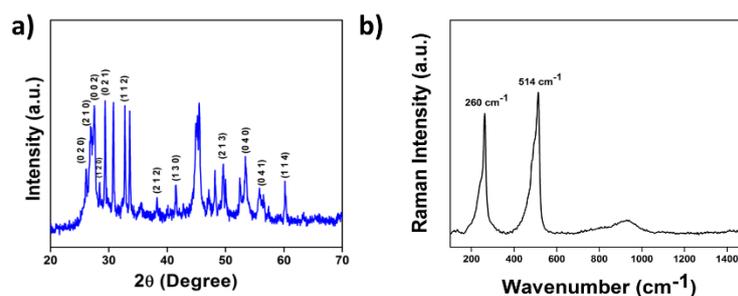


Fig.1: a) XRD and b) Raman spectrum of Cu<sub>2</sub>ZnSiSe<sub>4</sub> obtained by mechanochemical synthesis.

### OP-EN-437

## Fabricating Fe-aminoclay Functionalized Self-cleaning Polyacrylonitrile Membrane for Multipollutant Separation and Wastewater Treatment

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### ABSTRACT

Membrane fouling diminishes separation efficiency and truncates membrane life, posing a serious impediment to membrane performance and application. In this study, iron-aminoclay (Fe-AC) is introduced into the membrane via a blending approach, resulting in the development of self-cleaning characteristics in a simple and sustainable way. This incorporation was found to boost the flux rate dramatically without impacting the solute rejection efficiency or the structural integrity of PAN (polyacrylonitrile). The circumstantial engendered Fe-AC membranes persisted by structure and operative features such as ATR-IR, FE-SEM, P-XRD, contact angle, and zeta potential evaluations. The obtained membranes were tested for their potential using different feed streams. The adapted membranes dyes rejected > 90.0 % for the overwhelming majority of the anionic, cationic, and, neutral with 50.0 - 70.0 Lm<sup>-2</sup> h<sup>-1</sup> flux in 40.0 % of MgSO<sub>4</sub> at 4 bar pressures. The experiment remained broadened to include feed solutions i.e., pharmaceutical waste, with a rejection rate of more than 80%. The membranes were also reused, taking advantage of the self-cleaning property. The membranes were reused for up to five cycles with insignificant diminish in flux and no compromise in rejection (99.9 %) using a sustainable photo-Fenton reaction. Long-term experiments revealed that commercial polyamide RO and various Fe-AC membrane concentrations can be distinguished. In the case of Fe-AC membranes, the comparison investigation revealed less flux with no impairment in humic acid rejection. Even after several operating cycles, the membranes remained stable with no appreciable reduction in rejection. In this way, Fe-AC-

based PAN membranes can be expected to have excellent rejection and self-cleaning properties while also being cost-effective and environmentally benign.

**Keywords:** Nano-filtration membrane, Multipollutant separation, Pharmaceutical wastewater treatment, Self-cleaning, Antifouling.

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### OP-EN-438

## A High-Performance PEO-NaBO<sub>3</sub>.4H<sub>2</sub>O-Na<sub>3</sub>Zr<sub>2</sub>Si<sub>2</sub>PO<sub>12</sub> Composite Electrolyte for All-Solid-State Sodium-Ion Batteries

### ABSTRACT

Rechargeable all-solid-state sodium-ion batteries (ASSBs) are becoming more popular in small scale portable electronic devices as well as in large-scale energy storage systems due to their plentiful supply and inexpensive cost of sodium. The extensively used nonaqueous liquid electrolytes in ASSBs are flammable, thermally unstable, and potentially dangerous. In order to create all-solid-state sodium-ion batteries, this study provides a composite solid electrolyte technique that combines the adaptability of a polymer electrolyte and the high ionic conductivity of a ceramic electrolyte. A composite electrolyte contains a poly(ethylene oxide) matrix, NaBO<sub>3</sub>.4H<sub>2</sub>O salt and a ceramic Na<sup>+</sup> ion conductor (Na<sub>3</sub>Zr<sub>2</sub>Si<sub>2</sub>PO<sub>12</sub>) dispersed in it has been fabricated. The resulting composite electrolyte PEO-NaBO<sub>3</sub>.4H<sub>2</sub>O-Na<sub>3</sub>Zr<sub>2</sub>Si<sub>2</sub>PO<sub>12</sub> exhibits high Na<sup>+</sup> ion conductivity, dendrite suppression, decreased interfacial issues, and an elastic property. The morphology and composition of prepared composite electrolyte have been characterized by various physicochemical characterization techniques such as X-ray diffraction, transmission electron microscopy and energy dispersive x-ray spectroscopy. The results of electrochemical analyzes such as cyclic voltammetry, impedance and charge-discharge tests showed that PEO-NaBO<sub>3</sub>.4H<sub>2</sub>O-Na<sub>3</sub>Zr<sub>2</sub>Si<sub>2</sub>PO<sub>12</sub> composite electrolyte has higher electrochemical stability. All-solid-state sodium-ion batteries with a sodium metal anode and a NaFePO<sub>4</sub> cathode exhibit stable long-term cycling performance with the PEO-NaBO<sub>3</sub>.4H<sub>2</sub>O-Na<sub>3</sub>Zr<sub>2</sub>Si<sub>2</sub>PO<sub>12</sub> composite electrolyte.

OP-EN-445

## X-ray Diffraction Study, W-H plot, and Nelson-Relay Function for the Structural Data of $\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4 + \text{Xwt}\% \text{V}_2\text{O}_5$ where ( $x = 0.0 - 1.0$ )

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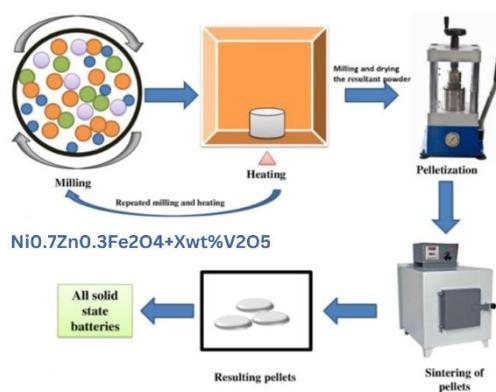
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### ABSTRACT

In the present study, we have synthesized nickel ferrite magnetic  $\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4 + \text{Xwt}\% \text{V}_2\text{O}_5$  where ( $x = 0.0, 0.2, 0.4, 0.6, 0.8$  and  $1.0$ ) via ceramic method. The synthesized powder of  $\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4 + \text{Xwt}\% \text{V}_2\text{O}_5$  ferrite was characterized by X-ray diffraction technique in order to identify Bragg's reflections and study the Miller indices (hkl). The structural parameters lattice constant (a) unit cell volume (V), X-ray density (dx) porosity (P%), etc. have been evaluated from the XRD data using the standard formulas. Williamson-hall extrapolation function and Nelson-relay extrapolation function have been deployed to reevaluate the calculated crystallite size (t) and lattice constant (a). The data obtained from the calculations has reflected the formation of cubic geometry; spinel structure and  $Fd3m$  space group of  $\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4 + \text{Xwt}\% \text{V}_2\text{O}_5$  ferrite. Resuming the important applications of  $\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4 + \text{Xwt}\% \text{V}_2\text{O}_5$  in the energy storage devices, microwave devices technology, and magnetic applications, the prepared  $\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4 + \text{Xwt}\% \text{V}_2\text{O}_5$  can be considered for future study by the research community.

**Keywords:** Additives, Ferrite, Ceramic, Structural property, W-H Plot, Nelson-Relay function.



**Fig.1:** Synthesis of the  $\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4 + \text{Xwt}\% \text{V}_2\text{O}_5$  using ceramic method

OP-EN-465

## Mechanosynthesis of Semiconductor Nanocrystalline $\text{Cu}_2\text{ZnSnSe}_4$ for solar cells

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### ABSTRACT

$\text{Cu}_2\text{ZnSnSe}_4$  is a promising material and mainly suitable for the fabrication of low-cost and highly efficient thin film solar cells. In this study, we established a simple and efficient approach for producing a single-phase  $\text{Cu}_2\text{ZnSnSe}_4$  bulk material from elemental precursors (Cu, Zn, Sn and Se) using dry ball milling. After every two hours of the dry milling process, X-Ray Diffraction (XRD) and Raman Spectroscopy investigations were carried out to investigate the movement towards single phase  $\text{Cu}_2\text{ZnSnSe}_4$  and the concurrent secondary phase depletion. The development of  $\text{Cu}_2\text{ZnSnSe}_4$  materials that crystallize in a Kesterite system is shown by the prominent diffraction peaks. The optical properties of the materials were studied using UV-Vis spectroscopy. Utilizing the transmittance and reflectance data, the linear and nonlinear optical constants of the  $\text{Cu}_2\text{ZnSnSe}_4$  films were calculated. It is also useful to examine solid-state properties as well, such as refractive index, extinction coefficient, dielectric constant, and optical conductivity. By using HRTEM and SAED to further examine the morphology and crystallinity of the mechanosynthesis  $\text{Cu}_2\text{ZnSnSe}_4$  nanoparticles, we can conclude that they are spherical in shape and have uniform size distributions over the entire region. Hence from these results we can conclude that the above synthesized powder can be used for the development of thin films via thermal or electron beam evaporations on desired substrate also we can use for various energy harvesting applications as a photoabsorber.

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PP-EN-104

## Nanomaterials and General Techniques to Treat day-to-day Waste and Pollutants from the Discharged Waste-Water

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### ABSTRACT

Waste is an unavoidable by-product of most human activity. In others terms it can be used for the alternatively products, whose inherent value of which has been consumed from the perspective of the current holder like, packaging bags and material, oil dispensers, plastics and rubber things who have lost their original inherent value from the consumers perspective. Solid waste included a wide range of materials of varying environmental toxicity like biomedical waste, batteries, solvents, resins, paints and sludges, glass, ceramics, stones, metals, plastics, rubber, leather, wood, cloth, straw, abrasives, etc. Uncontrolled, open dumping of all those things on the peripheries of many of the important areas of cities has resulting in the degradation of valuable land resources and the creation of long-term environmental and human health problems. Solid waste is not only an environmental problem, but also an economic loss of any country because different waste processes including waste collection, treatment and disposal costs often place a large burden on the government finances. This review article has tried to explain various nanomaterials available which helps in the removing various kinds of impurities from discharged water. Many of the treatments are available to treat water but all have there limitations. There are more advanced developments occurred in nanomaterials like nano-photo catalysts, nano-motors, nano-membranes and nano-sorbents are available for the effective treatment of discharged contaminated water. Because the nanomaterials show different responses as compared to bulk materials due to their distinct quantum effects and surface properties, they are a more competent method to treat wastewater than other available methods. It also enhanced various other properties like electric, mechanical, magnetic chemical reactivity and optical properties which make them ideal material to treat waste water. The nanomaterials which are more commonly available for water treatments are SiO<sub>2</sub>, ZnO, TiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Graphene and GO/RGO. The promising and primarily used photo catalyst is titanium dioxide (TiO<sub>2</sub>) because of it's easy availability, low cost, toxic free property, chemical stability, etc [1-3].

**Keywords:** Nanomaterials, SiO<sub>2</sub>, ZnO, TiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Graphene, GO/RGO.

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PP-EN-148

## Design & Fabrication of a Low Carbon Footprint Energy Efficient Vehicle

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### ABSTRACT

In the light of a global awareness to global warming and climate change caused by human activity it has become imperative to change our approach to things taken for granted since the industrial age.

The project aims to design and build an unconventional automobile that would have

- a low carbon footprint, low energy and water use for manufacture,
- low carbon emissions during use,
- operate at a higher efficiency,
- explore alternative natural materials for build
- explore alternative construction techniques

The concept is a micro two seater utility vehicle offering comparable range and gradability of a conventional automobile, with a top speed of 65 kmph for city and highway use, aimed at a nuclear family offering superlative safety, operational economy and low ownership cost with minimal damage to the environment.

The drivetrain uses a convergence of proven technologies

- a parallel hybrid drive train with ICE and Electric drives to enhance efficiency by
  - Regeneration to capture lost energy during braking and downhill drive
  - reduction in energy lost due to clutching,
  - offers a low speed all electric option when required.
- plug in charging from grid
- Solar panels to capture free renewable energy into the vehicle energy system.

A 6 kW gasoline engine with a 4 speed transmission drive the rear wheels through a hybrid transmission matched and mated to a 2 kW BLDC motor in a full time drive. Energy Storage is in lower carbon footprint fully recyclable lead acid gel batteries.

**Keywords:** SUV- Solar Urban Vehicle, MPV - Multipurpose vehicle, IC - Internal combustion, EV - Electric Vehicle, BLDC Motor - Brushless DC motor.



Fig.1: Concept proposal

PP-EN-165

## Investigating the Thickness-Dependent Schottky Behaviour in Halide Perovskite Nanocrystal-Based Schottky Diodes

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### ABSTRACT

Schottky junctions stand as a crucial component in some major optoelectronic and semiconducting applications like LEDs, photodetectors, photodiodes, solar cells, FETs, CCDs, triboelectric generators, etc. A metal-semiconductor contact with appropriate work functions can give rise to a Schottky junction where the junction characteristics primarily affect its electrical properties. In this work, we report Schottky devices based on metal halide perovskite nanocrystals (PNCs) and study the influence of varying the perovskite layer thickness on the junction parameters. The synthesis of perovskite nanocrystals was carried out using a facile solution-induced recrystallization approach. The optical studies confirmed the formation of nanocrystals with an average crystallite size of 22nm and an average excitonic lifetime of 29.85ns. We carried out the thickness tuning of the perovskite layer by varying the number PNCs layer coating (3,5,7 and 11). The Atomic force microscopy studies conducted on bare PNCs films revealed a single layer thickness of approximately 90nm. I-V characterization of the Schottky devices assembled in a device structure FTO/PNCs layer/Al were carried out under dark conditions and Schottky parameters were evaluated using the Thermionic emission theory. The best Schottky characteristics with a high value of rectification, low reverse saturation current, and maximum barrier height were obtained for 11-layer coated PNCs devices.

**Keywords:** Metal halide perovskite, Perovskite nanocrystals, Schottky device, Thickness, Barrier height; rectification.

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PP-EN-166

## Influence of Cobalt Doping for Enhanced Electrochemical Performance of ZnO Quantum dot Supercapacitor

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### ABSTRACT

Doping of metal oxide is an effective approach for increasing the electrochemical performance of supercapacitors. Among many metal oxides, ZnO QD is a promising electrode material used due to its low cost, eco-friendly nature, high energy density, higher surface-to-volume ratio, rapid charge transportation but poor cycling stability and low electrical conductivity restricts its application in energy devices. In this work, we have synthesized cobalt doped ZnO QD at different concentrations ( $x=0, 0.02, 0.04$ ) via the wet-precipitation method. The doping of Co in ZnO crystal is confirmed by XRD, EDX & UV analysis. On effective addition of Co dopant, charge transfer increased between the dopant and the ZnO resulting in more active sites and quick diffusion rate for both electron transfer and ion diffusion. Moreover, narrowing of band gap due to presence of  $\text{Co}^{2+}$  ion improves sample optical and electrical properties. The electrochemical studies revealed that  $x=0.04$  electrode is a prominent supercapacitor device with a high specific capacitance of 697 F/g, excellent power and energy density (1026 W/kg and 24Wh/kg, respectively), and good cyclic retention of 97% after 2000 cycles at 1A/g. These excellent performances of the  $\text{Zn}_{1-x}\text{Co}_x\text{O}$  ( $x=0.04$ ) electrode material make it a highly appealing candidate for future storage systems.

**Keywords:**  $\text{Zn}_{1-x}\text{Co}_x\text{O}$ , Supercapacitor Electrochemical studies, Quantum dot, Doping.

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PP-EN-170

## Doping Effect in Photo-Detecting Schottky Diodes Based on Perovskite Nanocrystals

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### ABSTRACT

Perovskite is the most popular area in the field of research on optoelectronic devices in recent era for their commendable performances. The paper relates to the development of Schottky junction photodiode, fabricated using undoped and metal doped MAPbBr<sub>3</sub> nanocrystals (NCs); where the metal doped (FTO/Perovskite NCs/Al) Schottky junction diode was found to be yielding a better rectification behavior with low reverse saturation current for detecting light. The nanocrystals were synthesized following ligand assisted re-precipitation method (LARP). The structural and optoelectronic properties of the devices were investigated systematically. Besides, optical and structural analysis of the nanocrystals were carried out by UV-vis absorbance spectroscopy, photoluminescence spectroscopy and x-ray diffraction method. All these devices were also characterized by current-voltage (*I-V*) characteristics and electrochemical impedance spectroscopy (*EIS*) under both dark and illumination conditions. Enhancement of the device current under illumination specifies generation of photocurrent in the device. Impedance spectra of all devices have been recorded in the wide range of frequency from 100 kHz to 2 MHz at 500mV biasing. From *I-V* characteristics, important parameters like ideality factor ( $\eta$ ), saturation current ( $I_0$ ), barrier height ( $\phi_B$ ), rectification ratio (*RR*) were obtained under dark and photo condition. The study revealed that the device with metal doped sample had good stability after storage for six months at ambient conditions.

**Keywords:** Perovskite, Metal Doping, Photocurrent, Schottky diode, Photo-detection, Charge trap.

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PP-EN-173

## Performance Investigation of a Scheffler Solar Cooking System Combined with Stirling Engine

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### ABSTRACT

The energy demand has increased in developed and developing countries. Governments and people are motivated to utilize sustainable energy resources. The experimental setup situated at Shoolini University, Solan, India has installed Scheffler's cooking system to cook 600 meals per day and is utilized to cook food three times a day for 200 days each year. The heat losses of the system are considered to be a crucial influence on the performance of the Scheffler cooking system. The present work is conducted to investigate experimentally the performance of Scheffler solar cooking system. As well as to integrate numerically Scheffler's cooking system with the Stirling engine to produce electricity. The novelty of the work is to determine the heat losses in the system and to utilize those heat losses to generate electricity by the Stirling engine with Scheffler thermal cooking system. The maximum efficiency of the Scheffler cooking system before integration is calculated at 28-29 %. However, the maximum efficiency of the Scheffler cooking system after integrating with the Stirling engine is calculated at 54 % which is considered more by 23-25 % more than before integration. the present study produces electricity power at 0.9 kW by Stirling engine.

**Keywords:** Scheffler dish, Concentrated solar technology, Scheffler dish with Stirling engine, Scheffler cooking system.

PP-EN-180

## Experimental Investigation on Thermal Efficiency Augmentation of Solar Air Heater Using Copper Wire for Discrete Roughened Absorber Plate

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### ABSTRACT

The thermal performance of solar air heater is improved by a higher value of radiation intensity on the absorber plate and efficient heat removal from the plate by the carrier fluid, air. The paper deals with the experimental results of enhancing the heat transfer by means of providing artificial roughness on the air flow side of the absorber plate. The underside of the absorber plate used discrete double arc reverse shaped artificial roughness, outside testing performance for heat transfer coefficient and thermal efficiency features of solar air heater were carried out in this article. The roughness range of parameters were employed in the outdoor experimental test are aspect ratio ( $W/H$ ) = 8, relative roughness pitch ( $p/e$ ) = 6.67-8.33, relative roughness height ( $e/D_h$ ) = 0.027, arc angle ( $\alpha$ ) = 60°, Reynolds Number ( $Re$ ) = 3000 to 14000. Additionally, from 11:00 A.M., just before noon, until 2:00 P.M., the outdoor test was conducted with solar radiation intensities ranging from 860 W/m<sup>2</sup> to 895 W/m<sup>2</sup>. The impact of various factors on heat transmission and thermal efficiency is compared to that of a smooth absorber duct under identical conditions of flow. Over the smooth duct, the maximum increases in coefficient of heat transfer and thermal efficiency are 288% and 129% times, respectively.

**Keywords:** Artificial roughness element, Heat transfer coefficient, Solar air heater, Solar flux, Thermal efficiency.

PP-EN-197

## Thermoelectric Properties of KCaP Half Heusler Alloys using *ab-initio* Calculations

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### ABSTRACT

The half-Heusler is emerging materials for renewable energy and potential alternatives to the organic and lead-based solar cells. In the present study, a systematic investigation on structural, electronic and transport properties of KCaP half-Heusler have been conducted using full potential linearized augmented plane wave method (FP-LAPW) method investigated with Density Functional theory. The correlation effect is implemented with PBE-GGA, TB-mBJ and mBJ+SOC as exchange potential. The electronic band plot reports the presence of indirect energy band-gap equal to 2.68 eV. The results demonstrate that our studied compound depicts semiconductor with p-type nature. Transport properties (i.e., Seebeck coefficient, electrical conductivity, thermal conductivity, power factor and figure of merit) of the studied compound were estimated using semi-conventional Boltzmann theory under constant relaxation time assumption at various temperatures, chemical potentials, and carrier concentrations.

**Keywords:** DFT, Half Heusler alloys, Figure of merit, Thermo power, Electrical conductivity.

PP-EN-204

## Review of the Impact of Nanomaterial on the Thermal Efficiency of an Evacuated Tube Solar Air Heater

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### ABSTRACT

The purpose of this review article is to analyse the use of nanomaterials to augment the thermal efficiency of an evacuated tube solar air heater. As a consequence of this, different varieties of nanomaterial are developed and utilized in the ETSAH. A comprehensive investigation is being carried out into both the incorporation of nanomaterials into the ETSAH and the improvement in performance that this will bring about. During the course of this in-

depth research, a number of issues have been investigated. One of these is how the enhancement of heat transfer is affected by the use of distinct nanofluid types, sizes, volume fractions, and applications in a variety of ETSAH types. For the purpose of justifying and, ultimately, explaining the behaviours of nanomaterials for the purpose of thermal augmentation of ETSAH, analyses have been performed and are being addressed here. Incorporating nanoparticles into the ETSAH, as shown by an analysis of the relevant literatures, results in a significant improvement in the thermal efficiency of an ETSAH.

**Keywords:** Evacuated tube solar air heater, Nanomaterials, Thermal efficiency, Heat transfer.

### PP-EN-207

## Simple and Effective Method for Finding the Value of Plank Constant

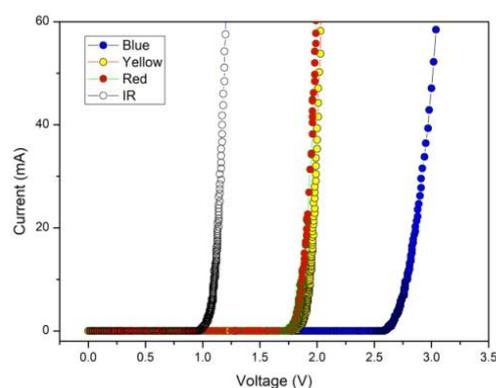
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### ABSTRACT

Plank constant play an important role in understanding behavior of matter at subatomic level. There are number of methods to find the value of it. I-V characteristics obtained for different LEDs with the help of digital potentiometer can be used to determine the planks constant. Here we use the Arduino UNO to obtain the data of the characterization curves of LEDs. Arduino is open source microcontroller which can be easily programmable using computer. For this experiment we used four different LEDs, Arduino board, digital potentiometer and connecting wires. The digital potentiometer can be used to sweep the applied voltage across the LEDs and the analog pins of Arduino can be used to measure the voltage across the different points of the circuit. The current can be calculated from the voltage drop across the series resistors. From the LED characteristics and with the value of its emitted wavelength, we are able to extract the value of planks constant. This method will be an easy and cost effective way to study one of the most important constants in Physics.

**Keywords:** Arduinio UNO, Digital potentiometer, Plank constant, LEDs, I-V curve.



**Fig.1:** I-V curve of four different LEDs

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**PP-EN-210****Synergistic Impact of Cationic Surfactants on the Performance of ZTO for Supercapacitor Applications**

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**ABSTRACT**

Zinc Stannate ( $Zn_2SnO_4$ ) nano powders were synthesized using different cationic surfactants (CTAB, EDA, TEA) via hydrothermal method technique. Structural, Morphological, compositional and optical analyses were made through XRD, FESEM attached EDAX, UV-DRS and FTIR. From the spectrum it has been observed that the morphology of all the prepared samples were modified using surfactants and the crystallite size of the sample was reduced from 14 nm to 12 nm when TEA was used as the surfactant. The specific capacitance of the electrode materials of the prepared samples were evaluated through three electrode system and found that TEA has increased the capacitance of the ZTO from 32 to 41F/g at the scan rate of 5mV/s.

**PP-EN-212****Survey of the Present Perspective of Lithium-Ion Batteries**

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**ABSTRACT**

Li-ion is rechargeable battery uses Li to store the energy and make current flow between cathode and anode by means of oxidation and reduction reaction inside it to give rise reaction potential. The positive terminal Cathode of a battery usually uses aluminium as a substrate [1]. From regular cathode material  $LiCoO_2$  which uses lithium intercalated cobalt, research is still going on for its replacement by layered cathode material, spinal  $LiMnO_2$  to olivine  $LiMPO_4$  [2]. On the other hand, negative terminal of battery usually uses copper as substrate with Li intercalated graphite as anode material. Many materials have been tested and still under research from carbon, TMO, silicon compounds to tin compounds. Smooth mobility of Li-ion between cathode and anode will be ensured by the electrolyte which is responsible for solid electrolyte interface (SEI), conductivity and thermal stability electrolyte with porous

polymer separator that is significant for total cost of battery. So far Li-ion battery is most promising among many others and potential research is on to make it more efficient. Particularly, we are interested in the Anode material of Li-ion battery as promising carbon materials with ability to tailor its morphology such as carbon fibers, tubes, aerogels, cones, graphene and beads. Nano structural study in transition metal oxide (TMO) specially in Titanium, Antimonides based on Alloying mechanism with Sb based compounds. Silicon and its compounds and their nanostructures are under our attention and their volumetric behavior during lithiation and delithiation along with the research on Sn and Sn compounds. Our aim is to synthesize such material for anode which sits compatible with cathode and electrolyte, with high energy density and better lithium absorption giving good operational future ready battery.

**Keywords:** Li-ion battery, Cathode, Anode, Electrolyte, TMO, SEI.

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#### PP-EN-219

### Evaluating the Performance and Emission Characteristics of Jackfruit Seed as Bio-oil in CI Engine

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#### ABSTRACT

Vegetable oils utilized in the production of biodiesel as the feedstock are consumables, required by the human community worldwide and is therefore not considered as a sustainable development. This need led to the study of extraction of oil from Jackfruit seed as an alternative feedstock. The study deals with the optimization of the extraction of oil using techniques and methods with solvents. The magnetic stirrer and the heater used in the process aided the extraction of oil. A biodiesel yield of 92% was incurred using methanol and potassium hydroxide as solvents during the transesterification process of the jackfruit seed oil. The conditions maintained during this process includes, 65°C of reaction temperature, 1:9 molar ratio of oil: methanol and 750 rpm of stirring speed for 40 minutes with 18g of potassium hydroxide as catalyst. The study reveals that the performance of the CI engine was found to decrease slightly when compared to the fuel diesel but the emissions of the engine were drastically reduced making it environmental friendly.

**Keywords:** Bio-oil, Transesterification, Jackfruit seed, CI engine.

PP-EN-220

## First Principles Study on Structural, Mechanical, Optoelectronic and Thermoelectric Properties of half-Heusler Alloys (KLiTe)

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### ABSTRACT

The rapid depletion of the fossil fuels and their environmental repercussion can be resolved wisely by exploring the efficient and sustainable materials which can convert waste heat into electricity. Half-Heusler materials are considered as one of the promising classes for the thermoelectric applications. Half-Heusler compounds with a valence electron count of 18, including LiMgN, NaMgN, and KMgN, are good thermoelectric materials owing to favourable electronic structures. In this work, the structural, mechanical, electronic, optical and thermoelectric properties of KLiTe compound have been predicted using first principles calculations based on the full potential linearized augmented plane wave (FP-LAPW) method and semi classical Boltzmann transport theory. Exchange-correlation effect is treated with the generalized gradient approximation with Perdew-Burke-Ernzerhof scheme (GGA-PBE) and local density Approximation (LDA) potential. The Poisson and Pugh's ratio has been calculated from elastic constants to distinguish the brittle and ductile character. KLiTe is found to be a semiconductor with direct wide band gap. Important optical response of studied half heusler is found in the visible and ultraviolet energy range. Despite the wide band gap, the studied compound exhibits large values of Seebeck coefficient and power factor, thus can be a potential candidate for technological applications. Finally, the thermoelectric properties including Seebeck coefficient, electrical conductivity, thermal conductivity, power factor and figure of merit are calculated at temperatures of values 300 K, 700 K, and 1200 K. KLiTe has large power factor of  $8.63 \times 10^{11}$  W/msK<sup>2</sup> at 1200K which makes it a possible promising candidate for the thermoelectric applications at high temperatures. Obtained results show that KLiTe could be a proficient candidate for applications in thermoelectric generators at low and moderate temperatures due to their high figure of merit values.

**Keywords:** DFT, Half Heusler alloys, Structural properties, Electronic properties, Optical properties, Thermoelectric properties.

PP-EN-228

## Nanomaterial Coating Research in Compact Thermal Energy Storage using a Counter Flow Heat Exchanger

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### ABSTRACT

This paper presents the experimental evaluation of a thermal energy storage system via Phase Change Materials (PCM). It is part of a TES used for heating, cooling, and DHW production that uses solar collectors and capable heating devices. It consists of a PCM-filled tank and a heat exchanger with staggered fins. The tank is made so that it can store a lot of energy and transfer heat quickly. Experiments showed that the tank can meet the needs of a DHW fitting and also increase system output.

**Keywords:** PCM, Heat exchanger, Heat transfer, Sensible heat, Latent heat SHS.

PP-EN-231

## Enhancing EDLC of $Ti_3C_2T_x$ Mxene with Novel Synthesis and Tunable Surface Properties

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### ABSTRACT

2D transition metal carbides/nitrides, MXenes (a family of with a general formula of  $M_{n+1}X_nT_x$  (n=1 to 3)) with their 2D lamellar structure, high density, metallic-like conductivity, tunable terminations, and intercalation pseudocapacitance charge storage mechanism show promising potential for energy storage applications.  $Ti_3C_2T_x$  is the most researched MXene, however there is a wide variety of them due to the varied transition metal, C, and/or N, and n layer combinations that can be utilized to create them. Due to its strong metal conductivity, redox reaction active surface, etc. Restacking, re-crushing, and titanium oxidation prevent  $Ti_3C_2T_x$  from achieving optimal specific capacitance. In order to mitigate these issues developing MXene with tuneable surface properties is essential. MXene's chemical diversity, electrical, mechanical, and optical properties make them useful for catalysis and electrochemical energy storage. MXenes are synthesized by eliminating the A atom layer from the parent MAX phase using an etchant like aqueous fluoride-containing acidic solutions such as Hydrogen fluoride. The synthesized MXene is then subjected to characterization where it expressed expected accordion shaped surface morphology with tunable surface terminations

possessing large surface area of  $649.171 \text{ m}^2\text{g}^{-1}$  having pore volume of  $0.844 \text{ cm}^3\text{g}^{-1}$ . The electrochemical energy storage studies showed the specific capacitance of the  $\text{Ti}_3\text{C}_2\text{T}_x$  increased at an unprecedented rate of charge storage up to  $633 \text{ F g}^{-1}$  on comparing with the studies performed in recent years.

**Keywords:**  $\text{Ti}_3\text{C}_2\text{T}_x$  MXene, EDLC supercapacitor, Wet chemical etching, Energy storage, Accordion morphology

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#### PP-EN-233

### Impact of Nanocoated Heat Exchanger with Material Behaviour of Silica Nanoparticles /water Nanofluid

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#### ABSTRACT

The use of nanofluid by engineers for thermal energy storage systems, heating and cooling microelectronic systems, space heating and cooling in contemporary buildings, as well as in smart fabrics for human comfort, has recently attracted a lot of attention. The role that nanofluid-based energy systems can play in reducing global gas emissions and saving energy is now in focus. Studies show that nanofluids based on  $\text{SiO}_2$  have physical characteristics that make them interesting fluids, particularly in industrial settings where there is substantial heat flow.  $\text{SiO}_2$  nanofluids based on the water were studied for potential applications in heat transfer. Commercial nanofluids were used to create dispersed solutions of the cited nanofluids in three distinct concentrations (0.01% vol., 0.05% vol., and 0.1% vol.). The produced nanofluid density, viscosity, and thermal conductivity were measured.

**Keywords:** Nanofluid, Thermal conductivity, Viscosity, SEM, Concentration.

**PP-EN-238**

## Effect of Te Doping on Optoelectrical Properties of Sputtered CdSe Thin Film

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### ABSTRACT

CdSe and CdSe:Te thin films were grown on glass substrates by RF magnetron sputtering method. The doping percentage of Tellurium (Te) in CdSe is 7% for the CdSe:Te thin film. X-ray diffraction (XRD) analysis confirmed the presence of CdSe and Te. The grain size is highly influenced by dopant and growth conditions, the grain size of CdSe higher than CdSe:Te. The value of  $E_g$  are found to be 2.01 and 1.73 eV for CdSe and CdSe:Te thin films respectively. The conductivity of Te doped CdSe are found to be in order of  $10^{-9}\Omega^{-1}\text{cm}^{-1}$ , while without doping it was  $10^{-8}\Omega^{-1}\text{cm}^{-1}$ , which was measured by I-V characteristics at room temperature.

**PP-EN-239**

## The influence of Phytochemicals on the Physiochemical Characteristics of ZnO Nanoparticles and their Effectual Visible Light Photocatalytic Usage

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### ABSTRACT

Natural green chemical compounds from plants with therapeutic prominence are increasingly being employed in synthesizing metal oxide nanoparticles because of their flexibility in reducing, capping, and complexing capabilities. It would be preferable to avoid resorting to chemical synthesis, which, while convenient, inevitably results in undesirable byproducts and is not environmentally beneficial. Therefore, bio-based nanoparticle synthesis using plant secondary metabolites is an environmentally great option, and is currently receiving a lot of attention from active research societies. In this work, the ZnO NPs synthesized using the medicinal valuable *W. Tintoria* leaf extract at different concentrations. X-ray diffraction, Fourier Transform Infrared spectroscopy, Field Emission Scanning Electron Microscope and UV-Visible spectroscopy were used to examine the structural, functional, morphological, optical, and photocatalytic properties of the ZnO NPs. Structural evaluation reveals that the biomolecular couplings efficiently controlled the size of their crystallites. The vibrational analysis demonstrates that the bio-ZnO NPs comprise phenolic, flavonoid, and alkaloid groups. Plant-derived compounds have a significant impact on particle morphology and size.

The bio-ZnO NPs-based Rhodamine B dye photo-degradation studies show that bio-ZnO NPs have an augmented degradation performance due to Phyto molecular incorporation.

**Keywords:** Biomolecules, Ecological sound, ZnO nanoparticles, Visible light, Industrial effluents.

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**PP-EN-240**

## A Comparative Study on the Electrochemical Performance of Ni- and Zn-Blended Copper Ferrite Asymmetric Supercapacitors

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### ABSTRACT

Among cost effective materials, copper ferrite ( $\text{CuFe}_2\text{O}_4$ ) is getting more attention towards supercapacitor application due to its vast multifunctional properties. In this present study, the nanoparticles of  $\text{CuFe}_2\text{O}_4$ ,  $\text{Cu}_{0.7}\text{Ni}_{0.3}\text{Fe}_2\text{O}_4$  and  $\text{Cu}_{0.7}\text{Zn}_{0.3}\text{Fe}_2\text{O}_4$  have been synthesized through facile microwave assisted combustion process and named as CF, NCF and ZCF respectively. Morphological analysis confirmed the inclusion of Ni and Zn in the final product samples. Furthermore, the nanoparticles fits in to cubic crystal system along with Fd-3m space group with an average crystallite sizes of  $\sim 30$  nm which is analogous with SEM images. From the electrochemical studies of the samples, the Nyquist plot revealed the specific capacitance of CF, NCF and ZCF to be 620,790, and 670  $\text{F g}^{-1}$  respectively. An asymmetric-type supercapacitor device have been fabricated using ZCF and NCF materials as electrode and the electrochemical performance of the same have been analyzed. The fabricated devices using ZCF and NCF have shown an energy density of 21.5 and 75  $\text{W hr kg}^{-1}$  and a power density of 417 and 600  $\text{WKg}^{-1}$  respectively. Our results are evident proof to achieve a facile cost effective preparation procedure of ZCF and NCF towards capacitive behavior with excellent energy density and constancy, which will pave the way to find the possibility of admirable competitor anode candidate for supercapacitor.

**Keywords:** CV and GCD curves, Asymmetric supercapacitors, Electrochemistry.

PP-EN-242

## Improving Energy Storage Properties of $K_{0.5}Bi_{0.5}TiO_3$ with $LiNbO_3$ as Substituent

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### ABSTRACT

$K_{0.5}Bi_{0.5}TiO_3$  (KBT) based binary system with 3.5%  $LiNbO_3$  was synthesized using conventional solid-state reaction method and its energy storage properties were analyzed. The formation of  $0.965K_{0.5}Bi_{0.5}TiO_3-0.035LiNbO_3$  (KLN35) with P4mm space group is confirmed using x-ray diffraction study. XPS results further confirms the formation of the sample. The polarization hysteresis curve shows a relaxor type loop with maximum polarization of  $35.5 \mu C/cm^2$ , remanent polarization of  $9.46 \mu C/cm^2$ , Breakdown strength of 95 kV/cm, recoverable energy density of  $1.2 J/cm^3$  and an efficiency of 71%. The optical transmittance of the sample as obtained from UV spectra is 82%.

**Keywords:** Relaxor, Energy storage density, Polarization hysteresis curve.

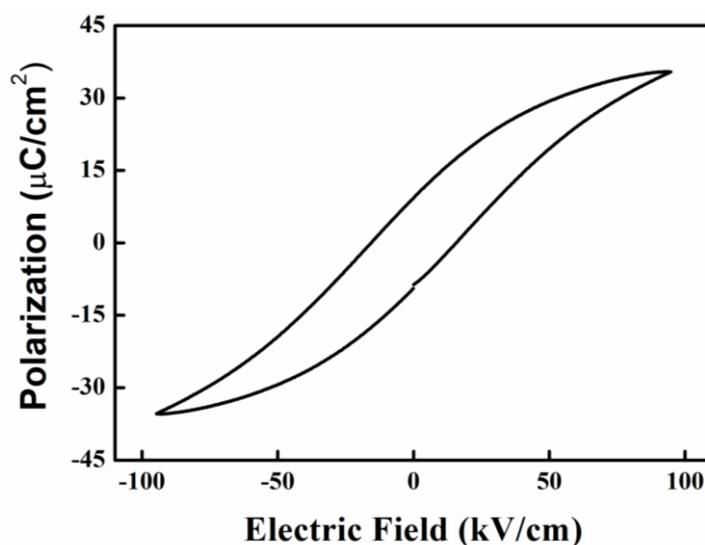


Fig.1: Polarisation Vs. Electric field curve of KLN35 ceramic.

**PP-EN-243**

## Combined Impact and Coating on Diesel Engine Using Diesel-Biodiesel Blends

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### ABSTRACT

The goal of the work is to determine how to split injection techniques and fuel injection pressure affect performance and emissions in CI engines using biodiesel mixes. This will increase combustion efficiency and lower emissions. To determine the ideal fuel injection pressure and twin injection technique, performance, combustion, and emission characteristics of biodiesel blends made from jatropha and karanja are compared at various fuel injection pressures. The data from the in-cylinder pressure sensor was measured, and the lab view programme was used to calculate combustion characteristics, including the mass fraction burned and heat release rate. Jatropha and karanja are separately blended with diesel with a blend percentage of 20 (biodiesel 20%, diesel 80%). It was found that J20 produced lower BSFC and higher thermal efficiency than diesel except at full load and also increasing and decreasing the injection pressure and performing split injection helped reduce the emissions.

**Keywords:** Jatropha, Karanja, BSFC, J20, Biodiesel.

**PP-EN-248**

## Review on Ternary Chalcogenides: Potential Photoabsorbers

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### ABSTRACT

The development of photovoltaic technology has brought in clean energy production. However, silicon is the most commonly used semiconductor in photovoltaics with a power conversion efficiency (PCE) of about 18% to 22% under standard conditions. Recently, the chalcopyrite structure of I-III-VI<sub>2</sub> constitutes ternary chalcogenides and the subsequent thin films are being used in second generation thin film solar cells (TFSC). Copper-based (Cu-III-VI<sub>2</sub>) and silver -based (Ag-III-VI<sub>2</sub>) chalcogenides are some examples, which emerged as alternatives for toxic elements in optoelectronics. In particular, Copper Indium Diselenide (with the optical band gap of 1.04 eV) cells have up to 14% efficiency with similar durability as silicon solar cells. Similarly, the optical band gap of Cu<sub>2</sub>SnS<sub>3</sub> (CTS) thin films is 1.23 eV and the absorption coefficient is in the order of 10<sup>5</sup> cm<sup>-1</sup> and hence act as potential photoabsorber in TFSC. Due to the increased absorption coefficient of these materials, only a thin coating is

needed, enhancing efficiency and reducing cost. Ag based Chalcogenides brings more attention because of their ability in non-linear optical and photonic applications. AgGaSe<sub>2</sub> and AgGaTe<sub>2</sub> have a direct band gap of 1.42 eV and 0.75 eV, respectively, and strong clarity in the 500–1200 nm wavelength range. Also, the optical properties of Ag-based chalcogenides (AgAlS<sub>2</sub>) are equivalent to those of Cu-based chalcogenides (CuAlS<sub>2</sub>). Similarly, a number of ternary semiconductors, including CuFeS<sub>2</sub>, CuGaSe<sub>2</sub>, CuSbS<sub>2</sub>, AgInSe<sub>2</sub>, AgGaS<sub>2</sub> and AgBiS<sub>2</sub> with a bandgap in visible regions are created with rich crystal structures and high absorption coefficients using various deposition techniques, making them well suited for photoabsorbers. Herein, the latest progress of ternary chalcogenides is reviewed from the aspects of synthesis, characterization, and properties. In addition, their potential in optoelectronic devices is also discussed.

**Keywords:** Ternary Chalcogenides, Chalcopyrite structure, Absorption coefficient, Photoabsorbers.

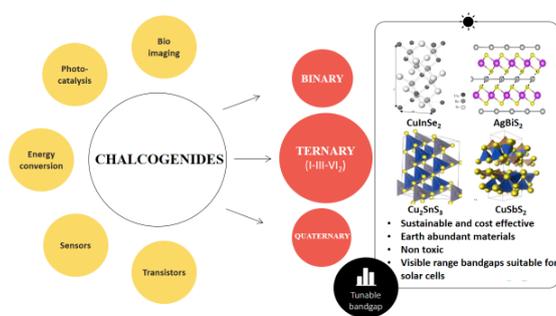


Fig.1: Overview of Ternary Chalcogenides

PP-EN-249

## Photocatalytic Dye Degradation of Green Cobalt Oxide Nanoparticles Synthesized via *Citrus Medica L.* Extracts

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### ABSTRACT

Developing materials for efficient environmental remediation via cheap and sustainable routes remains a challenge for the scientific community. We developed a novel green synthetic approach to prepare cobalt nanoparticles (NP's) for successful environmental remediation. A one-pot green synthesis of cobalt oxide nanostructures using an aqueous solution of *Citrus Medica L.* extract as the reducing and capping agent. The functional properties, structure and morphology of the as-synthesized Co<sub>3</sub>O<sub>4</sub> np's have been characterized by Fourier transform infrared spectroscopy (FT-IR), X-ray diffraction (XRD), scanning electron microscopy (SEM) supported by energy dispersive X-ray spectroscopy (EDX). The crystal size of the bio np's is reduced by varying the concentration of leaf extract concurrently. The phenol and flavonoid groups present in the leaf extract plays a major role in controlling the crystal size. The

functional groups and the biomolecules that are present in the as-synthesized np's were confirmed by FT-IR analysis. SEM analysis showed that the particle size, and morphological shape of the green  $\text{Co}_3\text{O}_4$  np's were agglomerating to spherical / circular structures. The synthesized  $\text{Co}_3\text{O}_4$  np's were used as a catalyst in the photodegradation of two different industrial dyes (ie., Methyl Violet and Methyl Orange) under solar light. The result showed the highest efficiency of photodegradation of the  $\text{Co}_3\text{O}_4$  nanostructure of MV and MO @ (90%), (92%) respectively. By using conventional energy, the maximum amount of dye was degraded by the catalyst in the minimum time period. The experiment can be modified for the further commercial applications.

**Keywords:**  $\text{Co}_3\text{O}_4$ , Green synthesis, Citrus medica, Photocatalysis, Industrial dyes.

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**PP-EN-254**

## Study of Ni-MOF as electrode material for High-Performance Supercapacitors: Effect of Electrolyte molarity

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### ABSTRACT

Supercapacitors are promising electronic devices for future generation due to its elevated specific capacitance, energy density & power density as compared to commercial batteries. Metal-Organic Frameworks (MOFs) are gaining popularity as leading electrode materials in supercapacitors due to its versatility. In the present work, the synthesis and applicability of Nickel-metal-organic framework (Ni-MOF) as electrode material for supercapacitors is investigated. The synthesized Ni-MOF characterized by means of X-ray Diffraction, UV-Visible Spectroscopy, Fourier-transform Infrared Spectroscopy and Atomic Force Microscopy. The fabricated Ni-MOF electrodes studied under different KOH molarity solutions viz; 2M, 4M and 6M in 3 electrode system. Among its Ni-MOF shows efficient results in 6 M KOH solution with 727.4 F/g specific capacitance at 10 mV/s. Additionally, Electrochemical Impedance Spectroscopy shows the minimum charge resistance in 6 M compared to its counterparts. The Ni-MOF electrodes maintains its cyclic stability up to 1000 cycles. The reported outcomes may help in the development of novel MOF-based supercapacitors and other electrochemical devices.

**Keywords:** Ni-MOF, Metal organic framework, Specific capacitance, Supercapacitors.

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## PP-EN-257

### Identification of Converter for Gamma ZSI fed Induction Motor Drive System

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#### ABSTRACT

Photovoltaic (PV) Renewable energy is frequently encountering major changes in input voltage of inverter because of oscillations in PV energy. The objective of the work is to reduce the voltage rating of PV by using high gain boost converter. By comparing the (KY Boost Converter (KYBC) / Single Boost Converter (SBC) / Quadratic Boost Converter (QBC) fed Gamma Z-Source Inverter (GZSI). Here the GZSI is placed between converter and three phase induction motor. This work compares the various combinations of converter fed GZSI between PV and three phase induction motor. The open loop simulation for KYBC/SBC/QBC fed GZSI with three induction motor is proposed here. Using MATLAB/Simulink the simulation for three converters fed GZSI with three phase induction motor are presented. By comparing the output voltage, motor speed, motor torque, voltage ripple and mechanical power for the KYBC/SBC/QBC fed GZSI. The results shows that QBC fed GZSI with three phase induction motor will give enhanced performance compared to KYBC-GZSI and SBC/GZSI. The comparison of KYBC/SBC/QBC fed GZSI systems is done for same input voltage and load conditions.

**Keywords:** Quadratic boost converter, KY boost converter, Gamma Z Source inverter.

**PP-EN-260**

## Graphene-Based Photoanodes with Anthocyanin- Sensitizing Dyes in Dye Sensitized Solar Cells: An Insight

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### ABSTRACT

Graphene which is a single layer of graphite and a carbon allotrope is the plentiful mineral on Earth. Graphene and its derivatives such as rGO, GO and pristine graphene, etc., when used as composites with TiO<sub>2</sub> semi oxide material exhibited an improvement in PCE in DSSCs from ~ 0.13% to above 12%. Graphene based DSSCs are more reliable than silicon solar cells and thin film solar cells, with the advantage of low cost, low toxicity, simple manufacturing techniques, flexibility, and is extremely light in weight. They have a large specific surface area, transparency, electron mobility and superior stability. Nature supplies a huge variety of putative structures for photosensitizers and combination may enhance stability, efficiencies and sustainability

This review paper presents a recent development reported in DSSCs when Anthocyanin Sensitizers with Graphene derivatives are used as photoanodes. They have the absorption range between visible to ultraviolet spectrum. Composite absorbed in natural dyes show a favorable increase in charge transfer or conductivity of the cell.

Moreover, the use of anthocyanin-based DSSCs has shown a much better power conversion efficiency (PCE) than the chlorophyll-based DSSCs.

**Keywords:** Graphene, Reduced graphene oxide, Graphene oxide, Photoanodes, Photosensitizer, Anthocyanin dye.

**PP-EN-262**

## Enhancement in Structural, Optical Properties of CuO Nano Powder by Tuning the Shape of the Nanograins through Zn Dopping

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### ABSTRACT

Nano materials are having dimension of  $\leq 100$  nm. The properties and structure are varying entirely different that of their macro material. Hence traditional theories are not applicable for Nano materials. The Imaging techniques are used for observing the structure of them.

Uses: CNT: Carbon Nano Tubes are very strong and very flexible and good conductor & used in reinforced composites, sensors, nano electronics and display devices.

Nano wires: It is a linear array of dots formed by self-assembly. These have remarkable optical, electronic and magnetic characteristics & used in very high density storage devices, Opto-electronic nano devices, etc.

These Nano particles are used in

- Laptop, Computer, Cell phones, TV & Digital Cameras
- Food preparation, processing, quality control & packaging fields.
- Medical organic chemistry, polymer chemistry, product synthesis, and other fields.

So, based on the above needs, the research was conducted by me on the topic and the result was found satisfactory.

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### PP-EN-265

## Effect on structural parameters upon Zirconium substitution in $\text{Li}_{1.3}\text{Al}_{0.3}\text{Ti}_{1.7}(\text{PO}_4)_3$

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### ABSTRACT

NASICON-type solid ceramic electrolyte has drawn researchers interest because of its excellent ionic conductivity, superior stability in air and water, and affordable processing costs. In the present work a pure  $\text{Li}_{1.3}\text{Al}_{0.3}\text{Ti}_{1.7}(\text{PO}_4)_3$  and Zr doped  $\text{Li}_{1.3}\text{Al}_{0.3}\text{Ti}_{1.7-x}\text{Zr}_x(\text{PO}_4)_3$  (LATZP) with ( $x=0.1$ ) has been prepared by solid state reaction method. Zirconia can partially replace titanium in the pure LATP structure since it is isovalent to titanium. An XRD analysis employing Rietveld refinement has been conducted to better understand the changes in various structural parameters with Zr substitution.

**Keywords:** Solid ceramic electrolyte, Solid state reaction, Rietveld refinement.

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### PP-EN-269

## An Ab-initio Study on Structural, Phonon and Elastic Properties of Semi-metal (YSb)

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### ABSTRACT

The current work focused on investigation of the structural, elastic, and electronic properties of YSb using a Full Potential Linearized Augmented Plane Wave (FP-LAPW) method based

on density functional theory (DFT). The GGA, mBJ and mBJ+SOC approximations are considered for exchange-correlation potential. The dynamical stability of YSb is evidenced from elastic properties and phonon dispersion studies. In order to analyze charge carriers movement from the valence band to the conduction band, we computed the electron localization function (ELF). The electrical properties of YSb suggest its semimetal nature and topological characteristics is advocated from the application of mBJ+SOC potential. The nontrivial transport characteristics of YSb make it potential candidate for thermoelectric applications.

**Keywords:** DFT, Structural properties, Electronic properties, Elastic properties, Vibrational properties.

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**PP-EN-283**

## Closed Loop Proportional Resonant Controller Controlled DC Microgrid System with Advanced Material Technology in Solar PV System

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### ABSTRACT

Direct Current Microgrid has emerged as one of the major research fields over the past several years because of the inherent advantages of DC systems over AC systems, such as compatibility with modern loads, storage devices, and renewable energy sources. Many studies have been conducted on the DC Microgrid system in order to improve its efficiency. In this paper, control of a DC microgrid system is done using conventional PI controllers and advanced controllers like Fractional Order Proportional Integral Derivative (FOPID) and Proportional Resonant (PR) Controllers. A closed-loop DC micro-grid containing sustainable power sources, stockpiling components, and transients is introduced. The PI controller is the most commonly used in power-frameworks for assisting with the control of microgrids. Aside from PI, there is a slew of independent and hybrid regulators that can serve significantly better than PI in terms of microgrid framework relevance. The closed-loop DC microgrid framework systems with FOPID controller and PR controller-based DC microgrid structures are investigated and re-enacted utilising Simulink in MATLAB and their outcomes are introduced. This paper also views towards the advanced solar cell material technology that been used as the source of energy in the DC Microgrid system for the higher power delivery. In this work, the performance of several solar cell is compared along with an overview of recent developments in solar cell technology.

**Keywords:** DC microgrid system, PI Controller, FOPID controller, PR controller, Solar PV System.

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## PP-EN-287

### Microstructure and Electrical Energy Storage Behaviour of Cold Pressed PVDF/MWCNT Polymer Nanocomposites

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## ABSTRACT

Polymer nanocomposites (PNC) of as purchased polyvinylidene fluoride (PVDF) and multi walled carbon nanotube (MWCNT) were synthesized in the form of pellets through the novel cold pressing method. The Microstructure and the dielectric properties of the samples were studied as a function of the fraction of MWCNT in the PNC and frequency. The Morphological microstructures of PNC have been investigated by SEM micrographs and show different extent of distributions of the MWCNT in the PVDF matrix. The dielectric parameters (Dielectric constant,  $\tan \delta$ , AC conductivity and their real & imaginary parts) were obtained and it was found that the dielectric constant increases about 100 times higher than that of the pure PVDF, when the weight fraction due to addition of MWCNT to the PNC increases from 0.005 to 0.007, have been explained by interfacial polarization and percolation theory. The PVDF/MWCNT PNC shows high dielectric constant with low loss tangent, may be suitable for high energy density storage applications.

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**PP-EN-299**

## Green Synthesized Carbon Quantum Dots from Nirmali Seeds and its Efficient Catalytic Application in the Reduction of Dyes

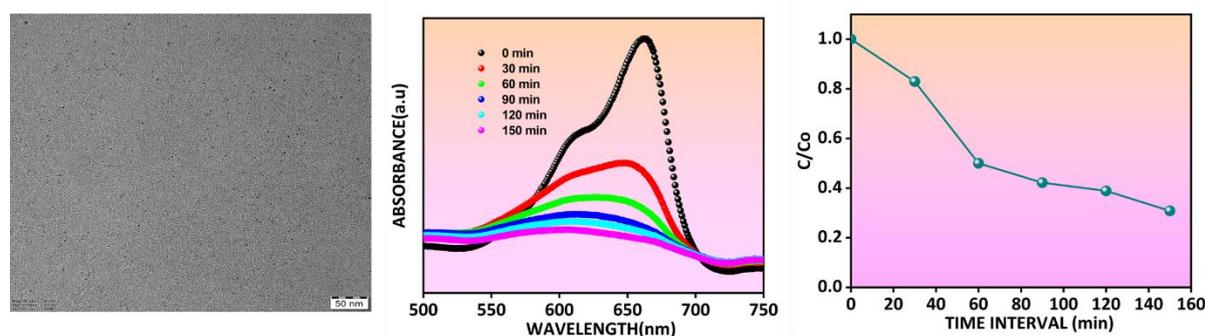
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### ABSTRACT

Facile and fast hydrothermal process used for the synthesis of nitrogen-doped carbon dots (N-CDs) from *Nirmali seeds (Strychnos Potatorum)*. Energy dispersive X-ray spectroscopy (EDS), the selected area electron diffraction (SAED) method and high-resolution transmission electron microscopy (HR-TEM) were used to analyse the morphology of prepared N-CDs. Ultraviolet-Visible (UV-Vis) and photoluminescence spectroscopy were used to determine the optical characteristics of the prepared N-CDs. X-ray diffraction (XRD) was carried out to study the crystallinity nature of N-CDs. X-ray photoelectron spectroscopy and Fourier transform infrared (FT-IR) spectroscopy were used to confirm the nitrogen doping (XPS). In response to a 310 nm excitation, the prepared nitrogen-doped carbon dots gave off blue fluorescence at 405 nm. The prepared N-CDs had an impact on the catalytic efficiency in the reduction of synthetic dyes. Additionally, the rate constant for the reduction of organic dye was estimated.

**Keywords:** Photocatalyst, Carbon Quantum Dots, Dyes, Drop casting method.



**Fig.1:** HRTEM image, Dye degradation and kinetic rate constant

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PP-EN-300

## Impact of Band Alignment at Interfaces in Perovskite-based Solar Cell Devices

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### ABSTRACT

This review provides detailed information on the significance of optimization of conduction and valance band offsets at the planar junctions in the perovskite-based solar cells. In order to facilitate the educated guess at the appropriate layered-composition, the influence of layer composition on electron affinity is studied in detail. Materials offering easy bandgap tunability are discussed. Electron affinity optimization is shown to lead us to a good band alignment and ultimately avails the way to control conduction and valance band offsets. Along with electron affinity, energy bandgap and doping density are also explored to obtain tuned conduction band energy levels for better band alignment and offsets control. The quantitative analysis of the influence of band offsets on interfacial recombination, Hall mobility, electron injection rate, VOC, JSC, FF, and PCE is also articulated. Energy bandgap and electron affinity values for commonly reported electron and hole transport layer materials are gathered, so that the appropriate material can be picked up readily and accurately to get offsets optimized and achieve better photovoltaic performance. Thus, an intensive review is carried out about the ways to control conduction and valance band offsets and considerably increase the power conversion efficiency of perovskite solar cell.

**Keywords:** Band offset, Interfaces, Electron affinity, Power conversion efficiency.

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PP-EN-301

## Hybrid Power Flow Controller based Micro-Grid System for Power Quality Enhancement with Futuristic Semiconductor Materials

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### ABSTRACT

Flexible ac transmission system (FACTS) controllers offers innovative approaches for enhanced control of power utilities and have the potential to solve some of the grid's most pressing issues, especially in the setting of smart grids. Additionally, the operation of distribution feeders has been made more difficult by the smartening of distribution systems with distributed generation, storage devices, and intelligent loads. These issues can be effectively resolved with power-electronics based controllers and FACTS based controllers for distribution systems. The paper proposes a reasonably priced FACTS controller that exhibits performance characteristics resembling those of the reconfigurable Unified Power Flow Controller (UPFC).

To mitigate the impacts of voltage sag, a hybrid power flow controller (HPFC) finds a spot between the sending and receiving terminals. This research work deals with the comparison of four bus systems employing UPFC and HPFC. The model consists of four bus system which consists of a single generator bus using PV and a battery. To fulfil the rising need for energy consumption, solar devices are employed to offset carbon emissions by lead halide perovskite solar cells (PSCs) with reduced emissions and higher efficiency. The Simulation is done for 4 bus system using UPFC and HPFC with respect to the voltage, active power and Reactive power. The constructed model is utilised to show how well the controller works in resolving issues with distribution networks such voltage sags brought on by feeder faults and power flow fluctuations carried on by fluctuating renewable generation for four bus system by comparing with UPFC.

**Keywords:** Hybrid power flow controller, Unified power flow controller (UPFC), Microgrid, modelling, Renewable source, Battery, PV array.

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**PP-EN-302****A review on Thermoelectric Material: Skutterudites**

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*Department of Physics, University Institute of Sciences, Chandigarh University, Gharuan, Mohali-140413, India***ABSTRACT**

Thermoelectricity has been studied for over two centuries and has provided a stable and efficient way of recovering and transforming waste heat into easily available additional electric energy. The majority of the materials utilized in today's thermoelectric generators and freezers were invented many years ago. Nonetheless, encouraging findings for various novel compounds and alloy systems have been published during the previous decade. Skutterudites, clathrates, and half-Heusler alloys are some examples of these materials. Thermoelectric devices are known for their reliability instead of their efficiency; they have no moving parts and their performance is mostly dependent on material selection, which has produced few great options. The focus of this paper is on one such material called skutterudites to review its interesting properties and summarize the latest research activities which improved its thermoelectric performance.

**PP-EN-313****Performance Analysis of a CI Engine Powered by Different Generations of Biodiesel; Palm Oil, Waste Cooking Oil, and Microalgae**Aman Singh Rajpoot<sup>a</sup>, Tushar Choudhary<sup>a,\*</sup>, H. Chelladurai<sup>a</sup>, Tikendra Nath Verma<sup>b</sup>, Upendra Rajak<sup>c</sup><sup>a</sup>*Department of Mechanical Engineering, PDPM IITDM Jabalpur, Madhya Pradesh, India*<sup>b</sup>*Department of Mechanical Engineering, MANIT, Bhopal, Madhya Pradesh, India*<sup>c</sup>*Rajeev Gandhi Memorial College of Engineering and Technology, Nandyal, Andhra Pradesh, India***\* Corresponding Author:** [tushar.choudhary@iitdmj.ac.in](mailto:tushar.choudhary@iitdmj.ac.in).**ABSTRACT**

The objective of this research is to analyse and compare the combustion behaviour of a diesel engine with different generations of biodiesel by evaluating its performance in terms of heat release, temperature, pressure, fuel consumption, thermal efficiency, and ignition delay. The research was performed on a direct injection, one-cylinder, liquid-cooled diesel engine using diesel and a 20% blend level of biodiesel made from three different generations of biodiesel, i.e., palm oil, waste cooking oil, and microalgae. The performance of the diesel engine was evaluated with a variable load of 25 to 100% and a comparison was made between the various fuels. The results justified the use of biodiesel in contemporary diesel engines and made them a viable alternative to fossil fuels.

**Keywords:** Biodiesel, CI engine, Palm oil, Waste cooking oil, Microalgae, Engine performance.

PP-EN-314

## Conductivity and Dielectric Properties of Sodium Ion Conducting PEO-PVA Based Blend Solid Polymer Electrolyte Systems

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### ABSTRACT

Sodium ion conduction in blended PEO solid polymer electrolytes films were investigated. Blended PEO electrolyte films were synthesized by mixing low molecular weight PEO ( $m_w = 1 \times 10^5$ ) and PVA ( $m_w = 1.25 \times 10^5$ ) with high molecular weight PEO ( $m_w = 1 \times 10^6$ ) complexed with  $\text{NaClO}_4$  salt. The ac conductivity and dielectric properties of these blend electrolyte films has been studied using AC impedance spectroscopic technique in the frequency range 0.1Hz -  $10^6$ Hz. The sodium ion conductivity measurements were performed at different temperatures in films with varying concentrations of low molecular weight PEO and PVA. An electrical equivalent circuit model was used to fit the impedance data of all compositions at different temperatures using EIS analyzer. The addition of low molecular weight polymers into the high molecular weight PEO enhances the ionic conduction in the blend electrolyte systems and the conductivity at room temperature was found to be  $10^{-5} \text{ Scm}^{-1}$ . The temperature dependence of DC conductivity (estimated from the impedance study) shows Arrhenius behavior.

PP-EN-316

## Ecofriendly and Cost Optimising Synthesis of rGO by Modified Humer Method and Charecterization

### ABSTRACT

Graphene and its derivatives have received wide attention in research in recent era. However, synthesis of graphene in an economical and efficient way with lesser time requirement remains great challenge. In present study we have synthesis Graphene oxide (GO) by modified Hummer method followed by photoreduction & Thermal reduction. Here we have reported improved method of reduction of GO to obtain reduce graphene oxide (RGO) by Photoreduction and thermal reduction so as to optimized the cost and time. The synthesis of RGO has been investigated by XRD, SEM, FTIR. XRD conclude the reduction of GO to RGO successfully as crystallite size reduce to 0.75nm to 0.66 nm. SEM study reported difference in surface morphology and effect of variation in pH is studied by FTIR. Present study affirms a promising and ecofriendly method of reduction of GO to RGO with regards to high cost and time consumption of synthesis of Graphene.

**Keywords:** GO, rGO, Photoreduction, Thermal reduction, Modified Hummer method, Eco-friendly.

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**PP-EN-318**

## Defect Chalcopyrite Structured $\text{ZnIn}_2\text{Te}_4$ – A Promising Thermoelectric Material

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### ABSTRACT

On the way to explore suitable thermoelectric (TE) material, semiconducting tetragonal defect chalcopyrite structured compounds has gained great attention due to its high Seebeck coefficient ( $S$ ) and low lattice thermal conductivity ( $k_L$ ). In the present work, structural, mechanical, thermodynamical and thermoelectric properties of  $\text{ZnIn}_2\text{Te}_4$  is investigated through the combination of first principles computations and Boltzmann transport theory. The band gap calculated using Tran-Blaha modified Becke Johnson (TB-mBJ) exchange correlational functional along with spin orbit coupling (SOC) is 1.37 eV, which is commensurate with the reported results. Furthermore, the obtained elastic and phonon properties ensures the mechanical and thermodynamical stability of the material. Moreover,  $\text{ZnIn}_2\text{Te}_4$  exhibits low lattice thermal conductivity of  $1.31 \text{ W m}^{-1} \text{ K}^{-1}$  at 1000 K ascribed to its low group velocity and larger Grüneisen parameter. Ultimately, at optimum carrier concentration,  $\text{ZnIn}_2\text{Te}_4$  exhibits noticeable figure of merit ( $zT > 1$ ) suggesting its suitability for high temperature TE applications.

**Keywords:** Thermoelectrics, Grüneisen parameter, Chalcopyrites, Lattice thermal conductivity.

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**PP-EN-322**

## Morphological and Electrochemical Studies of Hard Carbon-based Anode Materials for Na-ion Battery Application

Paldugu Srinivasa Rao, Dr. B Haribabu

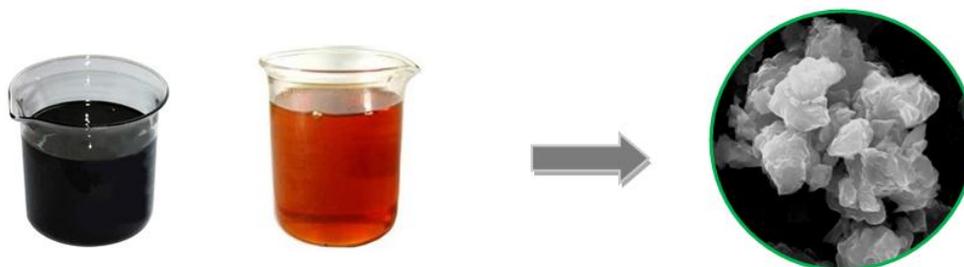
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### ABSTRACT

Sustainability & Renewable energy are the two key words attracting the world in the recent years. To develop the high-capacity storage devices other than the Lithium-ion batteries different Alkali metals (Sodium, Potassium) are getting attention now. Carbonaceous materials like Graphite, Soft & Hard carbons, Graphene and Carbon nano tubes are used as anode materials for alkali metal-ion batteries. In these Hard carbons (HCs) are significant anode materials for Sodium-ion batteries (SIBs), because of renewable source, low cost and high specific capacity. In this investigation, we derived different hard carbons from different

sources of carbon like Phenolic resins, Pitch compounds and some nano carbons by pyrolysis. After these hard carbons are studied for electrochemical properties, morphology, reversible capacity and cyclic stability.

**Keywords:** Hard carbons, Sustainability, Renewable energy.



**Fig.1:** Hard carbons preparation by pyrolysis

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## PP-EN-330

### Performance and Emission Characteristics of Waste Cooking Oil Biodiesel Blended with Nano Additives on Single Cylinder Diesel Engine

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#### ABSTRACT

As non-renewable conventional fossil fuel sources are decreasing day by day, researchers are continually finding new ways of producing and utilizing alternative, renewable, and reliable fuels. To reduce the emissions caused by running the engines, waste cooking oil (WCO) biodiesel is one of the best alternative fuels locally available in all parts of the world. Biodiesel is proved to be the best replacement for diesel because of its unique properties like significant reduction in greenhouse gas emissions, non-sulfur emissions, non-particulate matter pollutants, low toxicity, and biodegradability. Different study results are reviewed and analysed based on combustion, performance, and emission characteristics. Chemically, biodiesel is long-chain mono alkyl esters of fatty acids derived from renewable feedstocks such as vegetable oils and animal fats. It is obtained by transesterification in which an oil or

fat is reacted with a monohydric alcohol in the presence of a catalyst to give the corresponding mono alkyl ester. Blending with diesel fuel is indicated as "Bx", where "x" is the percentage of biodiesel in the blend. The blending of nano additives are chemical materials added in biodiesel to improve the desirable chemical properties for better performance of the engine and it also improves the efficiency and reduces the emission in biodiesel and makes biodiesel to completely burn. This study examines waste cooking oil as a raw material for biodiesel production and blending with (CeO<sub>2</sub>) cerium oxide nano additives and testing its properties such as density, Kinematic Viscosity @ 40°C, Flash point by PMCC method, Flash point by PMCC method, Calorific value. The test procedure was carried out under the following fuel blends: 10% & 20% of biodiesel added to 80% and 90% diesel, 30ppm and 45ppm, cerium oxide nanoparticles added with B10 & B20 blend (Diesel, B10+C30, B20+C45) and testing its fuel efficiency on single cylinder diesel engine.

**Keywords:** Non-renewable energy, Alternative fuel, Biodiesel, Waste cooking oil, Diesel engine, Nano additive, Fuel efficiency.

### PP-EN-332

## Synthesis of MgO@NiO and Study the Performance in the Supercapacitor by Solvothermal Method

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### ABSTRACT

11.5 atomic percentage presence of Mg in NiO, prepared by solvothermal method, gives highest specific capacitance nearly 40 F/g at 0.1 A/g current and specific power 1.1 Wh/Kg. Average crystallite size found 18 nm from WH plot. The percentage change of specific capacitance is 9.1% for current change from 0.1 A/g to 1 A/g. At high charging current 10 A/g the nano-composite gives 25 F/g and highest specific power 2000 W/Kg.

**Keywords:** Specific capacitance, Mg doped NiO, Solvothermal method.

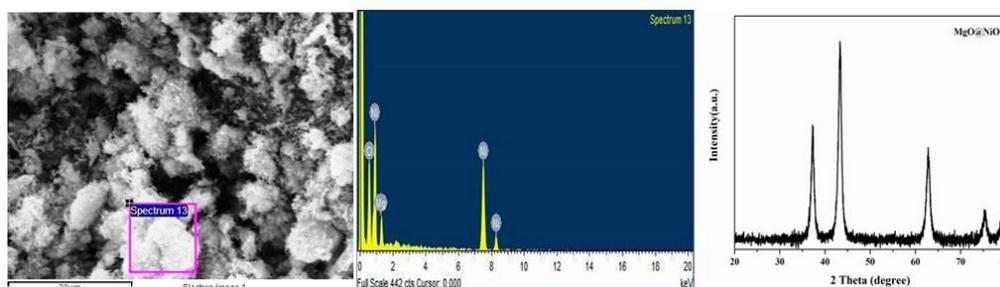


Fig.1: SEM, EDX and XRD of MgO@NiO

PP-EN-334

## Characterization of Proton Conducting Polymer Blend Electrolyte Based on Gum Tragacanth and Poly Vinyl Alcohol

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### ABSTRACT

Proton conducting solid polymer blend electrolyte developed using natural gum tragacanth, poly vinyl alcohol and ammonium thiocyanate was prepared and studied in the present work. A minimum amount of PVA was added to improve the mechanical stability. Free-standing films were obtained with different salt ratios through solution casting technique. To study the structural properties and the polymer-salt interactions, physical characterization techniques including X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR) were performed. Electrical properties of the prepared membranes were studied using Electrochemical impedance spectroscopy (EIS). The dc conductivity is found to increase with salt concentration in the blend polymer complexes and the highest dc conductivity was found to be  $7.75 \times 10^{-3}$  S/cm at room temperature. The dielectric spectra indicated the non-Debye nature of the electrolytes. According to Wagner's polarisation approach, the ionic transference number of mobile ions has been calculated, and the findings show that ions are primarily responsible for the conducting species.

**Keywords:** Natural polymer, Solid polymer electrolyte, Electrochemical impedance spectroscopy, Dielectric analysis.

PP-EN-340

## Optical Investigations of CdS doped Silica Aerogel

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### ABSTRACT

Aerogels are highly porous material having ultra-low density. Doping of the luminescent material in the silica aerogel gives the luminescent aerogel which has the applications in the light emitting diode (LED) and in the optoelectronics. Here, we have reported the photoluminescence study of the CdS doped silica aerogel. A CdS doped silica aerogel shows the three bands of emission viz. blue (470 nm), green (520 nm, 592 nm) and red (673 nm). The blue emission is assigned to the localized trap states created on the CdS surface and the green emission is associated with the sulfur vacancy as well as cation vacancy. The red emission is related to the substitution of the sulfur traps by other counter ions. Supercritical drying of the CdS doped aerogel leads to removal of the quantum dots which indicates non-covalently bonded CdS nanoparticles to the silica matrix. However, some of the quantum dots remain in

the aerogel which are observed from the weak emission band and the XRD pattern of CdS nanocrystals.

**Keywords:** Aerogel, Porous, Doping, Photoluminescence, Supercritical drying, Quantum dots.

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### PP-EN-344

## Experimental Investigation of Advanced Nano Materials Additives on Combustion Characteristics of Biofuels

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### ABSTRACT

This project highlights our work on hybrid fuels and the importance of choosing hybrid oil from seed. The aim of this study is the experimental investigation of performance and emissions on 4 stroke single cylinder direct injection diesel engine. Diesel, B10, B20, B30, B40 are used as fuels. The nano metal additives is mixed with bio diesel by means of Ultra sonication process, the act of applying sound energy to agitate particles in a sample, for various purposes such as the extraction of multiple compounds from plants, microalgae and seaweeds. Ultrasonic frequencies (>20 kHz) are usually used, leading to the process also being known as ultra sonication or ultrasonication. The Nano particles bio diesel fuel is prepared by mixing the titanium dioxide nano particles in the radish methyl ester with the aid of an ultrasonicator. The ultrasonicator technique is the best suited method to disperse the nano particles in base fuel, as it facilitates possible agglomerate nanoparticles back to nanometer range.

**Keywords:** I.C engine, Emission, Performance, Biofuel, Additives.

**PP-EN-354**

## Soil Microbial Fuel Cell Assisted Bio-power Generation Using Hexavalent Chromium Solution

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### ABSTRACT

The salts of hexavalent chromium Cr (VI) ions have boundless application industrially which in turn triggers negative impact in our biosphere as pollutant. Several methods have been adopted to remediate the Cr (VI) ions for maintaining its concentration under permissible limits. Various environmentally benign methods are followed for the reduction of chromium (VI) to trivalent chromium ion. One such a spot is soil microbial fuel cell (SMFC) which reduces chromium toxicity with simultaneous power generation. Hence in the present work soil microbial fuel cell was constructed using soil and biochar mixture. Synthetically prepared Cr(VI) solution from potassium dichromate served as catholyte and potentials were monitored using stainless steel electrodes. The redox junctures transferred electrons in a closed loop and the obtained potentials were measured using multimeter. Microbial population was monitored and correlation between the potential output and microorganism population are analyzed using nutrient agar medium. The constructed SMFC's were loaded with various concentrations such as 0.1N, 0.125N, 0.150N, 0.175N, 0.2N dichromate solutions and tap water was employed as control. The cell offered potential for 62, 75, 71, 70, 63 and 93 days for the above said concentration in the stated order. The obtained results justified the role of microorganism during cell discharge. The microbial count analyzed using MPN method revealed that the 5069 CFU/g bacteria were found in 0.150N concentrated chromium loaded soil which accomplished the exoelectrogenic activity. The formed biofilm was characterized using FT-IR and SEM studies.

**Keywords:** Soil microbial fuel cell, Chromium VI ion, Microorganism, Cell discharge.

**PP-EN-363**

## Rapid one-step simultaneous Pt deposition, and N & P co-doped graphene as an efficient electrocatalyst for ORR and MOR

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### ABSTRACT

Cathode limitations such as sluggish oxygen reduction reaction are the prime hurdle in energy storage and conversion devices such as, supercapacitors, PEMFC, DMFC etc. Platinum (Pt) have come across as an essential catalyst for ORR; nevertheless, amidst considering all the

other factors, in the production of PEM fuel cell, Pt contribute towards substantial expenditure. The present study aims to develop facile route for simultaneously depositing Platinum and doping nitrogen and phosphorous on graphene using conventional microwave oven. The as-synthesized electrocatalyst was characterized using X-ray electron photon spectroscopy to verify the Pt deposition and doping of N and P on the graphene layers. Further, microwave synthesis yielded in smaller Pt particle size which was estimated using both XRD and TEM analysis. Electrochemical studies were performed on Pt/NPG to evaluate its ORR and MOR properties and their results were compared with state-of-the-art Pt/C catalyst.

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**PP-EN-365**

## Band-gap Tuning in Hydrogen Terminated Biphenylene Nanoribbon by Boron and Nitrogen Doping: A First Principles Approach

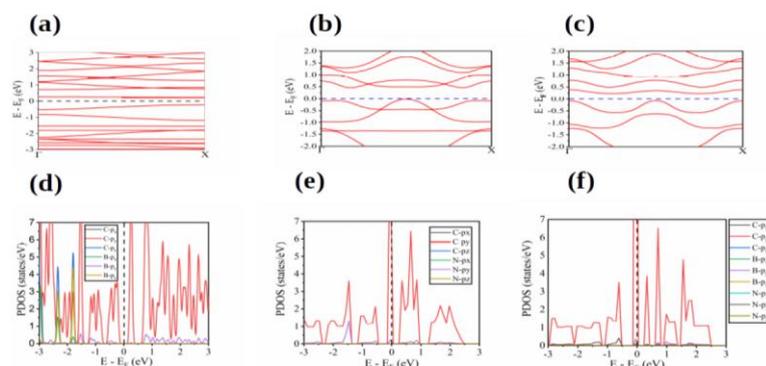
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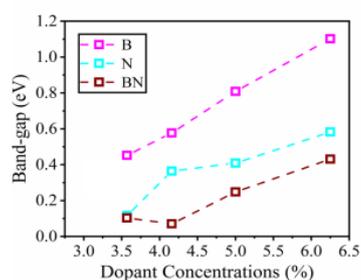
\* *Corresponding Author:* [priya.johari@snu.edu.in](mailto:priya.johari@snu.edu.in).

### ABSTRACT

First-principles density functional theory (DFT) calculations were carried out to investigate the band gap tuning of hydrogen terminated biphenylene (BPN) nanoribbon by substitutional doping and co-doping with boron (B) and nitrogen (N). We have observed that, band gap can be best tuned by B doping as it shown linear variation with doping concentrations. Significant weakening in bond strength can be observed for N doping than its pristine counterpart. The B – C bond lengths get expanded, however the N – C bond lengths get slightly shorten. We report the effect of single pair of B, N and B-N substitutional codoping at different doping concentrations in one-dimensional (1D) BPN nanoribbon at its most energetically favorable positions. We have simulated all the systems within the framework of abinitio density functional theory (DFT). Our results show that single pair B, N and B-N co-doping can able to open up a band gap near the Fermi level as well as it can be tuned with varying doping concentrations. Our results offer the possibility to modify the band gap of hydrogen terminated biphenylene (BPN) sufficiently for utilization in diverse applications. This investigation extends the understanding of the electronic and optical properties of 1D doped nanoribbons, which will benefit the practical applications of these materials in optoelectronics and electronics.



**Fig. 1:** Band structure of (a) boron doped, (b) nitrogen doped (c) boron-nitrogen co-doped  $7 \times 1 \times 1$  supercell of BPN nanoribbon. Partial density of states of (d) boron



**Fig.2:** Variation of band gaps with doping concentrations for different doped systems

## PP-EN-368

### One Pot Synthesis of Ultrathin MoS<sub>2</sub> Nanosheets using Cost-Effective Liquid Phase Exfoliation Technique

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#### ABSTRACT

The unique optical and chemical properties of MoS<sub>2</sub> have led to its various applications in catalysis, optoelectronics, and energy storage among the family of transition metal dichalcogenides (TMDs). Despite all the excellent features, large-scale production remains challenging to meet the needs of different industrial applications. To synthesize mono or few-layer TMDs with better yields, liquid phase exfoliation (LPE) is an effective method. Using a one-step, eco-friendly, and easy method of synthesizing MoS<sub>2</sub> nanosheets starting from small bulk initial concentrations using LPE in different organic solvents like ethanol, isopropyl alcohol (IPA), dimethyl formamide (DMF), and N-Methyl-2-Pyrrolidone (NMP), we are able to achieve stable MoS<sub>2</sub> nanosheets for a long time without adding any surfactants. In order to study the optical, vibrational, and morphological properties of our samples, optical absorbance spectroscopy, photoluminescence (PL), Raman spectroscopy, and scanning electron microscopy (SEM) are used.

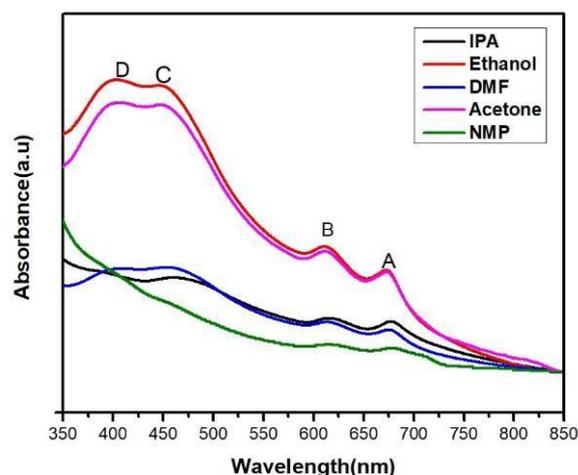


Fig 1: UV-VIS spectra of as-synthesized few layer MoS<sub>2</sub> nanosheets, prepared using LPE.

### PP-EN-369

## Investigations and Synthesis of Silver Doped Phthalic Anhydride Single Crystal and its Effect on Antibacterial, Photocatalytic Activities

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### ABSTRACT

The objective of this research was to dope silver with phthalic anhydride to obtain a new biological and photocatalytic active material. The chemical modification of crystal structure was proven through FTIR, P-XRD, UV- visible and photoluminescence. The derived materials demonstrated excellent inhibitory effect against *K. pneumoniae* and *Staphylococcus aureus*, species (rating 100% inhibition) and could also inhibit *Staphylococcus epidermidis* growth. The best antibacterial activity observed for the derivatives suggests that silver hydrophobization due to the addition of phthalic groups improved the interaction of these derivatives with bacterial cell wall components. The FTIR study gives the details of the functional groups and the optical property was given by UV and PL study. this work provides a new insight for incorporating dopants into the phthalic anhydride single crystal with high photocatalytic performance, considerably broadening their potential application in environmental area.

**Keywords:** Single crystal, P-XRD, Antibacterial, Photocatalytic study.

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**PP-EN-382**

## Effect of Zn Ratio on the Properties of CZTS Nanoparticles and its Performance in Solar Cells

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### ABSTRACT

Kesterite CZTS ( $\text{Cu}_2\text{ZnSnS}_4$ ), a direct band gap material with p-type conductivity and high absorption coefficient ( $10^4 \text{ cm}^{-1}$ ) exhibiting theoretical photoconversion efficiency of more than 32% has been considered to be the most suitable replacement for toxic CIGS and CdTe solar cells. Controlling the Zn concentration of the CZTS nanoparticles has a significant effect on some key properties of the absorber layers of the solar cell devices. Therefore, in this paper we report the properties of CZTS nanoparticles synthesized via solvothermal method by varying the concentration of Zn and also systematically investigated its influence on its performance as an absorber layer in the solar cell. The structural and optical properties of prepared nanoparticles were studied using X-ray powder diffraction (XRD), Raman analysis, scanning electron microscopy (SEM) and UV-vis absorption. It has been observed that the best conversion efficiency of CZTS/ZnO solar cell was 3.03% for Zn-rich composition.

**Keywords:**  $\text{Cu}_2\text{ZnSnS}_4$ , Nanoparticles, Solvothermal, Solar cell, Low-cost, Non-toxic.

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**PP-EN-383**

## Preparation and Characterization of Li Doped Polymer Electrolyte Membranes

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### ABSTRACT

A series of Arabic Gum (AG) biodegradable membranes were prepared by Solution Casting Method. AG membrane is brittle in nature. In order to increase the flexibility and mechanical

strength, poly-Vinyl Alcohol (PVA) is added in different weight ratios. Out of the different AG: PVA polymer blends, membrane having good flexibility and good conductivity was chosen for further studies. A new polymer electrolyte system was prepared by adding different wt.% of Lithium Nitrate ( $\text{LiNO}_3$ ) to the AG-PVA polymer blend. The relevant mechanism of Li ion transport involved in the case of the present polymer blend electrolyte viz., [AG (90 wt.)/PVA (10 wt.)]: x wt.% ( $\text{LiNO}_3$ ) (where x = 5, 10, 15, 20, 25, 30, and 35, respectively) have been evaluated in terms of AC impedance method, dielectric and electrical modulus formalisms. The complexation between the salt and polymer matrix was confirmed by FTIR analysis. All prepared electrolytes were found to obey Arrhenius behaviour and the lowest activation energy is observed for the highest conducting sample. The prepared polymer electrolyte membranes have been characterized utilizing X-ray Diffraction Analysis XRD to confirm the amorphous nature.

**Keywords:** Polymer blend, AG, Impedance, XRD, FTIR.

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**PP-EN-384**

## Development of sPEEK/PI Based Composite Membranes for Fuel Cell Application

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### ABSTRACT

Energy generation is one of the important factors that determine the overall sustainability of mankind. A steady depletion of fossil fuel reserves calls for an efficient, cost effective and sustainable technologies for energy conversion and power generation. Among which proton exchange membrane fuel cell (PEMFCs) is regarded as a suitable alternative because it offers high efficiency and present a clean alternative to internal combustion engines. Broader applications of hydrogen fuelled PEMFCs are restricted in two ways: (i) the PEM has limited proton conductivity at high temperature and low relative humidity conditions, and (ii) the PEM exhibits poor durability in automotive environment due to inadequate mechanical stability upon swelling with water and shrinking when dried. To overcome the drawbacks, avenues of research includes development of variety of composite membranes.

This research focusses on the development of composites with nano structured material. Herein, polyimide and sulfonated polyether etherketone was blended in varying ratios followed by reinforcing the sPEEK/PI matrix with copper-based metal organic framework material to improve the ion-exchange, water uptake, mechanical, thermal stability and proton conductivity. Uniform dispersion of Cu-MOF in the sPEEK/PI matrix was confirmed using XRD, FT-IR analysis and SEM images of Cu-MOF revealed octahedral morphology. The 3 wt.% Cu-MOF loaded sPEEK/PI membrane displayed a maximum IEC of 2.35 meq/g. The composite membranes were thermally stable up to 300 °C and exhibited proton conductivity

of 0.0711 S/cm. which is higher than that of pristine sPEEK (0.0277 S/cm) and sPEEK/PI (0.0205 S/cm)

**Keywords:** Fuel cells, metal organic framework, Sulfonated PEEK, Polyimide, Proton exchange membrane, Polymer composite.

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**PP-EN-389**

## Studies of Gd Doped ZnO Nanoparticles by Chemical Co-precipitation Method

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### ABSTRACT

The facile co-precipitation method was employed to prepare Pure and Gadolinium (Gd) doped Zinc Oxide (ZnO) nanoparticles (NPs) with the precursors Zinc acetate dihydrate and Gadolinium trinitrate in various ratios (0 mol% - 3 mol%). The structural properties of synthesized pure and Gd doped ZnO NPs were investigated by X-Ray Diffractometer which showed high degree of crystallinity of sample. The diffraction peaks (100), (002), and (101) are indexed to the hexagonal wurtzite structure and the lattice parameters and crystallite size of the prepared NPs were analyzed. Morphological properties were studied by HR-SEM, and the optical studies of the material were analyzed by UV-Visible spectroscopy technique for the exploration of the absorption and transmission of the nanoparticle material.

**Keywords:** Gd; ZnO, Co-precipitation, Nanoparticles.

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**PP-EN-390**

## Physical and Electrical Properties of Guar gum/Tragacanth Gum Blend Membranes

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### ABSTRACT

Green materials have attracted worldwide attention for their potential to reduce the environmental pollution caused by hazardous materials. Biopolymers are among such materials obtained from renewable sources and are considered an appropriate alternative for synthetic polymers. Due to their biocompatibility, being non-hazardous, cost effectiveness and abundance in nature, natural polymers are being extensively studied in food, agriculture and medicine industry. The usage of natural polymers in electrochemical applications are very limited. Hence in the present study we aim to prepare a blend polymer membrane and to explore its possible electrochemical application. Guar gum and tragacanth gum are blended in different ratios and free-standing films are obtained. Physical and electrical properties of the prepared membrane were studied.

**Keywords:** Biopolymer, Natural gum, Guar gum, Tragacanth gum, Impedance analysis.

**PP-EN-396**

## Hydrogenation of Carbon Dioxide into Formic acid in the Presence of Copper Complex as Catalyst: Synthesis, Characterization and Catalytic Study

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### ABSTRACT

A viable technique for the future energy portfolio is electrocatalytic water splitting, which is powered by renewable energy input and produces pure H<sub>2</sub>. The efficient production of hydrogen to meet the demand for hydrogen on a commercial scale is a major challenge. In terms of energy conversion and storage, water splitting electrolysis is a viable method for producing hydrogen. Researchers have developed technique for the hydrogenation of CO<sub>2</sub> to valuable chemicals and energy carriers in the presence of hydrogen and catalyst. The conventional metal catalysts are very expensive and showed poor stability under long-term operation. In the present investigations, the structurally characterized copper complex with 1,10-Phenanthroline derivative was tested as an efficient and selective catalyst for the hydrogenation of CO<sub>2</sub> to formate under 75 bar total pressure, 80°C. The experimental outcomes indicated that the higher efficiency for direct CO<sub>2</sub> hydrogenation to formate was

achieved (92% yield; 56,500 TON). This reaction system exhibited high stability and reusability. Here, the conjugated 1,10-Phenanthroline ligand system which lower the reduction potentials as well as to lower the over potentials for the CO<sub>2</sub> reduction. Further, the destabilization of the copper-bound formate accelerates product extrusion, the rate-limiting step in catalysis. Here, the ligand core containing azomethine and electron withdrawing substituent makes metal complex as effective catalytic performance with higher turnover number as compared to existing cobaloxime and metal glyoximate. Further, the metal complex contains anionic acetate group which is water soluble and catalyzes hydrogenation of CO<sub>2</sub> at relatively low overpotentials (300–400 mV at pH 4) with turnover number of 35000 (24 hrs). Therefore, the copper complex as active and robust catalyst lowering down the overpotential and thereby maximizing the energy conversion efficiency.

**Keywords:** Metal complex, Formate, reduction, Carbon dioxide, Catalyst.

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**PP-EN-397**

## Efficient Nondoped Blue Fluorescent Organic Light-Emitting Diodes with a higher Quantum Efficiency based on Copper complex with 1,10-Phenanthroline Derivative

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### ABSTRACT

Organic light-emitting diodes (OLEDs) can promise flexible, light weight, energy conservation, and many other advantages for next-generation display and lighting applications. Blue luminescent materials are highly desired for high quality full color displays, but are still quite insufficient. Therefore, developing efficient blue-emitting materials suitable for nondoped device with little efficiency roll-off is of great significance in terms of practical applications. In the present investigations was focused on the synthesis, characterization of copper complex with 1,10-Phenanthroline derivative which can achieved higher efficiency in nondoped OLEDs. The maximum external quantum efficiency (EQE) of nondoped device is 9.8% which is acquired at the luminescence of 1000 cd m<sup>-2</sup>. The EQE is still as high as 8.50% even the luminescence reaches 10000 cd m<sup>-2</sup>. The maximum luminescence is 57 000 cd m<sup>-2</sup>. Their photophysical properties, electronic structures, electrochemical behaviors, thermal stabilities and electroluminescence performances are comprehensively studied. The above experimental outcomes demonstrated that synthesised copper complex is promising candidate for application in deep-blue OLEDs.

PP-EN-401

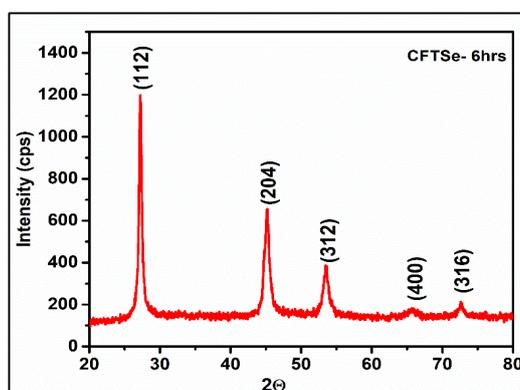
## Investigations on the Structural and Optoelectronic Properties of $\text{Cu}_2\text{FeSnSe}_4$ for energy applications

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### ABSTRACT

$\text{Cu}_2\text{FeSnSe}_4$  (CFTSe) is a quaternary chalcogenide semiconducting material used in energy applications such as solar cells, supercapacitors, thermoelectric devices, and other energy harvesting devices. The quaternary chalcogenide of CFTSe was produced utilizing earth abundant elemental precursors (Cu, Fe, Sn & Se) in a mechanosynthesis route in 2:1:1:4 ratios at different time durations (2-6hrs). X-ray diffraction confirmed the materials structural properties, revealing that they crystallized in a tetragonal crystal system in the space group of I-42m in stannite structure. UV-Vis spectroscopy was used to analyse the materials optical properties; it has substantial absorption in the visible region, making it suitable for usage as photo-absorber materials in solar cells. The optical band gap of the materials is 1.6 eV. The bulk electrical characteristics of the materials were assessed utilizing hall measuring techniques for 10mm square pellets with a thickness of 0.5mm; the results indicate p-type conductivity, good mobility, and a high carrier concentration. Hereby we conclude that, CFTSe is a good photoabsorber and it can be used for thin film solar cells and thermoelectric devices. X-Ray diffraction of mechanosynthesized CFTSe.



X-Ray diffraction of mechanosynthesized

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PP-EN-404

## A Review of Nanoparticles as a Fuel Additive and Part of Biofuel Production in Ternary Blend-fueled Diesel Engines

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### ABSTRACT

The depletion of fossil fuels has led to a move towards renewable and cleaner diesel fuel in recent years. Researchers are studying different types of biofuels. Diesel fuel may soon be challenged by biodiesel. Due to lower calorific value, lower cetane number, and higher density, biodiesel cannot substitute for diesel fuel completely. Thus, diesel engines that use biofuel blends are preferred. This study examines the combustion characteristics, emissions, and performance characteristics of biodiesel-diesel blend-powered diesel engines. The study aims to provide a comprehensive assessment of biodiesel-diesel blends. The potential and application of nanoparticles in bioethanol production have been studied in a large number of research studies in the past. Various nanoparticle ratios of biofuels are collected and examined in this study to assess the effects of nanoparticles in diesel fuel. Various methods for improving engine performance are examined. From preparation of feedstock to chemical reactions, nanoparticles are useful in the development of biofuels. In compared to blends containing no alcohol or alcohol with or without nanoparticles, adding nanoparticles to biodiesel-diesel blends reduces brake-specific fuel consumption by 18 to 20 percent. Moreover, nanoparticles are highly thermally conductive, improving brake performance by 2% to 5% and improving combustion. The reviews found that NO<sub>x</sub> emissions increased by 50%, whereas HC, CO, and PM emissions decreased considerably. According to the findings, introducing nanoparticles to biodiesel and biodiesel blends as a fuel for CI engines could dramatically improve performance while reducing emissions.

**Keywords:** Biodiesel, Nanoparticle, Diesel engine performance, Nano-Additives, Blends..

**PP-EN-440**

## Ferric Iron III and Barium Chromate ( $\text{Fe}_2\text{O}_3$ – $\text{BaCrO}_4$ ) Dye-Sensitized Solar Cells

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### ABSTRACT

Ferric Iron III Oxide ( $\text{Fe}_2\text{O}_3$ ) with Barium Chromate ( $\text{BaCrO}_4$ ) were used as counter electrodes in the formation of Dye-Sensitized Solar Cells (DSSC). Ferric Iron III oxide and Barium Chromate were synthesized through a simple chemical synthesis method. In a DSSC a counter electrode made up of band gap 1.11 eV with long electron diffusion length is needed for supporting dye molecules and transporting photo injected electrons. In this study, the dye 5Nitrosalicylaldehyde and Diglycolamine were synthesized from slow evaporation method. To our best knowledge, there is no report on the binary metal oxides  $\text{Fe}_2\text{O}_3$ /  $\text{BaCrO}_4$  and organic dye 5NSD. Successful dye-sensitive solar cell was created with a flexible conducting electrode and a power conversion efficiency of 0.8%.

**PP-EN-454**

## Fabrication of p-type and n-type SnS Thin Films Through Vacuum Free Deposition Techniques

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### ABSTRACT

Tin sulphide ( $\text{SnS}$ ) is an inexpensive and eco friendly absorber material among the group of compound semiconductors that are currently being explored for low-cost photovoltaic applications. It is also suggested as a pronounced material for photo detectors, photo catalysts, gas sensors, biosensors, field effect transistors, lithium and sodium ion batteries, thermoelectric devices, super capacitors and other such applications.

A variety of deposition methods have been used to prepare SnS thin films. Unlike many other film deposition techniques, Chemical Bath Deposition (CBD), Chemical Spray Pyrolysis

(CSP), represents a very simple and relatively vacuum free cost-effective processing methods. It offers an extremely easy technique for preparing films of any composition. Spray pyrolysis does not require high-quality substrates or chemicals. The method has been employed for the deposition of dense films, porous films, and for powder production. Even multi-layered films can be easily prepared using this versatile technique. SnS films were deposited through CBD, CSP technique and changes in phase and surface nature due to variations in pH, deposition temperature and atomic concentrations were studied. Here we are reporting a new technique for type conversion of SnS nanomaterial, without adding any type of metal as dopant through vacuum free chemical spray pyrolysis technique for various opto electronic applications such as supercapacitor, batteries, bio sensors and solar cell.

**Keywords:** Chemical spray pyrolysis, SnS, Thin films, Photovoltaics, Nanomaterials.

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**PP-EN-457**

## **Synthesis of Novel Catalyst Using Waste Shrimp (*Penaeus Indicus*) Shells for Biodiesel Production**

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### **ABSTRACT**

Calcinated shrimp shells (Cao) Their potential as a heterogeneous basic catalyst for the transesterification of waste cooking oil with high FFA level was assessed. Biodiesel was made via a transesterification technique. The waste cooking oil was filtered and blended for 30 minutes at room temperature at 300 rpm in a magnetic stirrer in the first phase. Using calcined the esterified oil was converted into biodiesel using shrimp shells (Cao) as a heterogeneous basic a catalyst and a methanol-to-oil ratio of 6:1. The Cao catalyst's properties were evaluated using X-ray diffraction, scanning electron microscopy and energy dispersive X-ray, Fourier transform infrared spectroscopy, and gas chromatography mass spectrometry. FTIR was used to analyze the structure of shrimp shells.

**Keywords:** Shrimp shells, Transesterification, Waste cooking oil.

PP-EN-461

## Development of high-performance Supercapacitor using faceted ZIF-67 MOF synthesized by facile chemical route

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### ABSTRACT

Supercapacitors with the meritorious characteristics like high-power density and long cyclic stability have grab the wide research attention in recent time. Supercapacitor as a new type of energy storage device between traditional capacitor and rechargeable battery. ZIF-67 Metal organic framework synthesized simply by means of mixing precursors using magnetic stirrer. The ZIF-67 MOF were characterized by using X-ray Diffraction, UV-Visible Spectroscopy, Fourier-transform Infrared Spectroscopy and Atomic Force Microscopy. The present investigations deal with electrochemical (CV, EIS, GCD) performance of fabricated ZIF-67 electrodes in 2 M, 4 M and 6 M KOH as an electrolyte solution in the potential window of 0-0.5 V. The electrode shows efficient results in 6 M KOH with specific capacitance value 164 Fg<sup>-1</sup> at a scan rate of 10 mVs<sup>-1</sup> compared to 72 Fg<sup>-1</sup> and 99.8 Fg<sup>-1</sup> for 2 M and 4 M respectively. The ZIF 67 MOF electrodes shows retention up to 96% over the 1000 repeated charge-discharge cycles. This method facilitates a simple approach to synthesis ZIF 67 MOF and its applicability as energy devices.

**Keywords:** ZIF-67, Metal organic framework, Specific capacitance, Supercapacitors.

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PP-EN-466

## Effect of Solvent on ZnO Nanoparticles by Simple Sol-gel Method

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### ABSTRACT

ZnO nanoparticles are prepared by simple sol-gel method with the initial precursor as water and ethanol, followed by heat treatment to obtain the ZnO nanoparticle in single phase. In this study, water and ethanol are used as solvents to create zinc oxide nanoparticles which may control the shape, size and composition, which are then subjected to various characterisation investigations. Basic characterisation techniques were involved to investigate the structural, morphological, and dielectric properties of the material. X-ray diffractometer (XRD) used to investigate the nanoparticle and confirmed the material has formed in crystalline nature with single phase where there is no secondary phase obtained. And also changes in its vibrational and morphological exposures are characterized through Fourier-transform infrared spectroscopy (FT-IR) and scanning electron microscopy (SEM) analysis. In our experiment of synthesizing the ZnO nanoparticles, different solvents are employed to elucidate the change in its properties. Particle size analyzers investigate the particle size of the synthesized nanoparticles. Variation of  $Z'$  and  $Z''$  is studied from the impedance analyser using a LCR meter. The results of the overall optimized experiments are the best results the ZnO nanoparticles are different technological applications.

**Keywords:** Solvent, X-ray diffraction Microscopy techniques, Vibrational property, Dielectric measurement.

PP-EN-468

## Study of Bismuth Oxide/Polystyrene Composites as Electrode Material for Supercapacitors

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### ABSTRACT

Efficient and high capacity storage devices are needed to store energy in flexible composites. To study effect of filler concentration like bismuth oxide (BO) (BO = 1 to 5%) on the energy storage performance of polymer polystyrene (PS) was tested in this manuscript. BO/PS composite films of 100 $\mu$ m thickness were synthesized by solution casting method. The

structure, phase, morphology and bonding nature of composites were characterized using x-ray diffraction (XRD), scanning electron microscopy (SEM) and Fourier transform infrared spectrum (FT-IR) spectroscopy. Dielectric constant of composite electrode materials with varying concentration of BO and frequency was analyzed with the help of Impedance analyzer. The value of dielectric constant was found to increase on increasing BO concentration in composites and decreased with frequency. These results indicate BO/PS composites might be good electrode materials for high performance supercapacitors.

**Keywords:** Composites; Dielectric properties; Bi<sub>2</sub>O<sub>3</sub>; Polystyrene; Electrodes; Energy storage.

## PP-EN-475

### Study of Nano-materials and Thin Films for Wastewater Analysis

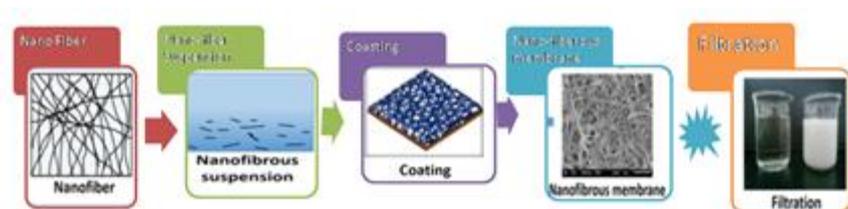
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#### ABSTRACT

Nano-technology and thin films has foremost potential that can be supportive in the areas of atmosphere, purification of impurities, treatments in the present state of water else remediation, exposure of pollutants through various sensors, but foremost is prevention of water resources. Execution of contamination free aqueous for healthy lives are a challenging issue and resource of the same in various parts of the world are facing severe problems. This may cause scarcity in food production, new water born diseases and less fresh water resources. Indeed an innovative approach where aqueous technologies can provide safe drinking water and reduce global water pollution by enhancing natural resources of water alongside by offering new opportunities is urgently required. Present work is representing a review and wide ranging information on the role of nanotechnology in aqueous toxic waste remediation and focused on three major categories of nano-materials (catalyst, membranes, thin films and filtration) in submission of effluvia aqueous. Emerging technologies like thin films, thin films dryers, thin film composites and hybrid membranes have been discussed and marked for the wastewater ministration. Nano-photocatalyst, membranes, adsorbents and dryers review is presented along with various risks of these technologies and futuristic scopes. Due to limited resources available on above techniques an overview is required to reach up to maximum site with further advancement in existing technologies.

**Keywords:** Photocatalyst; adsorbents; Membranes; Nano-materials; Thin Films.



**Fig. 1:** Process of filtration for Nano-materials as membranes

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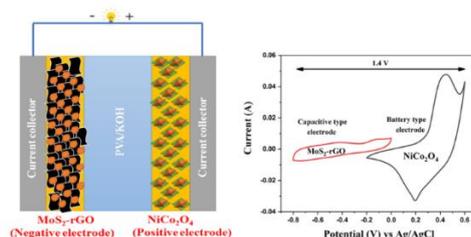
**PP-EN-478****Green Nanotechnology: Synthesis of Zinc Oxide Nanoparticles**Jyoti Mayekar<sup>a</sup>, S.Radha<sup>b</sup><sup>a</sup> Jai Hind college, Mumbai-20, India.<sup>b</sup> University of Mumbai, Mumbai-98, India.**\*Corresponding Author:** [nwwton@gmail.com](mailto:nwwton@gmail.com)**ABSTRACT**

The use of green synthesis methods by researchers is rapidly increasing due to usage of less toxic chemicals, ecofriendly nature and one step synthesis of nanoparticles. The biological system involved in the green synthesis of nanoparticles are plants and their derivatives, microorganisms like bacteria, fungi, algae and yeast Phytochemicals which are present in leaf extract are responsible for the synthesis of ZnO nanoparticles. These phytochemicals are terpenoids, flavonoids, carbohydrates, saponins, alkaloid and protein molecule. Carbohydrate can play multiple role like coating/capping, functionalizing, poring, stabilizing and as coordinating agent. Fruit extracts from citrous are rich sources of citric acid and ascorbic acid which are excellent reducing agents. In the present study various methods for green synthesis were studied and comparative study is done of the various plant extracts used for the synthesis like leaves, roots, flower or fruit.

**Keywords:** Zinc oxide nanoparticles, Green synthesis, leaves extract, plant extract**PP-EN-484****Charge Storage Kinetics of Spinel NiCo<sub>2</sub>O<sub>4</sub> Nano-Sheets for Advanced Solid-State Hybrid-Supercapacitor**Deependra Jhankal,<sup>1</sup> Mohammad Saquib Khan,<sup>2</sup> Bhanu<sup>1</sup>, Nikita Bhardwaj<sup>1</sup>, Preeti Shakya<sup>1,2</sup>, K. K. Jhankal<sup>3</sup>, K Sachdev<sup>1,2,\*</sup><sup>1</sup> Department of Physics, Malaviya National Institute of Technology, Jaipur 302017 (India).<sup>2</sup> Materials Research Centre, Malaviya National Institute of Technology, Jaipur 302017 (India).<sup>3</sup> Department of Chemistry, University of Rajasthan, Jaipur 302004 (India).**\*Corresponding Author:** [ksachdev.phy@mnit.ac.in](mailto:ksachdev.phy@mnit.ac.in)**ABSTRACT**

Design and development of both capacitive and battery type electrode materials artistic with high capacitance, wide potential window and desirable cycle stability are essential to enhance the performance of hybrid supercapacitor. In this study, a simple sol-gel synthesis strategy has been adopted to fabrication of layered spinel  $\text{NiCo}_2\text{O}_4$  nano-sheets. The morphological and structural analysis shows that the  $\text{NiCo}_2\text{O}_4$  is formed with nano sheets morphology, high phase purity and good stichometry without any impurity. The electrochemical study of binder free  $\text{NiCo}_2\text{O}_4$  electrodes in three electrode set-ups in 3M KOH aqueous electrolyte reveals that the electrode has highest specific capacitance value that is 455 Fg<sup>-1</sup> at 2 Ag<sup>-1</sup>. The detailed electrochemical analysis of Cyclic Voltammetry (CV) profile is also carried out to investigate the capacitive and diffusive controlled charge storage kinetics of the electrodes. Furthermore, a hybrid supercapacitor device is fabricated by employing molybdenum disulfide reduced graphene oxide ( $\text{MoS}_2\text{-rGO}$ ) nanocomposite and  $\text{NiCo}_2\text{O}_4$  as the negative and positive electrode, respectively. PVA-KOH is utilized as the gel electrolyte and separator. The fabricated hybrid supercapacitor device delivered highest energy density of 40 WhKg<sup>-1</sup> with the corresponding power density of 1200 Wkg<sup>-1</sup>. The facile, low cost and green synthesis route for layered binder free battery type materials provides new insight for developing advanced positive electrode materials to construct advanced sodium-ion hybrid storage devices.

**Keywords:** sol-gel synthesis method, spinel structure, hybrid supercapacitor, energy density, gel electrolyte.



## PP-EN-485

# INFLUENCE OF $\text{CuO}$ NANOPARTICLES ON THE ENGINE PERFORMANCE & EMISSION CHARACTERISTICS OF NEEM OIL BIODIESEL BLENDS IN C.I. ENGINE

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## ABSTRACT

Neem is playing an important role in the development of sustainable alternatives to commonly-used contaminating fuels. Not only is neem a cleaner source for generating fuels,

it is also a cheaper one. This paper deals with the manufacturing process of Biodiesel from neem oil. This paper mainly involves "Esterification". Factors effecting the biodiesel production (reaction temperature, reaction rate & catalyst) are analyzed. The esterification procedure converts neem oil to its methyl esters. The important properties of the biodiesel oil such as flashpoint, viscosity, calorific value, density is comparable with the diesel. The viscosity of biodiesel oil is nearer to that of diesel and the calorific value is about 16% less than that of diesel. This paper study supports the production of biodiesel from non-edible neem oil as a viable alternative to the diesel fuel.

**Keywords:** Biodiesel, neem oil, biodiesel, copper oxide, nanoadditive.

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**PP-EN-491**

## **Porous Nitrogen-doped Carbon Coated on MnCo<sub>2</sub>O<sub>4</sub> nanospheres as electrode materials for high-performance Asymmetric Supercapacitors**

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### **ABSTRACT**

Spinel-based nanostructured materials are commonly used as promising electrode materials for supercapacitor applications. The combination of Heteroatom doped carbon materials coated with spinel substantially improves the specific capacitance and cyclic stability. In this work, dopamine-derived Nitrogen-doped Carbon was coated on spinel phase MnCo<sub>2</sub>O<sub>4</sub> nanospheres using simple solvothermal and calcination methods. The synthesized MnCo<sub>2</sub>O<sub>4</sub>@Nitrogen doped Carbon was characterized by Field Emission Scanning Electron Microscope (FESEM), Energy Dispersive analysis of X-rays (EDX), X-ray Diffraction spectroscopy (XRD), and X-ray Photoelectron Spectroscopy (XPS). Surface morphology and the crystalline structure of the prepared MnCo<sub>2</sub>O<sub>4</sub>@Nitrogen doped Carbon were confirmed by FESEM and XRD. The electrochemical performance of MnCo<sub>2</sub>O<sub>4</sub>@Nitrogen doped Carbon electrode material was analyzed by cyclic voltammetry, Galvanostatic charge-discharge, and electrochemical impedance spectroscopy techniques. MnCo<sub>2</sub>O<sub>4</sub>@Nitrogen doped Carbon exhibits the highest specific capacitance of 1200 F/g at 1 A/g compared to MnCo<sub>2</sub>O<sub>4</sub> spheres are 726 F/g and exhibits excellent cyclic stability (capacitance retention of 87 % at 7 A/g after 3000 cycles). The excellent cycling stability might benefit from the synergistic effect between a coating of conductive Nitrogen-doped carbon on porous MnCo<sub>2</sub>O<sub>4</sub> spheres. Furthermore, an asymmetric supercapacitor device was fabricated by using the optimized composition of MnCo<sub>2</sub>O<sub>4</sub>@NC<sup>-2</sup> as a positive and Nitrogen, sulphur doped reduced graphene oxide (NS-rGO) as a negative electrode, respectively. This asymmetric supercapacitor device achieves a maximum energy density of 61.0 Wh kg<sup>-1</sup> at a power density of 2889 W kg<sup>-1</sup> and possesses excellent capacitance retention of 95 % after 5000 cycles at 7 A/g.

**Keywords:** MnCo<sub>2</sub>O<sub>4</sub>, nitrogen-doped carbon, specific capacitance, core-shell, composite, asymmetric supercapacitor.

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**PP-EN-495**

## Thin Films of Solid Electrolyte Lithium Sulfate Deposited by E-Beam Evaporation

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### ABSTRACT

Fabrication of Li<sub>2</sub>SO<sub>4</sub> thin films has been successfully attempted by the electron beam evaporation technique, and the deposition conditions were systematically optimized to get stable Li<sub>2</sub>SO<sub>4</sub> thin films. The structural, optical, and electrical properties of the fabricated films were investigated using X-ray diffraction, scanning electron microscope, vibrational spectroscopy techniques, optical transmission spectroscopy, and electrical conductivity measurements. The as-deposited films were X-ray amorphous, although they exhibited Bragg peaks corresponding to Li<sub>2</sub>SO<sub>4</sub> when annealed. The fundamental vibrational modes of sulfate anions were observed through Raman and FT-IR spectroscopy studies. The ionic conductivity value for the thin film was found to be  $2.03 \times 10^{-8}$  S cm<sup>-1</sup> at 373 K, which is of three orders of magnitude higher than that of the bulk.

**Keywords:** Solid electrolyte, Li<sub>2</sub>SO<sub>4</sub> thin film, e-beam evaporation, in-situ Raman, ionic conductivity.

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**PP-EN-497**

## A New Insight into Processing Parameters Impact on Sol Properties of Peptized TiO<sub>2</sub> hydrosol

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### ABSTRACT

TiO<sub>2</sub> is one of the most attractive and extensively studied photo catalytic materials so far. Peptized titania sol is of real importance due to its various advantages like uniform distribution, very small particle size, good dispersibility in aqueous solution, strong interfacial adsorption capability etc. Present article focused a new insight on methodical analysis of the major parameters controlling the characteristics of titania sols prepared from the hydrolysis-

peptization of titanium isopropoxide (TIP). The electrostatic stabilization, parameter reliant particle size distribution, optical density, structural analysis has been studied in consideration of varying modifying conditions e.g. H<sup>+</sup>/Ti molar ratio, solid material content, solvent, peptizing temperature etc. UV-VIS spectroscopy, Particle size analysis, X-ray diffractometer (XRD), and Field Emission Scanning Electron Microscopy (FESEM) were used to analyze the synthesized particles. Few existing literatures explored effect of different parameters on peptizing condition. The present article first time claimed mobility of charges facilitating charge accumulation on particle surfaces under different condition and leading to enhanced electrostatic potential development in the solution as reflected from zeta potential value. But reverse effect is observed in presence of alcohol. Article commendably explore detail effect of some parameters like pH, zeta potential, optical density and focused on some critical analysis. Photo catalytic activity study of synthesized nano TiO<sub>2</sub> sol particles have been done in respect to kinetic degradation of an organic dye.

**Keywords:** TiO<sub>2</sub>, Peptization, Zeta potential, Electrostatic stabilization, Particle size distribution.

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**PP-EN-498**

## **p-Silicon Coupled NiCo<sub>2</sub>O<sub>4</sub>/MoS<sub>2</sub>/RGO as photocathode for Enhanced Photoelectrochemical Solar Water Reduction**

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### **ABSTRACT**

Newly designed efficient photocathode is constructed through optimal combination of NiCo<sub>2</sub>O<sub>4</sub> nanoflakes (N)/ MoS<sub>2</sub> (M)/RGO (G) based photoactive catalyst coupled top of p-Silicon substrate. Initially, high purity in phase, chemical composition and morphology of the synthesized hybrid ternary composite materials are employed through X-ray diffraction, FESEM, HRTEM and BET studies. Further, fabricated hybrid photocathode demonstrates the photoelectrochemical water reduction under solar irradiation at neutral electrolyte (pH~7) condition. As result, fabricated photocathode exhibits the improved solar proton reduction including highest photocurrent density 5.5 mA cm<sup>-2</sup> at 1.23 V vs. RHE along with photon to current conversion efficiency about 0.68 %. Moreover, obtained improved performance of the ternary composite NMG, over bare N and NG, towards catalytic activity is achieved through the dual charge transfer pathway between interfacial layer of N and M to G on top surface p-Si substrate. Therefore, proposed hybrid ternary composite coupled p-Si based photocathode offers the strategy for achieving enhanced solar water reduction activity.

**Keywords:** p-Silicon, MoS<sub>2</sub>, Photocathode, Photoelectrochemical, Solar water reduction.

# **2. GLASS CERAMICS**

## **PAPER PRESENTATIONS**

**OP-GC-071****Effect of Li<sub>2</sub>O on the physical, optical and structural properties of calcium doped zinc containing borate glasses**

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**ABSTRACT**

Glass system of chemical composition  $x\text{Li}_2\text{O} - 5\text{CaO} - 20\text{ZnO} - (75-x) \text{B}_2\text{O}_3$  with  $x=0, 5, 10, 15$  and  $20$  mol% was fabricated through melt quench technique and investigated by X-ray diffraction technique, UV-Absorption spectroscopy, FT-IR and Raman spectroscopy. No crystalline peaks were found in the XRD spectra which confirmed the amorphous nature of the glassy samples. The effect of Li<sub>2</sub>O on the physical parameters like density, oxygen packing density (OPD) and molar volume have been investigated. The density of the glass system increased from  $2.236 \text{ g/cm}^3$  to  $2.732 \text{ g/cm}^3$  with the increase of Li<sub>2</sub>O content. Optical absorption spectroscopic studies were carried out on the glass system. The Cut-off wave length ( $\lambda_c$ ) varied between 271 nm-360 nm whereas, the optical band gaps ( $E_{\text{opt}}$ ) decreased with the addition of Li<sub>2</sub>O in the glass network. The Urbach energy ( $\Delta E$ ) and refractive index of the glass system also increased.

**Keywords:** Density, Optical band gap; Raman Spectroscopy; FTIR spectra.

**OP-GC-086****Evaluation of a Glass Fiber-Made Partial Foot Orthosis Foot Plate Utilising Experimental and Computational Methods**

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**ABSTRACT**

In the first half of this study, a partial foot template mould is made using 3-D printing, and the real partial foot orthosis (PFO) model is made using glass fiber for those who have lost part of their foot owing to diabetes, war veterans, or vascular shortage. In the test rig, the created partial foot orthosis is put through several loading scenarios. The model is designed using Unigraphics in the second aspect, and it is analysed using ANSYS 16.0. The load will be applied to the foot portion, and the heel will be fixed, because the foot is partially amputated. Using a vernier calliper in the test rig, the findings of deformation on the heel and toe are evaluated and measured. At the toe and heel, the deformation is measured under loads of

196.13N and 392.26N. Both mathematically and empirically, the deformation results were deemed safe. For those who have had a partial foot amputation, the PFO model composed of glass fibre aids in the restoration of the natural gait cycle. The study examines how to quickly and reasonably produce orthopedic devices in underdeveloped countries and make them available to the public.

**Keywords:** FO (Foot Orthosis), Foot plate, composite materials, PFA (partial foot amputation), Glass fiber.



**Fig.1:** 3-D printed template to manufacture glass fibre foot plate and Glass fibre cut as per AFO 3-d printed template.

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### OP-GC-094

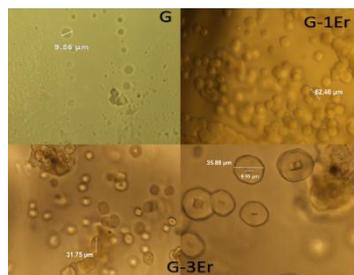
## Er<sup>3+</sup> Doped Bismuth-Niobium-Tellurite Glass Ceramics and Crystalline Materials

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### ABSTRACT

Tellurite glass samples with composition:  $7.5\text{Bi}_2\text{O}_3\text{-}7.5\text{Nb}_2\text{O}_5\text{-}85\text{TeO}_2\text{-}x\text{Er}_2\text{O}_3$  with  $x = 0\text{-}3$  mol% were synthesised by normal melt and splat quenching techniques. Samples with 0-2 mol% Er were found to be transparent glass ceramics (TGCs). The sample with 3 mol% Er had two parts, one prepared by normal melt-quenching technique which was opaque-crystalline and the other prepared by splat-quenching and found to be amorphous. Uniformly dispersed spherulites were observed in glass and TGC samples. Various structural, physical, thermal and luminescent properties were studied by X-ray diffraction (XRD), density measurements, Differential scanning calorimetry (DSC), Raman and Photoluminescence spectroscopy. The XRD scans confirmed amorphous nature of undoped and splat-quenched samples and crystalline nature of other samples with glass-ceramics having orthorhombic  $\text{Te}_3\text{Nb}_2\text{O}_{11}$  phase. The density and glass transition temperature were found to increase with increase in concentration of Er.



**Keywords:** Transparent Glass Ceramics; Crystalline; Spherulites; Differential Scanning Calorimetry.

Table 1: Composition, Density and Tg.

Fig 1: Spherulites observed in samples.

| Sample code | Composition (mol%)             |                                |                  |                                | Density, $\rho$ (g cm <sup>-3</sup> ) | Glass Transition, T <sub>g</sub> | Nature        |
|-------------|--------------------------------|--------------------------------|------------------|--------------------------------|---------------------------------------|----------------------------------|---------------|
|             | Bi <sub>2</sub> O <sub>3</sub> | Nb <sub>2</sub> O <sub>5</sub> | TeO <sub>2</sub> | Er <sub>2</sub> O <sub>3</sub> |                                       |                                  |               |
| G           | 7.5                            | 7.5                            | 85               | -                              | 5.92                                  | 350                              | Glass         |
| G-1Er       | 7.5                            | 7.5                            | 84               | 1                              | 5.94                                  | 355                              | Glass Ceramic |
| G-2Er       | 7.5                            | 7.5                            | 83               | 2                              | 5.97                                  | 360                              | Glass Ceramic |
| G-3Er       | 7.5                            | 7.5                            | 82               | 3                              | 5.98                                  | 374                              | Glass Ceramic |
| C           | 7.5                            | 7.5                            | 82               | 3                              | 5.99                                  | -                                | Crystalline   |

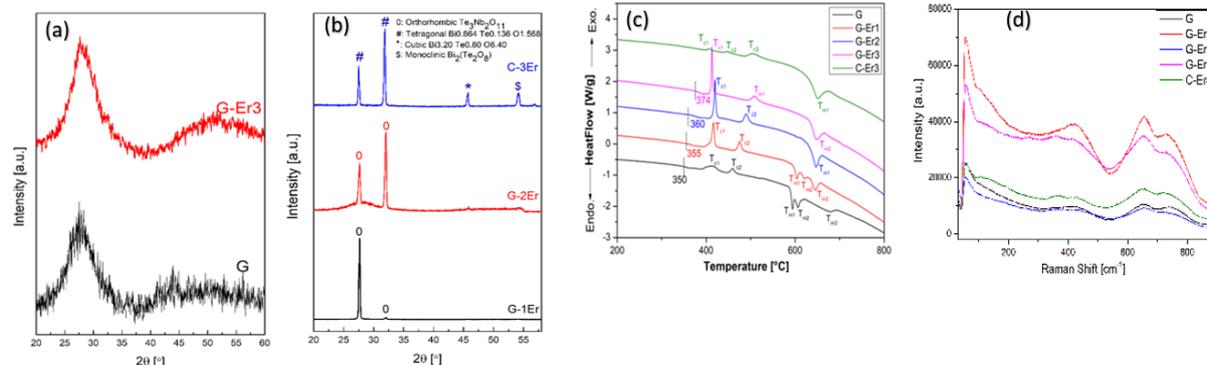


Fig 2: (a), (b): XRD scans; (c): DSC pattern and (d): Raman Spectra at wavelength 785 nm for Tellurite samples

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## OP-GC-097

### Spectroscopic investigations of Dy<sup>3+</sup>/Eu<sup>3+</sup> co-doped glass ceramics for solid-state lighting applications

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#### ABSTRACT

In the present work Dy<sup>3+</sup> (0.5 mol%) and Eu<sup>3+</sup> (1.0 mol%) co-doped zinc aluminoborosilicate glass ceramics prepared by melt-quenching method followed by thermal treatment is reported. The glass ceramics are obtained by heating precursor glasses at four different temperatures such as 470 °C, 510 °C, 550 °C and 590 °C at duration of 3 hours. The XRD study confirmed the polycrystallinity of glass ceramics with formation of NaBSiO<sub>4</sub> (sodium borosilicate) crystalline phase subjected to heat treatment. FESEM studies showed the growth of agglomerated particles on the surface of heat-treated glasses which signified the evolution of NaBSiO<sub>4</sub> crystals. The UV-Visible-NIR studies showed transitions of Dy<sup>3+</sup> and Eu<sup>3+</sup> peaks and the bandgap of the glass ceramics reduced with heat-treatment. Photoluminescence measurements under 350 nm and 393 nm showed the enhanced emission intensity of glass ceramics compared to unheated base glass. The CIE chromaticity coordinates evaluated under 350 nm showed cool white light from the glass ceramics with the CCT values obtained around

5000 K. The lifetime studied prevailed the energy transfer between  $Dy^{3+}$  and  $Eu^{3+}$  ions and the lifetime of glass ceramics obtained at 590 °C showed higher value. Therefore, the prepared glass ceramics act as efficient white light material and suitable for solid-state lighting applications such as W-LEDs.

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## OP-GC-214

### Influence of ZnO on the physical and optical properties of ZnO enriched CaO containing Boro-Tellurite glasses

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## ABSTRACT

Glassy system with a chemical composition  $xZnO-10CaO-30TeO_2-(60-x) B_2O_3$  with  $x=0, 5, 10, 15$  and  $20$  mol% was synthesized by conventional melt quenching method. X-ray diffraction studies confirmed the non-crystalline (amorphous) nature of the prepared glasses. The density ( $\rho$ ) of the present glasses varied between 3.19-3.77g/cm<sup>3</sup> with increasing molar content of additive ZnO. Density related physical parameters such as molecular weight, oxygen packing density (OPD) and molar volume etc. have been investigated. Optical parameters such as cut off wavelength, optical band gap energy, refractive index, Urbach energy etc. have been calculated from UV-Absorption spectra. It was observed that the cut off wave length ( $\lambda_c$ ) shifts towards higher wave length side where as indirect band gap energy decreases with increasing ZnO content. The Urbach energy ( $\Delta E$ ) of the present glasses increased with ZnO content which confirms more disorderness. The refractive index of the glass system varied between 2.23-2.30 with changing of ZnO content. The high refractive index of the studied glasses and the presence  $TeO_2$  and ZnO enables the prominence of the glasses for NLO and antimicrobial applications.

**Keywords:** Density; refractive index; Optical band gap; Urbach energy.

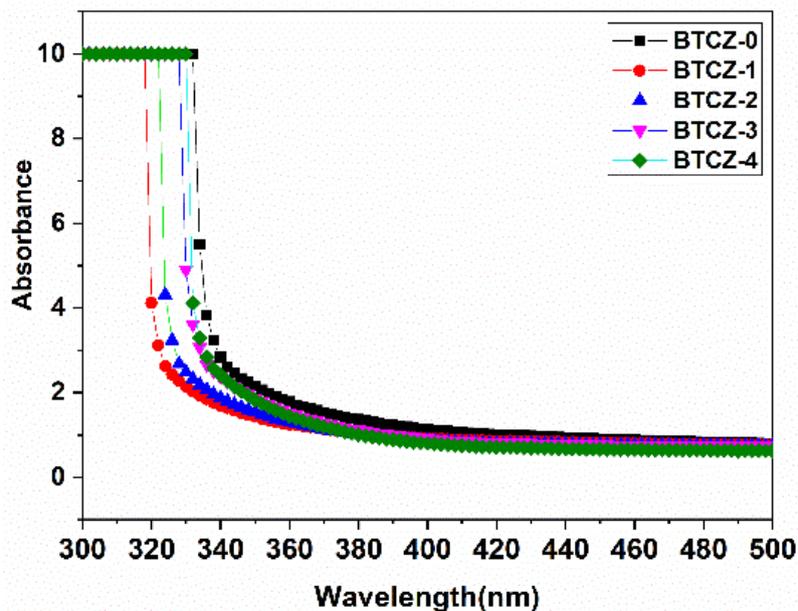


Fig.1: UV-Vis. spectra of BTCZ glass system.

### PP-GC-226

## Optical, Structural and Physical Properties of Fluoride Doped Bioactive Glasses

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### ABSTRACT

Glasses of composition  $(60-x)\text{NaPO}_3-25\text{B}_2\text{O}_3-x\text{CaF}_2-15\text{MgO}$  with  $x = 2.5, 5, 7.5, 10$  and  $12.5$  mol% were prepared by melt quenching technique at  $1100^\circ\text{C}$ . Different properties such as optical, structural and physical properties were calculated on synthesized glasses. The amorphous nature of the glasses was confirmed using X-ray diffraction technique. Density of the glasses were found to increase when  $\text{CaF}_2$  composition was varied from 2.5 mol% to 12.5 mol%. With the increase in  $\text{CaF}_2$  content, refractive index value of the glass samples decreased. UV visible absorption spectra of the samples shows broad absorption band at nearly about 215 nm. The optical band gap and Urbach energy of prepared glasses were derived from the optical absorption spectra by using UV-Visible spectrometer. The band gap energy of glasses was found to increase due to the formation of ionic cross-links in the glass structure. The various other parameters like calcium ion concentration, polaron radius, internuclear distance, field strength, dielectric constant, reflection loss, optical basicity, molar refractivity, molar and oxide ion polarizability values were calculated from the density and refractive index of glasses. This paper deals with the effect of calcium fluoride addition on the optical properties of the prepared glasses for biomedical optics applications.

**Keywords:** Optical band gap; Refractive index; Oxide ion polarizability; Optical basicity.

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## PP-GC-327

### Comparison of Carbon fiber and Glass Fiber Partial Foot Orthosis by Experimental and Computational Method

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#### ABSTRACT

Many persons living in industrialised nations who have undergone lower limb amputations now have better function and a higher quality of life because of significant advancements in prosthetic foot research and development over the past 20 years. A drawback of this new R&D is that the vast majority of end users in developing nations are unable to take use of it because of the components' high price, low durability, high maintenance requirements, and limited accessibility. Research is needed in this area to build and improve a prosthetic foot that is extremely valuable, meets economic, environmental, and physical standards, and can withstand harsh working environments and climates. Successful prosthesis that strive to maximise function while minimising production costs typically rely on the elasticity of their component materials to produce a "spring," which resembles a physiological foot's stride. To identify design elements influencing improved functional results, this study examined the mechanical parameters of PFOs, specifically structural stiffness, rotational motion, and strut deflection. Diabetes patients frequently receive prescriptions for insoles and footwear to help avoid the development of foot ulcers. Plantar peak pressure (PPP) is decreased in areas of interest with the use of insoles and sturdy footwear (ROI). These areas are known as the heel and metatarsal phalangeal joints 1-2. The purpose of this study was to examine the pressure distribution of two distinct types of insoles.

**Keywords:** Orthosis, partial foot amputation, carbon fiber, Glass Fiber, Manufacturing.

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**PP-GC-336****Physical and Optical Properties of Lithium Zinc Borate Glasses Doped with Antimony Oxide**

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**ABSTRACT**

57.5B<sub>2</sub>O<sub>3</sub>- 22.5 Li<sub>2</sub>O- (20-X) ZnO- XSb<sub>2</sub>O<sub>3</sub> (X = 0, 0.5, 1) glasses are synthesized using conventional melt quenching technique. The density of glass decreases whereas molar volume increase with the addition of Sb<sub>2</sub>O<sub>3</sub> content. This clearly suggests that the addition of Sb<sub>2</sub>O<sub>3</sub> creates more NBO's in the glass structure. Incorporation of Sb<sub>2</sub>O<sub>3</sub> in the glasses have reduced the optical bandgap from 3.29 eV to 3.18 eV which is quite similar to that of physical properties. Bond ionicity, oxide ion polarizability, basicity and interaction parameter exhibit composition dependent trends. This paper details about optical and physical properties of the lithium zinc borate glasses doped with antimony oxide.

**Keywords:** Lithium Strontium Borate Glasses, refractive index, Optical Properties, Polarizability.

PP-GC-356

## Synthesis and Characterization of Cerium doped Gadolinium Silicate Ceramic by Vacuum Hot-Pressed Method

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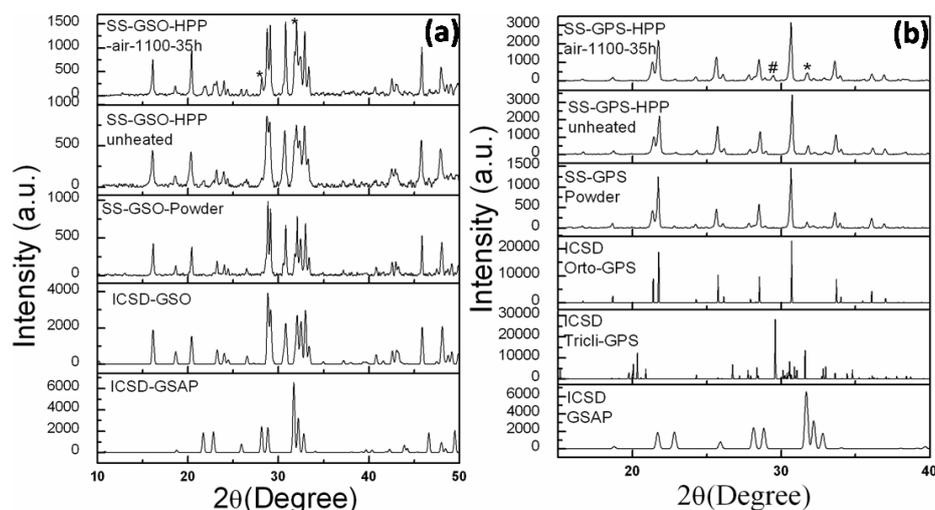
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### ABSTRACT

Cerium doped gadolinium silicate powder in two different phases namely oxyorthosilicate (GSO) and pyrosilicate (GPS) were synthesized by solid state sintering and solution combustion method. Synthesized powder was used for making ceramic by vacuum hot-pressed method applying the pressure of 4-6 ton at temperature of 1500°C for two hours in the vacuum of  $2 \times 10^{-6}$  mbar. Heat treatment were given to vacuumed hot pressed ceramic in different atmospheric condition and its effect on structural and optical properties were studied using XRD, photoluminescence and scintillation spectra.

**Keywords:** Gadolinium Silicate, Scintillation, Ceramic, luminescence.



**Fig.1:** XRD pattern of HPP prepared using solid state sintering (SS) of (a) GSO and (b) GPS.

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# **3. PROCESS AND MECHANICAL BEHAVIOR**

## **PAPER PRESENTATIONS**

**OP-MB-043**

## Investigation on mechanical properties and anisotropy of Inconel 625 solid block fabricated by Wire Arc Additive Manufacturing

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### ABSTRACT

Wire Arc Additive Manufacturing (WAAM) process is attracting researchers in academia and industries due its low-cost components and capability to fabricate medium to large size structural components. Inconel 625 is a solid solution strengthened Ni based super-alloy, widely used in aerospace, nuclear and marine application due to its excellent high temperature mechanical and physical properties. In the present study, a solid cubical block of Inconel 625 has been fabricated using Gas Metal Arc Welding based robotic WAAM setup. The microstructure and mechanical properties such as micro-hardness and tensile behavior along build direction and perpendicular to the build direction have been investigated and anisotropy in mechanical properties were quantified. The average micro-hardness was found to be 235 HV<sub>0.5</sub> along with the anisotropy of ~4%. The anisotropy in the yield strength and ultimate tensile strength were calculated as ~15% and ~16% respectively. The growth of long columnar grains along build direction and inter-dendritic micro-segregation Nb & Mo with the formation of laves phases was the prime factor for the anisotropy in the mechanical properties.

**Keywords:** Wire Arc Additive Manufacturing, Inconel 625, Microstructure, Mechanical Properties.

**OP-MB-050**

## Microstructure, Mechanical properties, and Strain Rate Sensitivity of Vacuum Arc Melted CoCrNi Medium Entropy Alloy

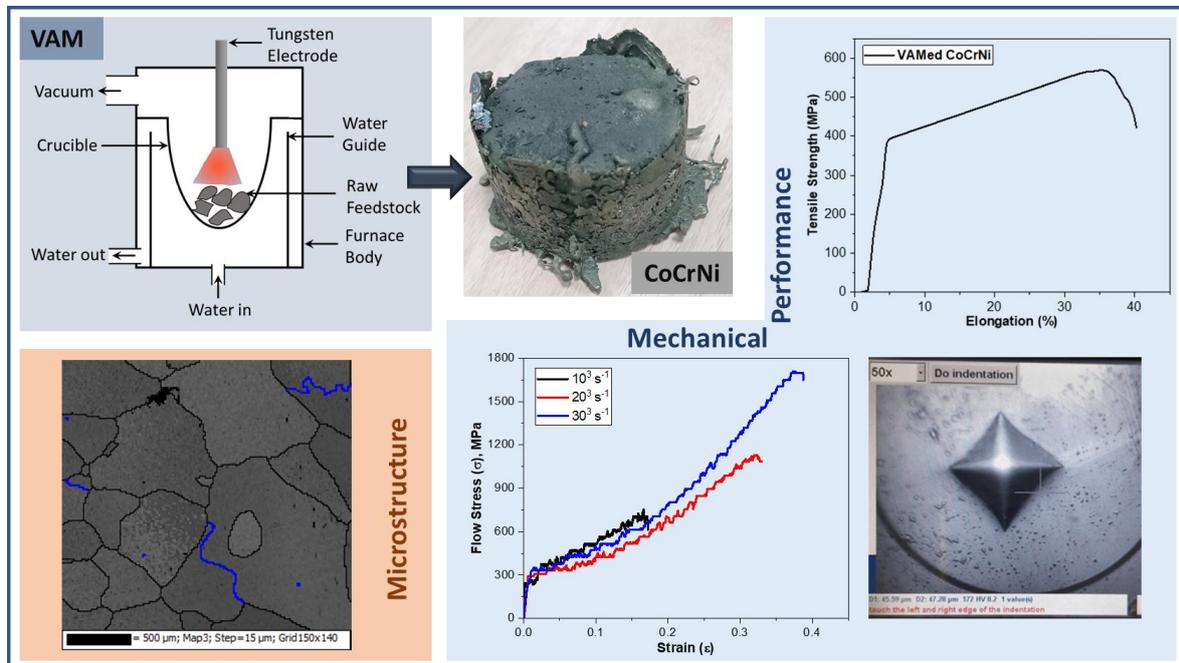
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### ABSTRACT

Vacuum arc melting is a prevalent and low-cost technique to synthesize several metals and alloys. This study reports the microstructure, mechanical properties, and high strain rate testing of vacuum arc melted CoCrNi Medium Entropy Alloy (MEA). CoCrNi is a popular MEA owing to its better combination of strength and ductility, and the alloy also exhibits superior fatigue properties to the well-known first generation CoCrFeMnNi high entropy or Cantor alloy. The CoCrNi MEA is found to be single-phase face-centered cubic (fcc) solid solution and microstructural investigation revealed near-equiaxed coarse grains. Since strain hardening is an important mechanism for strengthening of CoCrNi at higher strains, the high

strain rate tests are performed at strain rates of  $10^3$ ,  $20^3$ , and  $30^3$  S<sup>-1</sup>. The strain hardening effect is dominant at higher strain rates, and a positive strain rate sensitivity of  $0.256 \pm 0.03$  is observed.

**Keywords:** Vacuum Arc Melting; Medium Entropy Alloy; Microstructure; Mechanical Performance; Strain Rate Sensitivity.



### OP-MB-114

## Mechanical Properties of Hard Chrome prepared by Electroplating

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### ABSTRACT

Chrome plating (chromium plating), is a technique of electroplating a thin layer of chromium onto a metal or plastic object. The chromed layer can be decorative, provide corrosion resistance, ease cleaning procedures, or increase surface hardness. Sometimes a less expensive imitator of chrome may be used for aesthetic purposes. This project is based on the deposition of Hard Chrome on EN-19 steel. The steel substrates are coated with hard chrome by electroplating process. The metal to be coated is kept at cathode and lead is placed at anode, and chromic acid is used as the electrolytic solution. Then, the coated samples are characterized using X-ray diffraction, Pin on disc and Microvicker hardness tester to study the structural, wear and mechanical properties. Before coating, the material is thoroughly cleaned and etched. A typical hard chrome thickness for our sample is ~ 5 μm. The results

obtained are then compared for before and after the hard chrome plating. X-ray diffraction pattern confirms the formation of hard chrome. Wear studies indicated that the coefficient of friction is 0.68. The mechanical properties indicated that the hardness of EN 19 is 320 HV and the hardness increased to 825 HV after the hard chrome plating. The hardness is increased 3 times approximately.

**Keywords:** surface modification, surface Tribology, Fracture surface.

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**OP-MB-116**

## **Water Hyacinth (Eichhornia crassipes) Plant Powder with Moringa Filler Powder Reinforced Epoxy Polymer Composite Absorption Properties for False Ceiling Applications**

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### **ABSTRACT**

This study investigates the absorption properties of a polymer composite material made from water hyacinth (Eichhornia crassipes) natural plant fibres, especially for false ceiling applications. The use of hyacinth fibre with moringa powder filler material in polymer composites has not been well studied in the literature due to lack of research. This study aims to study whether moringa plant powder can be used as a filler material for hyacinth powder composites for the purpose of reducing the moisture content of the composites. If the moringa filler material is used in the preparation of hyacinth fibre composites, they have improved properties such as hardness and absorption. In order to create composite samples, it is combined with an epoxy polymer matrix, and the powder particles are used as a part of the compression moulding process. A composite sample with high hardness strength was obtained in which 30% of hyacinth fibre and 5% of moringa filler powder were used. This combination achieved a Shore D hardness value of 98 in the composite sample. Based on the results of the water and chemical absorption studies, it can be concluded that the filler material can increase the level of absorption resistance of composite samples (15% for water and 25% for chemical) by a significant amount. It is possible to observe fibre bonding, moringa plant powder combinations, as well as the absorption of primary and secondary phase materials utilizing a scanning electron microscope machine. As a result of this study, the use of hyacinth fibres reinforced with moringa powder composites in false ceiling applications is strongly recommended based on the results presented in the paper.

**Keywords:** Water Hyacinth Fibre; Moringa Filler Powder; Water Absorption; Chemical Absorption; Hardness Strength; FESEM.

**OP-MB-130**

## Investigation on Natural Plant Powder Reinforced 3D Printed Composite Absorption Properties

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### ABSTRACT

In addition to the freedom of design offered by 3-D printing, additive manufacturing (AM) also offers the ability to fabricate complex structures with minimal waste due to its additive nature. A key factor driving the growth of composite 3D printing is the ability to reduce the cost and streamline the traditional manufacturing processes of composite materials, as well as the ability to simplify the process. For instance, most of them require manual laying up of the layers of a composite, and these materials have to be cured using expensive curing equipment and tools. Additionally, 3D printing is not the only method that can be used to fabricate composite components; there are several other methods as well. In this research work natural plant based powders are reinforced to the PLA filament with different weight percentages. Then the different water and chemical solutions are used to investigate the absorbance behaviour of natural fibre incorporated 3D printed composites. The hardness test also measured the 3D printed composite samples by using Durometer. The major aim of this research work is to investigate the natural fibre reinforced 3D printed composite plates hardness and absorbance behaviour especially for light weight material applications.

**Keywords:** PLA filament; Natural Fibres; 3D Printed Composites; Natural Powders.

**OP-MB-131**

## Structural and Wear Assessment of H11 Die Steel as A Function of Tempering Temperature

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### ABSTRACT

H11 steel is widely used in helicopter landing gears, dies for extrusion and forging. For longer life and higher design accuracy, properties of this type of tool steel can be improved by various types of heat treatments. The current attempt was made to study the effect of single tempering cycle on the two-body abrasive wear of these steels. The different tempering temperatures used in the present investigation are 200°C, 400°C and 600°C. The result shows that the wear mechanism like (ploughing and micro cutting) in each condition was dominated by types of

phases present and their morphology, martensite is a hard phase whereas retained austenite is tougher phase which substantially affect the wear mechanism. The wear debris particles are flaky in shape with a threaded like surface structure. There is a presence of small amount of removal of SiC particles from the abrasive wear paper due to high load of 40N which is appeared bright (white) in color. The wear debris particles are relatively finer are found to be in as-quenched condition and tempered 200°C condition whereas large size flaky particles are found in tempered 400, 600° and annealed condition. The wear debris analysis through micrographs and their XRD patterns does not show the removal of iron oxide particles whereas it confirms the removal of SiC particles, martensite and carbide particles in different abrasive condition.

**Keywords:** H11 steel, abrasive wear, carbides, wear debris, XRD.

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**OP-MB-142**

## The Effects of Nano-Alumina Particles on the Enrichment of Tensile, Flexural and Impact Properties of Carbon Fiber-Reinforced Epoxy Composites

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### ABSTRACT

Over the past years the combination of dissimilar synthetic materials reinforced epoxy-based composites have replaced many of the conventional metal/materials in most of the modern engineering. This is achievable because of the advantages of manmade resources reinforced polymers put forward over existing materials. Collectively ordinary resources reinforced epoxy-based composites are light, stiff and allow both large- and small-scale production at lower energy cost however; strength of these composites is highly not noticeable. In an attempt to improve the different tensile, flexural and impact properties of the existing synthetic materials reinforced epoxy-based composites, a small amount of nano alumina powder has added as constituent with different weight ratio of epoxy resin and constant amount of carbon fiber. After the fabrication process, all the specimens were prepared as per the ASTM standards and it's tensile, flexural and impact properties were evaluated experimentally. Experimental results reveal that the addition of optimum weight percentage

nano alumina particles into the carbon fiber and epoxy resin matrix improves the tensile, flexural and impact properties of the composites considerably.

**Keywords:** Nano composites; experimentation; mechanical properties; alumina; carbon fiber; hybrid composites.

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**OP-MB-152**

## Effect of Oxygen on Plastic Deformation of Nb: an Ab-Initio Investigation

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**ABSTRACT**

Refractory metal-based alloys are mostly used in nuclear power plants, high speed engines due to their excellent strength and creep resistance in elevated temperature conditions. The presence of non-metallic impurities is known to have significant impact on mechanical properties of these alloys, such as ductility and strength. Nb alloys have a very high solubility of oxygen and prone to hardening and embrittlement even at very low concentration of oxygen. The oxygen embrittlement affects both service life and durability of machinery part by decreasing fracture toughness and ductility. The generalized stacking fault energy (GSFE) is considered as an important indicator of the microscopic plastic response. In this work, density functional theory calculations were utilized to quantify the generalized stacking fault curve for Nb with inclusion of different atomic percentages of interstitial oxygen. It was very conclusive from this work that oxygen induces hardening in niobium by increasing unstable stacking fault energy that results in decrease in ductility. Finally, these findings were interpreted with the help of different electronic insights to characterize the bonding behavior of O with host Nb in key slip system.

**Keywords:** First-principles calculations, Oxygen embrittlement, Plasticity.

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**OP-MB-157**

## Performance Enhancement in Vapour Compression Refrigeration System Using Graphene Nanopowder

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**ABSTRACT**

In this study graphene nanopowder in compressor lubricating oil at different quantities ranging from 0 to 0.6 g/L and R600a concentration of 70g. Enhancement in R600a refrigeration

system performance, refrigeration effect and to reduce the compressor power consumption by using graphene nanopowder. The R600a refrigeration system was used in the research and can be used as a superior alternative to pure mineral refrigeration. In contrast to the R600a system without nanolubricants, the inclusion of graphene nanoparticles increased cooling capacity from 140 W to 180 W and consumed less energy from 148 to 122W were achieved with the use of nanoparticles in the lubricating oil. There is an increase in the performance of the system by 25% from 1.2 to 1.6. The results obtained by using nanoparticles are compared with the normal refrigeration system. The performance enhancement parameters are predicted using the Fuzzy logic technique.

**Keywords:** Graphene, Refrigeration effect, R600a.

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**OP-MB-176**

## **Fabrication and investigation on mechanical properties of Heat treated AL6061 Nano metal matrix composites**

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### **ABSTRACT**

A progress has been put to evaluate the various composite combinations and how they impact the characteristics of the various aluminum alloys. In order to conduct an overall investigation of the composites, a full understanding of the characteristics is offered, and the best findings may be used for the continued development of the Aluminum reinforced composition. The mechanical characteristics and microstructure of an Al6061 alloy reinforced by nanoscale zirconium diboride (ZrB<sub>2</sub>) particles were evaluated in the present work. The development of Al6061 metal matrix nanocomposites (AMMNCs) via the stir casting technique is employed by altering the amount of ZrB<sub>2</sub> nanoparticles from 0 to 2 Wt.%. To investigate the crystalline size and phase distribution of AMMNCs, X-ray Diffraction (XRD) was employed. Analysis using a scanning electron microscope (SEM) exhibits that ZrB<sub>2</sub> nanoparticles are uniformly distributed throughout AMMNCs. The inclusion of ZrB<sub>2</sub> nano particles improved the AMMNCs' functionality. ultimate yield strength, hardness, and tensile strength respectively. The results suggest that increasing the weight percentage of reinforcement in the produced nanocomposite improves mechanical characteristics.

**Keywords:** MMNCs, Al6061, nano composite structures, microstructure, mechanical characteristics.

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**OP-MB-191****Effect of Infill Pattern on the Mechanical Behavior of Fused Deposition Modeling Printed Polylactic Acid Product**

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**ABSTRACT**

Research on biodegradable polymers has gain momentum to mitigate the environmental pollution associated with the usage of conventional plastics. Polylactic acid (PLA) has been a key ingredient in the preparation of several biodegradable plastics. In manufacturing technology, additive manufacturing has emerged as a process to develop customized design products within a short time with minimal wastage of materials. Among the several techniques, fused deposition modeling (FDM) offers the advantage of fabricating thermoplastic components. In the present study, PLA specimens have been prepared using FDM process and the effect of infill pattern on the mechanical behavior of the prepared samples have been studied. Diamond and linear infill patterns have been used and their influence on the tensile strength, flexural strength, impact strength and hardness of the samples has been evaluated. Differential scanning calorimetry has been performed to investigate the phase changes in the fabricated specimens. Results of such studies will be discussed.

**Keywords:** Biodegradable; Diamond; Linear; Tensile Strength; Flexural Strength; Impact Strength.

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OP-MB-201

## Understanding friction of graphene/h-BN at nanoscale using molecular simulations

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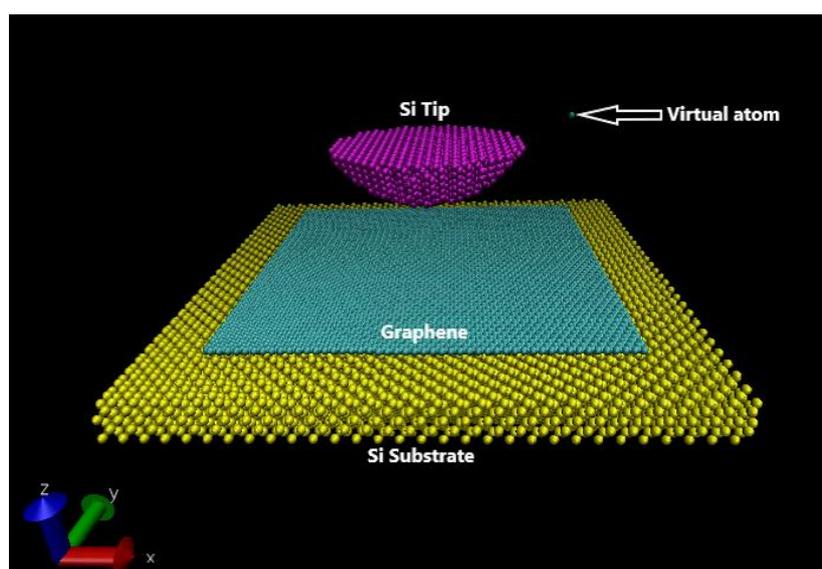
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### ABSTRACT

Almost all mechanical systems with moving parts experience friction, which often accounts for significant energy loss as well as mechanical breakdowns and inefficiencies. More attention is being paid to the use of two-dimensional (2D) nanomaterial as lubricant additives and solid lubricants in order to increase the energy efficiency of tribological systems. 2D nanomaterials are layered structures either a monolayer or multilayer of atomic thickness and ultra-low shear strength. This paper investigates the effect of temperature on nanoscale tribology properties of layered materials such as graphene and hexagonal boron nitride (h-BN). A molecular dynamics setup with a silicon tip and 2D layered material supported over a crystalline substrate is used. Large-scale Atomic/Molecular Massively Parallel Simulator (LAMMPS) is used to conduct all our molecular simulations. The silicon tip is made to slide over the substrate with a constant velocity. The lateral force experienced by the tip is measured as a function of sliding distance for different normal loads and temperatures. The effect of temperature and substrate thickness on changes in the frictional behaviour at nanoscale will be discussed.

**Keywords:** Tribology, friction, two dimensional materials, solid lubrication, MD simulation.



**Fig.1:** Model setup for Si tip sliding over graphene/Si substrate system.

**OP-MB-435**

## Numerical Study on Influence of Target Thickness on Impact Response of GFRP Composites

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### ABSTRACT

The ballistic resistance of GFRP composite against a projectile with a 4.76mm diameter and a flat nose was examined in the current work. Three-dimensional nonlinear finite element analysis using the LS DYNA code was used to replicate the impact testing. It has been found that the numerical results, such as residual and ballistic limit velocity, closely resemble the test results reported in the literature. With altering target thickness, it has also been explored how the projectile's residual velocity, ballistic limit velocity, energy absorption capacity, and failure of the composite all relate. The numerical results make it evident that the target thicknesses have a significant impact on the target's ballistic resistance.

**Keywords:** High-velocity impact; GFRP Composites; Target thickness; Finite element method.

**OP-MB-436**

## Implementation of Proper Hardening Method and Hardness Range (35-40 HRC) For Tool Holder Sleeve in CNC Turning Machine

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### ABSTRACT

Hardening is a one of the important heat treatment process. Most of the machinery related components or parts must be hardened, because usages of those parts are regular. Likewise, various hardening process are available to harden the different kind of materials. Every hardening process is unique. It requires proper material; temperature etc., all machine shop which have a CNC turning machine must use the sleeve to hold the toolbars. This sleeve also is hardened. It will be in proper hardness. Most of the quality sleeve has a high price. Low price sleeve can't able to withstand minor accidents occur in machine. Hardening has a vital role in the sleeve. Aim of this particular project is to manufacture a quality steel for a moderate price with good hardening process (Good quality). Font size: Times New Roman -11 points, 1.5 line spacing.

**Keywords:** hardening, sleeve, hardness.

**PP-MB-113**

## Investigation corrosion and wear behavior of Al - SiC composite

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### ABSTRACT

The present study focusses at evaluating the mechanical properties of piston ring for vehicle by changing the existing metal with non-ferrous material (i.e.) Aluminium in the presence of silicon carbide and its different combinations coated with silicon dioxide or tungsten dioxide. The compositions were added up to the required level and stir casting method was used for the development of Aluminium metal matrix composites. Structural characterizations were carried out on metal matrix a composite by mechanical testing was used for the micro structural studies. The mechanical properties of metal matrix composites like tensile strength, impact tests and flexural test were carried out. In the presence of silicon dioxide Aluminium matrix, it was fairly observed that the densities of the composites were decreased and the hardness was increased. Correspondingly, the decrease in tensile strength was observed with decrease in addition of reinforcement. The aluminium-SiO<sub>2</sub> metal matrix composites extremely differed in all of the properties measured. The SEM analysis also carried out of the Material Morphology.

**Keywords:** Corrosion surface, salt spray test, wear test, hybrid mmc.

**PP-MB-132**

## Mechanical and Absorption Properties of Pineapple Leaf Fibre Reinforced with Dates Seed Powder in High Performance Epoxy Polymer Composites

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### ABSTRACT

This work focuses on the study of Pineapple fiber reinforced composites based on natural fibers, while taking into account the eco-friendly nature of the materials and their unique properties. These pineapple fibre materials are a type of material that is stronger, lighter, and less expensive than traditional materials due to their strength, lightness, and affordability. As a reinforcement material for polymeric composites for use in technical applications, natural fibres have been an important research subject for scientists in recent years. Natural fibres boast the advantage of continuous supply, easy-to-handle, and biodegradable nature which makes them a good choice. As a result of their low cost, low density, hardness, greater tolerance for harsh weather conditions, good thermal and mechanical performance, and

environmental friendliness, natural fibre has grown in popularity worldwide. It is estimated that thousands of tons of different crops are produced every year, but most of the waste produced by these crops is not used for any purpose. It is commonly known that agricultural wastes include pineapple leaves, dates seeds, and shells from a variety of dry fruits. The wastages of pineapple leaves (PALF) and date seeds (DS) are combined in this work. A number of promising applications are being investigated, such as the use of metal as an alternative to the building of automobile bodies.

**Keywords:** Pineapple Leaf (PALF); Date Seed (DS); Epoxy Resin; Mechanical properties.

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**PP-MB-134**

## **Mechanical and Absorption Properties of Banana Fibre and Rice Husk Reinforced High Performance Epoxy Polymer Composite for Particle Board Applications**

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### **ABSTRACT**

The purpose of this study is to examine banana fibre reinforced with rice husk-reinforced high-performance epoxy polymer composites, especially for particle board applications. Considering the fact that this banana fibre is available and sustainable, it is considered one of the best options when it comes to natural fibres. There is no doubt that banana fibre materials are one of the strongest, lightest, and most affordable materials that exist because of their strength, lightness, and affordability, in comparison to traditional materials. During the past few years, natural fibres have been gaining a lot of attention from scientists as a reinforcement material for polymeric composites in order to use them in technical applications. This makes natural fibres a very good choice due to their continuous supply, ease of handling, and biodegradable nature, all of which are great advantages. In comparison to existing particle boards that are available on the market, banana fibre composite boards have achieved high hardness strength. In accordance with ASTM standards, hardness strength and absorption tests are performed according to the specified parameters. Based on the hardness strength of banana composites, 95 shore D hardness values were obtained. The absorption studies show that the banana composite increases the absorption level up to 15 to 30% depending upon the reinforcement. It has been found that metal is capable of being used in a number of promising applications, such as building automobile bodies out of metal as an alternative to wood.

**Keywords:** Banana fibre; Rice husk; Epoxy Resin; Mechanical properties; Absorption Studies.

PP-MB-150

## Evaluation of Mechanical and Ultrasonic Properties of NbN Thin Layers by NDT Method

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### ABSTRACT

In the present paper, we have calculated the elastic, mechanical and thermophysical properties of NbN/MgO (001) layers in the temperature range of 600-900 °C using higher order elastic constants. With two fundamental factors, nearest-neighbour distance as well as hardness parameter, in this temperature range, the second and third order elastic constants (SOECs and TOECs) are estimated using the Coulomb & Born-Mayer potential approaches. The computed values of SOECs have been used to calculate Young's modulus, thermal conductivity, Zener anisotropy, bulk modulus, thermal energy density, shear modulus as well as Poisson's ratio in order to assess the thermal and mechanical properties of NbN/MgO (001) layers. Additionally, the SOECs are used to calculate the wave velocities for shear as well as longitudinally modes of propagation along crystalline orientations  $\langle 100 \rangle$ ,  $\langle 110 \rangle$ , &  $\langle 111 \rangle$  in these temperature range. Temperature dependent Debye average velocity, hardness, melting temperature and ultrasonic Grüneisen parameters (UGPs) have been evaluated. The fracture/toughness (B/G) ratio in the current investigation is more than 1.75, indicating that the NbN/MgO (001) nanostructured layer is ductile in nature in this temperature range. The selected materials fully satisfy the Born mechanical stability requirement. In this ambient temperature, it has been computed how long thermal relaxation takes to complete as well as how ultrasonic waves are attenuated by thermo-elastic relaxation as well as phonon-phonon interaction mechanisms. For industrial applications, the findings with other well-known physical features are helpful.

**Keywords:** Thin layers, Elastic properties, Thermal conductivity, Ultrasonic properties.

PP-MB-151

## Drilling Simulation Using DEFORM-3D on UNS31603-Steel and Parametric Optimization by Integrated MOORA Coupled PCA

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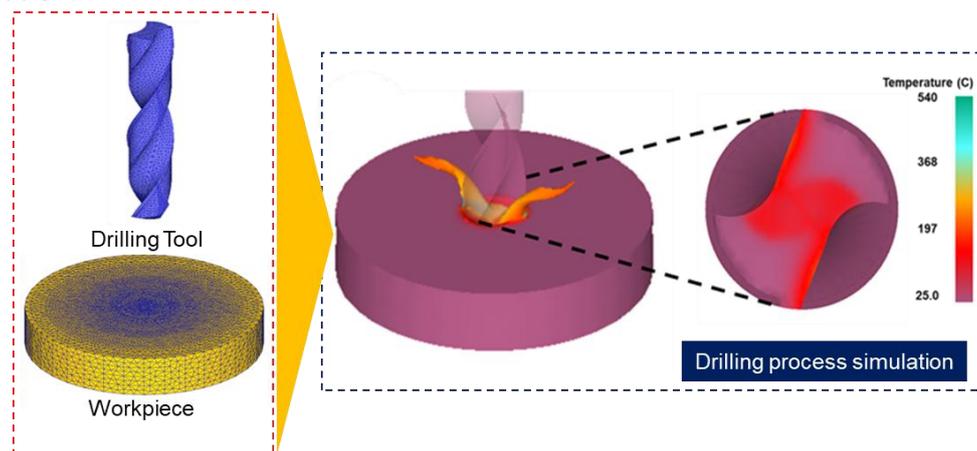
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### ABSTRACT

Due to its creep and stress-rupture strengths, superior formability, and high temperature tensile, UNS S31603 alloys are regarded as a good machinability material. As a result of the increased heat and thrust force generated by the cutting process, increased tool wear and damage are an inevitable byproduct of increased cutting speed and feed rate at the cutting edge. Drilling parameters are the only variable that can be changed to affect the temperature, and hence the wear and tear on the drill bit. In this inquiry, a 3D FEM has been proposed to study the drilling process simulation of UNS S31603 to reduce the material and time cost of machining. With DEFORM, a computer simulation model has been run to examine temperature changes as a function of cutting speed and feed rate. This study found that raising either the feed rate or the cutting speed resulted in a corresponding rise in temperature. With the aid of the novel optimization approach, integrated MOORA coupled PCA, the input process variables have been optimized. At long last, optimal findings have been obtained that can assist cut down on the excessive development of heat, thrust force, and drilling time.

**Keywords:** DEFORM 3D, Thrust force, Drill point angle, MOORA-PCA, Temperature, Optimization.



**Fig.1:** Drilling Process Simulation using DEFORM 3D FEM

**PP-MB-158**

## Experimental Investigation of Titanium dioxide Nanopowder In Vapour Compression Refrigeration System

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### ABSTRACT

In this research, 0 to 0.6 g/L of titanium dioxide nanoparticles were diffused in compressor oil with 70 gm of R600a refrigerant. Titanium dioxide is employed to improve R600a refrigeration system performance, cooling effect, and compressor power consumption. R600a system was employed in the study and is better than the pure mineral oil refrigeration system. The R600a system with titanium dioxide nanoparticles in its compressor lubricating oil improved performance by 29%, increasing cooling capacity from 136 to 180 W and decreasing compressor power consumption from 146 to 115 W. Refrigeration using nanolubricants was found to be safer and more efficient than conventional refrigeration. The results obtained using nanoparticles are predicted using the fuzzy logic optimization technique.

**Keywords:** Titanium dioxide, Refrigeration effect, R600a.

**PP-MB-159**

## Impact of MWCNT On Coefficient of Performance in Vapour Compression Refrigeration System

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### ABSTRACT

In this study multi-walled carbon nanotube dispersed in compressor lubricating oil at quantities from 0 to 0.6 g/L and 70g of R600a refrigerant. R600a system was involved in the analysis and is better than pure mineral refrigeration. There is a significant increase in performance and cooling effect by using less amount of energy. When compared to a normal refrigeration system R600a with MWCNT resulted in an enhanced coefficient of performance by 28% and the refrigeration effect improved by 25% and a reduction in the energy utilized by the system by 20%. This system will be a better alternative to the normal refrigerator. The experimental results obtained using carbon nanotubes are predicted using the fuzzy logic optimization technique.

**Keywords:** Multiwalled carbon nanotube, Refrigeration effect, R600a.

**PP-MB-160**

## Performance enhancement of r600a refrigeration system suspended with cerium oxide nanoparticle

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### ABSTRACT

In this research, cerium oxide nanoparticles are dispersed in the R600a refrigeration system at various quantities ranging from 0 to 0.6g/L. As a result, factors such as cooling impact, system performance, and energy consumption are all improved. It was shown that R600a refrigeration may be employed as a better option than pure mineral refrigeration in the investigation. Cerium oxide was added to the R600a, which resulted in a 24 per cent increase in performance and a 20 per cent decrease in compressor energy consumption. There's a comparison between the results of nanoparticles and conventional refrigeration systems.

**Keywords:** Cerium oxide, Cooling effect, R600a.

**PP-MB-161**

## Pressure dependent mechanical and thermo-physical properties of the Laves phase compound

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### ABSTRACT

The Lennard-Jones potential has been used to systematically investigate the elastic, mechanical and thermodynamic properties of Laves phase Fe<sub>2</sub>Hf compound. Using the potential model, it is observed that the higher order (second and third order) elastic coefficients of the Fe<sub>2</sub>Hf compound increase monotonically with pressure. The mechanical properties (elastic stiffness constants, linear compressibility constants, melting point, micro hardness parameter (H), Poisson's ratio and Kleinman parameter (ξ)) and thermodynamic properties of the leaves phase Fe<sub>2</sub>Hf compound have been examined in the current study using elastic constants. It is established to they all increase monotonically with the increasing pressure. The computation results have been also satisfactory in estimating the Debye temperature and thermal conductivity (kmin) under various pressures. The thermal conductivity of Fe<sub>2</sub>Hf gradually increases as pressure increase. The pressure dependent ultrasonic velocities, attenuation of this Fe<sub>2</sub>Hf compound have evaluated. This Laves phase Fe<sub>2</sub>Hf compound behaves as its purest form at higher pressure and is further ductile verified by the minimum attenuation.

**Keywords:** Elastic properties; Laves phase compound; Mechanical properties; Thermal conductivity; Ultrasonic properties.

**PP-MB-169**

## Effect of presence of holes locations and size on spring back in u bent components

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### ABSTRACT

The automotive industry is widely using the forming processes. Spring back is a significant issue associated with forming processes. Spring back is caused because of elastic stresses present in bent areas. These residual elastic stresses try to get relieved when the punch is retracted and cause the movement of the formed-up parts called spring back. In this paper, the effect of holes on sheet metal components (such as base, corner, and sidewall of the U shape component) and the spring back is investigated. The results obtained by finite element analysis (FEA) are compared with the experimental results.

Further, the size of the hole in the base wall of the U shape component on the spring back is studied. For all locations of holes, i.e., the hole in the base wall, corner, and sidewall, a decrease in the spring back is observed. It was found that the presence of a hole in the side wall shows a maximum decrease in spring back. Also, with an increase in the size of the hole, decrease in spring back is observed.

**Keywords:** Forming; spring back; FEA; Hole in component; hole location.

**PP-MB-174**

## Efficiency enhancement of variable compression ratio engine performance using prunus domestica methyl ester

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### ABSTRACT

This study is to find the Brake Thermal Efficiency (BTE), Specific Fuel Consumption (SFC) and to reduce emissions by operating the Variable Compression Ratio Engine using PRUNUS DOMESTICA METHYL ESTER as a biodiesel. Extraction and Transesterification process is done with PRUNUS DOMESTICA to get Methyl Ester and the Methyl Ester is mixed with diesel to prepare biodiesel with proper composition. 100% of biofuel cannot be used in the engine, since the investment on the biofuel will be higher. So, the biofuel is mixed with a pure diesel to get a biodiesel blend. Therefore, four samples are prepared with a proper ratio i.e., 90% of diesel and 10% of biofuel, 80% of diesel and 20% of biofuel, 70% of diesel and 30% of biofuel & 60% of diesel and 40% of biofuel. All the samples are tested in the Variable Compression Ratio Engine. The Specific Fuel Consumption (SFC), Brake Thermal Efficiency (BTE) and the emission characteristics from the Variable Compression Ratio Engine is noted as graph and compared to get a better result of the engine's performance using PRUNUS DOMESTICA METHYL ESTER as a biodiesel.

**Keywords:** Variable Compression Ratio Engine, Prunus Domestica, Prunus Domestica Methyl Ester, Biofuel, Diesel, Biodiesel, Brake Thermal Efficiency (BTE), Specific Fuel Consumption (SFC), Emission, Brake Power (BP).

**PP-MB-192**

## Low-Velocity Impact Behavior and Mechanical Characteristics of Basalt/Glass Hybrid Composites with Graphene Filler for Enhancing Aircraft Nose Tip

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### ABSTRACT

The growing need for eco-friendly, reliable, lightweight yet rigid materials for aircraft structures served as the inspiration for this work. the intention of this research is to examine the effects of a hybrid composite made of basalt/ glass fiber with graphene, on the low energy drop weight impact test. In this work, four main methods are used, which encompass the

fabrication of composites, low-velocity impact testing, methods for evaluating impacted composites using ultrasound nondestructive testing, and a study of damage morphology through a scanning electron microscope. In this paper, glass fiber combined with natural basalt fiber and graphene nanoparticles is manufactured to develop a more appealing hybrid composite for aviation industries. Twelve samples of hybrid composite, each varying with 1% and 2% graphene weight ratio with the fibers are used. eight outer layers made of glass fiber and two inner layers of basalt fiber composites are prepared using hand layup and compression molding method. Different impact energy levels ranging from 5J to 25J are applied to study the propagation of impact in the composite. The impact response and impact damage of the tested specimens are affected by the mechanical characteristics and quantity of fabricated plies for the glass/basalt with 1% and 2% of graphene.

**Keywords:** glass fiber reinforced polymer, natural fiber, drop-impact behavior, nanoparticle, NDT, mechanical property.

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**PP-MB-195**

## Utilization of Cathode Ray Tube as an Abrasive Particles in AJM

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### ABSTRACT

The growth of the electronic industries have developed in recent decades to make more electronic items as the demands increases which lead to disposal of non-bio degradable waste. This causes environmental pollution and harmful effect to human being and animals. In this project, the abrasive particles used in the abrasive jet machining process are made from repurposed e-waste. For this idea, the flow analyses of nozzle are finding from the research on various published papers. Based on research the nozzle is fabricated. Further, the e-waste like CRT and using sieving and segregated methods, monitors are gathered and reformed into abrasive particles. The mixing chamber is constructed, and the abrasive particles and dry air are mixed inside. Then, through the outlet opening, the mixed particles are forced to flow out into the working chamber. As a result, in the abrasive jet machining process, a targeted stream of abrasive particles is accelerated through a nozzle at a high velocity stream to machine the glass materials. Furthermore, the abrasive particle performance parameters of the abrasive jet machining process are assessed.

**Keywords:** Abrasive particles; e-waste; Cathode ray tube; Nozzle; Coordinate measuring.

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**PP-MB-196**

## Automatic Detection of defects in Welding using Deep Learning - A Systematic Review

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### ABSTRACT

The large number of research studies on defect detection and classification using Deep Learning implies the demand for AI in industrial automation systems. Welding is one of the crucial processes used in various industries with diverse applications, and one of the challenges faced in welding automation is the Defect identification using Non-Destructive Testing. This paper aims to provide a systematic review on the application of defect detection in Tungsten Inert Gas Welding using Computer Vision. This study analyses and compares the existing methodologies used in the earlier days and what is being used now. In addition, we also discuss how Convolution Neural Network (CNN), a deep learning technique can solve the problems faced by traditional machine vision and how the Vision Transformers can be incorporated to get the better results.

**Keywords:** Welding; Deep Learning; CNN; ViT, Automation; TIG; Computer Vision; AI.

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**PP-MB-202**

## Study of mechanical and thermal behaviour of silicon and carbon/magnetic nanocomposites

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### ABSTRACT

Silicon rubber is mainly used for electromagnetic interference (EMI) shielding application. Silicon rubber is required to improve its mechanical and thermal properties in order to withstand high thermomechanical thermal load. Thus, the present study is aimed to improve the mechanical and thermal properties of silicon rubber by adding carbon and magnetite nanoparticles with various concentrations such as 50% magnetite nanoparticles and 25% magnetite and 25% carbon nanoparticles. Hydraulic press method was used to prepare the nanocomposite sheets. Mechanical properties such as tensile strength, tear strength, hardness etc were examined. Results shows carbon incorporated silicon sheet had better mechanical properties than that of silicon rubber. Electromagnetic properties of the nanocomposite sheets were studied. The result shows that the sheet having 50% magnetite nanoparticles had good magnetic properties (Retentivity and coercivity) when compared with the silicone sheet having 25% magnetite and 25% carbon Nanoparticles. The VSM analysis shows that for only magnetite nanoparticles added silicone sheets the retentivity and coercivity increases which shows good magnetite nature even in the absence of magnetic field. The carbon and magnetite nanoparticles added silicone sheets also shows good retentivity and coercivity, but it is comparatively lesser than the magnetite added silicone sheet.

**Keywords:** Mechanical Properties, Thermal Properties, Silicon Rubber, Carbon Nanoparticles, Magnetic Nanoparticles.

PP-MB-213

## Distinctive Study on Banana/Sisal Fiber Hybrid Composites Filled with Nano Marble Dust Particles

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### ABSTRACT

The increased popularity of synthetic fibers has been stymied by high production costs and environmental concerns, despite the former's superior stiffness and strength. As a result, it's reasonable to consider devoting considerable effort to finding natural fibres that can replace synthetic ones in a variety of applications. Because they have superior mechanical and thermal qualities over synthetic fibres, hybrid fibres are typically preferred. Natural fibres have the advantage of being more ductile and robust, but they cannot repel water. Through a variety of processes, including as chemical, physical, laser, thermal etc., the surface properties of fibres are enhanced with stronger interfacial bonding. Another advantage of introducing nano particles to composites is that it helps to improve cross-linking in the attachment of the matrix as well as fibre. Short mercerized banana and sisal fibres are combined via injection moulding with a polypropylene matrix to generate a hybrid that is packed with Nano marble dust particles. The composites' flexural strength, impact strength, thermal conductivity, and water absorption are vastly enhanced by the addition of Nano marble dust particles as filler material. It is noticed that banana and sisal fiber added composite contributed the better tensile properties than Nano marble dust particles added composites.

**Keywords:** Nano marble dust particles, banana fiber, sisal fiber, polypropylene, injection moulding, hybrid composites.

**PP-MB-222**

## Stress analysis of projectile 155mm ERFB BT

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### ABSTRACT

The stress analysis of 155 mm High Explosive Extended Range Full Bore Boat Tail projectile, the artillery ammunition subjected to propellant pressure inside the gun barrel by an analytical method is a complex exercise because the physical parameters of the projectile - the wall thickness and the external profile of the shell vary along the length. However, the analytical analysis is simplified by assuming the shell as a thick wall cylinder. Lamè's theory is applied to study the tangential, radial, and longitudinal stresses induced in the shell body. The work aims to check if the shell body filled with the explosive yields against the propelling charge pressure inside the gun barrel. In this study, numerical and analytical analyses are presented taking into account the static loading. The stress analysis of 155mm HE ERFB BT projectile using finite element analysis capabilities of the computer-aided software SOLIDWORKS reveals the nature of stress distribution in the shell body and boat tail. Numerical modeling has included a comprehensive mesh convergence study of the projectile. The von Mises stresses induced in the shell body and boat tail are within the limit of the yield strength of the shell. The results obtained are useful to support the failure analysis of the projectile from the point of view of the material strength of the shell assembly.

**Keywords:** Stress analysis; 155mm HE ERFB BT; Lamè theory; Static loading; von Mises stress; Failure analysis.

**PP-MB-229**

## Study on the mechanical behaviour of Metal Matrix Composites (MMC)

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### ABSTRACT

Materials having metals as the base and separate, usually ceramic phases, added as reinforcements to improve the characteristics are known as metal matrix composites. whiskers and particles are examples of possible reinforcements. By changing the type of ingredients

and their volume percent, metal matrix composite properties can be adjusted. They provide a superior mix of qualities that no monolithic material currently in use can match, and as a result, the aerospace and automotive industries are using them more frequently. MMCs' main advantage over other materials is their increased strength and hardness per unit weight.

**Keywords:** MMC, alloy, mechanical properties, aluminium matrix composite, Al<sub>2</sub>O<sub>3</sub>.

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**PP-MB-235**

## Investigation of Aluminum Alloy 6061 in Wire-EDM regarding surface roughness & material removal rate by adopting optimization techniques

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### ABSTRACT

Wire-electric discharge machining (WEDM) offers a number of benefits in comparison to traditional manufacturing process likewise, no obvious mechanical cutting trace also hard and rigid materials can be processed perfectly in WEDM. Since, aluminum alloys are used in aerospace, shipbuilding, breathing gas cylinder for scuba diving, surgical components and automotive industry for high strength to weight ratio, accurate shapes and dimensions. Through this method, complicated structures made of aluminum alloy are produced in a single setup with incredibly tight tolerances. The present investigation explores WEDM by varying different process variable of AA6061 performance measures in terms of MRR and SR. The Taguchi L18 OA matrix, S/N ratio, ANOVA and GRA were employed to study SR and MRR in WEDM. It has noted that pulse on time and peak current are the utmost influential aspect for SR and MRR. Further, the best possible considered parameters setting has been established by applying GRA for outcomes.

**Keywords:** WEDM; AA6061; Taguchi Method; GRA; SR and MRR.

**PP-MB-236**

## Laser Ignition System by Using Composite Ceramics for Combustion Engine

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### ABSTRACT

Different lasers have a wide range of expanding scientific, engineering, and medical applications. The basic principles, operation, and applications of lasers for fuel ignition are succinctly reviewed in this article. The goal is to outline the current significance of lasers for fuel ignition and to talk about how they operate in combustion engines as well as their uses, benefits, and drawbacks. In essence, there are four ways that laser light might start an ignition event. They are also known as photochemical ignition, resonant breakdown, thermal initiation, and non-resonant breakdown. The non-resonant initiation of combustion technique is currently the most widely used method because of its ease of usage and freedom in choosing the laser wavelength. In many ignition systems, lasers can be used in place of conventional spark plugs. We are confident that internal combustion engines will keep powering our cars. Improvements in combustion and treatment are required to reduce pollution and the environmental impact of the continuous use of IC engine vehicles as the worldwide mobility of products and people continues. The concept of the ignition process can be altered by the laser ignition system. When compared to a normal ignition system, it has many benefits.

**PP-MB-237**

## Study on surface roughness & material removal rate in vertical milling of EN8 and EN31 steels by Taguchi's and GRA techniques

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### ABSTRACT

The optimum machining parameters of milling operations are of great concern with manufacturing environment. The aim of the work is to relate the comparison of the surface roughness & material removal rate for EN8 and EN31 steel alloys. In these, EN8 are used for moderately stressed parts of motor vehicles while EN31 are used for components that are subjected to severe abrasion, wear or high surface loading due to its high resisting nature against wear. The experiments have conducted on vertical milling machine using carbide tool. This investigation deals with the optimization of the milling parameters by using Taguchi's optimization and GRA techniques to select the best combination of input parameters towards

maximum material removal rate and minimum surface roughness for these materials. These milling input parameters as spindle speed, feed rate and depth of cut were optimized for the outcomes by utilizing Taguchi's L9 orthogonal array, signal to noise ratios and analysis of variance. The analysis revealed that the spindle speed is the dominant factor affecting surface roughness and MRR. Further, the optimum level of process parameters for attaining optimal values of outcomes by employing GRA.

**Keywords:** Taguchi methodology; S/N ratio; ANOVA; MRR; surface roughness; EN8 and EN31 steel.

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**PP-MB-250**

## Lightweight material for weight reductions in an automotive suspension part lower link

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### ABSTRACT

In the automotive world, the function of the suspension system is to absorb vibrations due to rough terrains or road disturbances and to provide stability under circumstances like accelerating, cornering, uneven road, braking, loading and unloading etc. A control arm is one of the most important parts of the suspension system, as it joins the steering knuckle to the vehicle frame. Also, the suspension arm is responsible for the up and down movement of wheels when hitting bumps. It is also designed to maximize the friction between tire contacts, and patch the road surface to provide vehicle stability under any circumstances. It can be seen in many types of the suspensions like wishbone or double wishbone suspensions. Many times, it is also called an A-type control arm. In this work, looking for a weight reduction study based on the Steel material (various yield), Aluminum and Thickness iteration based on Steel material.

**Keywords:** Suspension system, Shock absorber, FEA, aluminium alloys, Boundary conditions.

**PP-MB-251**

## Experimental investigation and analysis of copper nano material as catalyst for reduction of NOx gases in diesel engine

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### ABSTRACT

The reduction of NOx gases in diesel engine using copper catalyst is used to reduce the emission & greenhouse gases from the engine exhaust and it will reduce the NOx emission completely during the combustion it will also increase the efficiency of the engine. The main aim of our project is to reduce the engine emissions like NOx, smoke and particulates etc. In our project work we have fixed the COPPER Powder material in the exhaust of the engine. During the combustion process the air filter absorbs the air from the atmosphere and sends it to the engine cylinder. The purpose of air filter is to absorb the impurities from the atmospheric air and sends only oxygen & other gasses to the engine cylinder. Due to this the combustion process takes place completely. And also, further reduces the engine emission. And thereby combustion takes place efficiently. We can further recycle the copper for reuse, at that time the copper was heated in a certain stage, at that stage the absorbed nitrogen can be liberated, this nitrogen can be used for the production of NH<sub>3</sub>, which is used as the main component in fertilizer preparation.

**Keywords:** C Engine, Emission, Performance, NOx, Nano Additives.

**PP-MB-253**

## Application of Distinct Multi Criteria Decision Analysis Techniques in the Manufacturing Sector: A Comprehensive Review

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### ABSTRACT

Multi-criteria decision making (MCDM) or multi-criteria decision analysis (MCDA) have been utilized by a variety of researchers beginning in the early 1970s with the goal of improving decision-making in the field manufacturing industry. MCDM stands for multiple criteria decision making, and it is an operational research method that also incorporates software. This method assists in decision making by assessing numerous contradicting criteria or

objectives all at once. The MCDM approaches have evolved throughout the course of the years, and as a result, several new ways have been developed. This review article performs a literature survey of various optimization techniques that are utilized to select the best possible option among various options in various criteria such as selection of supplier, selection of best raw material and optimization of machining parameters in manufacturing processes. The analysis of a number of approaches that was carried out in the study enables a specific approach to be chosen that is appropriate for the circumstance.

**Keywords:** Analytical hierarchy process; Weighted product model; MCDM; Operation research.

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**PP-MB-264**

## Non-destructive testing using thermography – A review

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### ABSTRACT

Defects such as blowholes, pinholes, swell, metal penetration, hot tears, shrinkage cavity, lack of penetration, slag inclusion, wash and cuts, lack of fusion etc. are the common defects observed during manufacturing process. In order to identify these defects, destructive type testing were being carried out in general which may cause an irreversible change to the material under inspection in terms of its physical characteristics. To avoid these irreversible changes Non-Destructive testing methods were introduced. There are different types of conventional NDT methods that are being widely used such as visual testing and penetrant testing. Even though there are various NDT testing developed and used for finding defects, there are limitations like detecting interior void, micro crack cannot be observed. Surface finish and ferromagnetic property of the material can also affect the inspection sensitivity. In order to overcome this issues Infrared thermography (IRT) is proposed, which can detect defects using thermal radiations. In this IRT technique the amount of radiation released by the object rises with temperature, allowing it to detect temperature changes. IRT technique is used in other applications such as inspection of bonding in composite materials and to diagnose breast cancer, fever screening, brain imaging, cardiology, peripheral vascular diseases etc. This paper compiles different thermographic testing methods that are being used in order to identify defects in various kinds of materials.

**Keywords:** Non-Destructive Testing; Thermography; Concealed defects; Radiography; Infrared.

**PP-MB-266**

## Study and analysis of structural steel swaybar by using linear and nonlinear regression technique

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### ABSTRACT

The main objective of this project is to find out the effect of a change in swaybar stiffness and the stress developed if the clamping distance of the anti-roll bar is changed. The effect of a sway bar on the rear suspension can only have an adverse effect on vehicle handling. These installations should be tested under severe cornering conditions to ensure the desired handling characteristics of a vehicle. The analysis has been done by using Beta CAE ANSA, MSC NASTRAN, and Beta CAE META POST software applications for Generative Structure Analysis. This analysis is done on the basis of constant displacement but in the opposite direction since the main motive of the sway bar is achieved by twisting it. After gathering the engineering data, the prediction of bushing distance for the respective stiffness of the bar is calculated using a linear regression technique. In this study, our main aim is to observe the stiffness behaviour with respect to bushing position and predict the bushing distance for a target stiffness using a linear regression table.

**PP-MB-268**

## Applications of Lasers in Industries and Laser Welding: A Review

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### ABSTRACT

Laser can be focused up to 1/1000 of a millimetre. Laser machining is clean, and free from post-machining burrs. Laser technologies are highly effective and efficient in industries which has created a massive impact in manufacturing. Laser is versatile, it can be performed efficiently on a large range of materials, high precision, speed, and quality of laser machining are a few advantages of this technology. The involvement of Laser in industrial activities has been a paradigm-shifting technological advancement in the field of engineering. Lasers are used in Industries for applications like cutting metals and fabrics, cleaning metallic surfaces, altering the surface roughness, measuring dimensions, and also to weld metals with high precision. Laser welding is predominantly used in automobile and aeronautical industries which would require engineering works to be carried out with high precision. The

compatibility of this technology makes it extremely convenient to incorporate into industrial lines. This review paper compiles the impact of various laser sources, industrial applications of laser on industries over conventional methods. It also summarizes the Laser Welding being used in the industries for précised manufacturing.

**Keywords:** Laser; Welding; Micromachining; CO<sub>2</sub> Laser; Nd: YAG.

**PP-MB-274**

## Design Optimization of Display Unit Cabin

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### ABSTRACT

The objective of this research was to develop an optimization technique that can be used to optimize the present design of display unit cabinet at supermarket. The technique can be applied to both continuous and discrete values of design variables. Large number of design variables can be also considered. In order to meet the objective, an optimization procedure was developed by coupling the finite element analysis (FEA) to the orthogonal array experimentation technique, because FEA is a common analysis tool for engineers. Following optimization were performed namely topology, topography and size optimization to come with a combined optimized design for reduction in material weight and cost. The goal is not necessarily to get the actual optimum value, assuming that one exists, but to develop a more practical approach that will achieve a result close to the optimum with reasonable effort. A fixed structured grid with a linear approximation for the interface within each element is used. Linear material is considered for the optimization technique with no usage of any contact related non-linearities. The optimization program checks the design and updates the model until it converges on a best solution to meet the optimal characteristics and design criteria.

**Keywords:** FEA, Topology, Topography, Design Variable, Objective, Constraint.



**Fig.1:** Display Unit Cabinet.

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**PP-MB-275**

## Design and Optimization of Aluminium Alloy Wheel Rim in Automobile Industry

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### ABSTRACT

The unsprung mass of a vehicle is an essential parameter for considering the effective handling of a vehicle. The higher the reduction in the unsprung mass, the higher the handling of the vehicle can be obtained. In this project, the wheel rim is considered for optimization. In order to reduce the unsprung mass of the vehicle and to assess the steerability of the vehicle, the wheel rim is designed using SolidWorks and the analysis is carried out using Ansys workbench academic 2021. The material used for analysis is aluminium alloy Al6061-T4 and the magnesium alloy is AZ80. The parameters such as the pitch circle diameter, lug nut pattern, and the thickness of the rim are considered parameters for design. The existing design is being studied and optimized to get a weight reduction of nearly 58.33 % without any compromise on the safety parameters of the rim. The rim is a cylindrical wheel outer edge holding the tire on the wheel. The main function of the rim is supporting and sealing the tire to the wheel. The rim ensures proper fitting between the tire and rim and retains the air inside the tubeless tire.

**PP-MB-276**

## Effect of Lubricant on Machining Characteristics of Duplex Stainless Steel

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### ABSTRACT

Turning operation is one of the most commonly used machining processes. However, turning of high-strength materials involves high heat generation which in turn results in undesirable characteristics such as increased tool wear, irregular chip formation, and minor variations in physical properties. In order to overcome these, synthetic coolants are used and they are supplied in excess quantities. The handling and disposal of excess coolants are tedious and relatively expensive. In this proposed work, Water Soluble Cutting Oil suspended with

nanoparticles is used in comparatively fewer quantities by using the Minimum quantity lubrication method to improve the quality of machining. The study is done based on Temperature, Cutting Force, Chip Morphology and Surface Roughness.

**Keywords:** Lubricant, cutting force, surface roughness, cutting fluid, temperature.

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**PP-MB-281**

## Plastic design and strength on Automotive Hard trims Doghouse

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### ABSTRACT

Trims are the plastic parts installed on the inside and outside of a car. The interior trims are usually used for giving the aesthetic look to the interior of the car. There are various types of trims used in automobiles. Functionality and aesthetically pleasing trim applications are crucial factors for a perfect interior experience and successful vehicle sales. The selection, design, and processing of plastics solutions for interior trim components are very important for consumers when making their purchase decisions. Trim applications require a variety of essential plastic material properties such as protecting the occupant from sharp edges and hard points of the sheet metal and underlying components. In this work, looking for a Strength study on Automotive various hard trim dog houses based on plastic material.

**Keywords:** Automotive trims, Doghouse pulling force, Strength, Abaqus.

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**PP-MB-282**

## A Study of Microstructure and Mechanical Properties of AZ91D/B<sub>4</sub>C/hBN Hybrid Composite Fabricated through Powder Metallurgy

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### ABSTRACT

The current study examines the mechanical and microstructural characteristics of AZ91D/B<sub>4</sub>C (0–12 wt. %) and hBN (5 wt. %) particles. Powder metallurgy was used to fabricate the magnesium composites. To study the microstructure of the alloy and the manufactured

composites through optical microscope, phase analysis was investigated using X-Ray diffraction. The test findings showed that the composite with B<sub>4</sub>C reinforcement had better hardness and compression strength and slight reduction in higher wt. % of (B<sub>4</sub>C/hBN) particles. Through XRD analysis, the (Mg, Mg<sub>17</sub>Al<sub>12</sub>) phases, which are the found as primary and secondary phases with a tiny grain formations and precipitation at the grain boundary.

**Keywords:** Powder metallurgy, Optical Microscope, Mechanical Strength, Magnesium alloy.

### PP-MB-291

## Effect of Non-Thermal Oxygen-DBD Plasma Treatment on reducing the phthalate content and in Improving the Mechanical Strength Properties of Polymethyl Methacrylate Denture Base and Denture Liner Interface

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### ABSTRACT

Phthalates and esters of aromatic carboxylic acids are used as plasticizers in certain denture soft-lining materials and tissue conditioners. The presence of phthalates is of concern, because they may induce undesirable biological effects such as hormonal disorders, reproductive toxicity, hepatocellular tumours, genital disorders owing to a capacity to bind oestrogen receptors. Despite the potential risk posed by phthalates, their use in denture and denture liner is unavoidable due to the lack of efficient substituent material. Varied curing cycles, solvent wash, thermal plasma treatment/curing, etc., are some of the methods used to eliminate the phthalate content. The use of varied curing cycles, thermal plasma curing etc., will harm the polymer matrix of the acrylic denture resulting in further complication of the acrylic-liner interface bond architecture such as increased wettability, formation of pores, formation of gas pockets, micro fractures at the edges, etc. Hence, in order to overcome the above mentioned, curing of the materials under non thermal Oxygen dielectric barrier discharge (NT-O<sub>2</sub>/DBD) plasma is suggested. Sets of research samples prepared and lined with PDMS liners (as per ISO 178) were treated with NT-O<sub>2</sub>/DBD plasma. The treated samples were subjected to mechanical strength tests and calorimetric phthalate leach test. The results indicated that NT-O<sub>2</sub>/DBD plasma reduced the phthalate content remarkably and improved the overall mechanical strength properties when compared to the controls (thermal plasma treated and heat cured samples).

**Keywords:** phthalate; Non-Thermal; Oxygen-DBD; Plasma Treatment; mechanical strength.

PP-MB-306

## Recent Progress in Reinforcement of Nanofillers in Epoxy-based Nanocomposites

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### ABSTRACT

Now a days, nanomaterials have attracted the attentions due to their small size, large surface area, as well as large applications in industrial fields. This review gives detailed information about the epoxy composites and nanofillers to improve their crystallinity, nanostructures and mechanical strengths. Due to the presence of aromatic rings in the structure, epoxy polymer has a high degree of heat and chemical resistance. Epoxy and their composites have large applications in coatings and aircrafts. Since their commercial inception in 1947 by the Devve-Raynolds Company, epoxy has become the most extensively studied, researched thermoset polymer. Most commonly used epoxy resins are bisphenol A and Epoxy Novolac Resins. Epoxy Novolac resins differs from standard DGEBA based epoxy resins primarily in their multifunctionality, which is about 2.5 to 6.0. Epoxy is preferred over other polymer matrix due to its high durability, chemical resistance and high adhesive properties. Currently modified epoxy resins are used in making of natural fibre reinforced composites and different instrumental parts in industries and aircrafts. This review also aims to give emphasis on the recent advancements in epoxy polymer composites and their various strengths with respect to different concentration of nanofillers. As we know that formation of composite is an exothermic process, thus this review also carries the promise to increase the thermal conductivity of the epoxy composite by encapsulating suitable nanofillers with appropriate molecular wt%.

**Keywords:** Thermoset polymer; Epoxy resins; Mechanical strengths; Thermal conductivity.

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**PP-MB-315**

## New Model for Predicting the Tensile Strength of Unidirectional Fiber-Reinforced Composites

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### ABSTRACT

To predict the tensile strength of composite, the Rule of Mixture (ROM) is generally used. ROM is linear function of volume fraction of fibers and tensile strength of both fiber and resin. Tensile strengths obtained by experiments are generally lower than the predicted value of ROM and shows non-linear variation with volume fraction. Modification in ROM is needed for more accurate predictions of tensile properties. In this paper the leading factors that shows deviation from ROM are discussed in detail that are - Fiber breakage, insufficient wetting due to lower capillary pressure, and clustering of fibers with each other. The effective surface area that binds with resin get decreased due to above mentioned factors so not all fibers take load of composite effectively. The ROM is modified by calculating the effective fiber load in composite by taking some theoretical assumption and using some practical data. Some new parameters were introduced such as Fiber Breakage Factor (FBF), Insufficient Wetted Fiber Factor (IWFS) & Clustered Fiber Factor (CFF). All these new parameters have new constant terms that depend upon the manufacturing method and arrangement of fibers in resin. So these constants were calculated using experimental data. Finally, we got modified equation that predicted the tensile properties with more accuracy.

**Keywords:** Rule of the mixture, Tensile strength, fiber-reinforced composites, Volume fraction.

**PP-MB-329**

## Simulation and Optimization of warpage of fiber reinforced using Human Behavior Based Optimization

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### ABSTRACT

Although injection moulding is a popular manufacturing process, Warpage is a major drawback in injection molding which reduces the quality of the materials. Some researches have been carried out to reduce the warpage by the changing the parameter settings. The optimization techniques were applied to the parameter to find the optimized value. The popular method in optimizing the parameter is Genetic Algorithm (GA) and this has the limitation of big stochastic components. The main objective of this research is to propose the Human Behavior Based Optimization (HBBO) in the warpage. This method doesn't have large stochastic and has a fast convergence rate. The orthogonal Array is used to measure the

warpage for the different parameter settings. The fiber reinforced component is used to measure the performance of the proposed method. The Back Propagation Neural Network is used to find the relationship between the warpage and other factors. Then optimization technique is applied to find the parameter value. The experimental result of the proposed method is compared with other existing method in warpage optimization. The HBBO method has the warpage of 0.0858 and the GA method has the warpage of 0.0953.

**Keywords:** Fiber reinforced component, Human Behavior Based Optimization, injection molding, orthogonal Array, and Warpage.

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**PP-MB-341**

## Numerical Study on The Performance of Al<sub>2</sub>O<sub>3</sub> Nano fluids as a Coolant in Pin-Fin Heat sink

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### ABSTRACT

This research presents a numerical simulation of a microchannel pin-fin heat sink with nanofluids as coolants. The nanofluid is made up of pure water and various volume fractions of nanoscale metallic or nonmetallic particles. The effects of different volume fractions, volumetric flow rate, and different nanoparticle materials on the performance of pin-fin heat sink have also been studied. To investigate the conjugate fluid flow and heat transfer phenomena in micro channel heat sinks, a three-dimensional computational fluid dynamics model was developed using the commercial software package FLUENT. The results show that the cooling performance of a microchannel heat sink with water based nanofluid containing Al<sub>2</sub>O<sub>3</sub>/Water (vol 0.25%, 0.50%, 0.75%) is enhanced by about 5.5% compared with micro channel heat sink with pure water. Nanofluids reduce both the thermal resistance and the temperature difference between the top (heated) surface of the pin-fin heat sink and inlet nanofluid compared with that pure water. Because metal nanofluids have a higher thermal conductivity than oxide metal nanofluids, the cooling performance of a micro channel heat sink with metal nanofluids is better than that of a micro channel heat sink with oxide metal nanofluids. Micro channel heat sinks with nanofluids are expected to be promising candidates for next-generation cooling devices for removing extremely high heat fluxes.

**Keywords:** nanofluids; microchannel; heat sink; Al<sub>2</sub>O<sub>3</sub>/water; heat transfer coefficient; and Reynolds number.

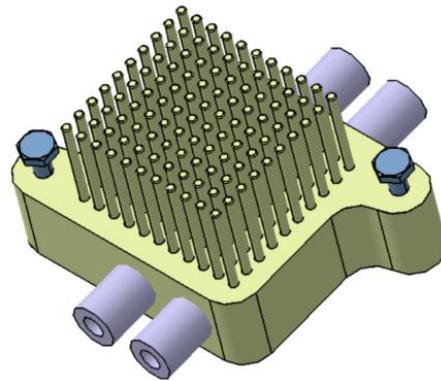


Fig.1: Pin-Fin Heatsink with microchannel

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## PP-MB-349

### Optimization of squeeze casting process parameters for the production of al composite reinforced with bone powder

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#### ABSTRACT

Al6061 alloy is most commonly used in automotive, marine, and aerospace applications to reduce weight and improve the strength of the composite. Al6061 alloy is a precipitation-hardened aluminium alloy used as a matrix material. Beef bone is a bio-waste that has polluted the environment and the people who live in the vicinity of its manufacturing and disposal sites. Bio-waste has been used in a variety of ways by researchers in recent years, including activated carbon, water purification, reinforcement in composites, fillers, and additives etc. Recycled beef bones that had been abandoned as waste were collected, cleaned,

and ground into a fine powder with a particle size of 5–50  $\mu\text{m}$  and used as reinforcement. From the critical literature survey, beef bone has good tensile and compression strength and is light in weight, which helps improve the strength without much increase in cost. The aluminium composite are fabricated through the design of experiment based on Taguchi design then using the squeeze casting process substrates are produced. The aluminium composite was fabricated and nine samples were successfully obtained for further testing and analysis. The prepared substrates are analyzed for hardness and tensile strength. Based on the experimental run the optimized process parameter conditions are found also regression equation is provided for the design.

**Keywords:** Al Composite; Bone Powder; Mechanical; optimization.

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**PP-MB-367**

## Optimum Insulation Thickness in Process Pipelines

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### ABSTRACT

Thermal insulation of pipelines and components are mandatory in aerospace, automotive and process industries where the operating fluid is at high temperatures. Basically, thermal insulation is provided to reduce heat loss from the system, to protect humans from burns and injuries, and to protect nearby components from damage. Different types of thermal insulation materials are available in market with different thermal conductivities. Heat loss from system can be brought to minimum by increasing the insulation thickness and this thickness will be different for different insulation materials for the same pipe diameter and process temperature. Insulation material and the thickness selected should be cost effective also. It is possible to calculate the critical thickness of insulation materials with the help of formula. In this paper heat loss at various process temperatures and various insulation materials for different pipe diameters are estimated and plotted graphically by using software to obtain optimum thickness. Theoretical calculations are further used to find the optimum thickness of insulation with respect to cost and safety. Stainless steel pipe diameters of 1, 2, and 4 inch, and insulation materials of EPS, XPS, and Fiber Glass are selected for the study. The analysis is performed using ANSYS software.

**Keywords:** Thermal insulation; optimal thickness; ANSYS, SST analysis.

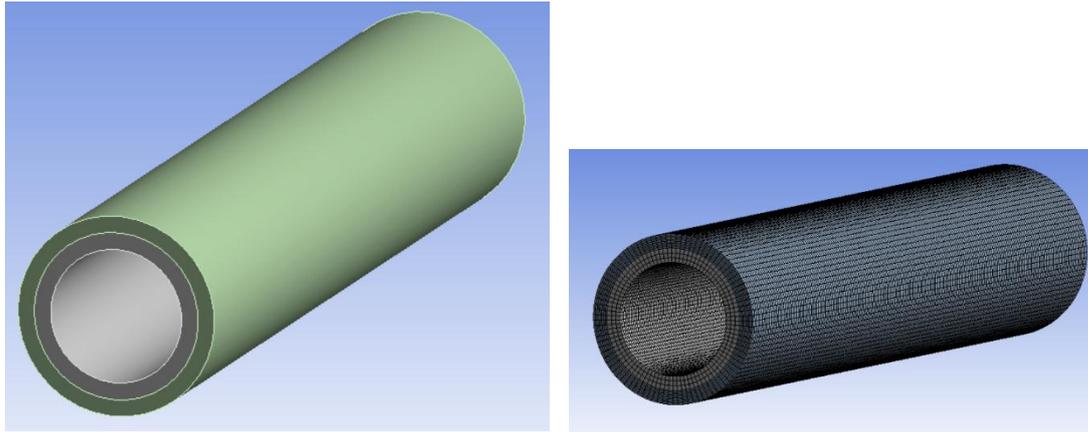


Fig. 1: Geometry imported into Model tab in ANSYS for Case 1. Fig. 2: Mesh generated on geometry for Case 1.

**PP-MB-386**

## Buckling Analysis of Structural Steel Panel with Multiple Configuration of Stiffeners

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### ABSTRACT

In the present paper, the comparative study between stiffened plates with different stiffeners configurations is performed. Initially, the T-shaped, L-shaped and flat stiffener configurations are taken for this study. Then the stiffened plate with each stiffener configuration is designed using ANSYS Design modeller. Structural steel material properties are imported to the model and all sides simply supported loading condition is given for all configuration. The buckling analysis is performed using ANSYS Workbench 2020 R2 for each stiffened plate configurations in order to obtain the load factors. The load factors obtained are compared in order to get the stiffened plate configuration with highest load factor. The obtained results are validated with published literature. As the results obtained from the analysis helped to determine the best configuration of stiffened plate among the other configurations.

**Keywords:** Buckling, Stiffeners, Finite element analysis, Structural steel.

## PP-MB-395

## The effect of temperature on the tribological characteristics of A356/15Wt. % SiC<sub>p</sub> functionally graded composites in unidirectional contact

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### ABSTRACT

In this paper, preparation of A356-15wt.%SiC<sub>p</sub> functionally graded metal matrix composites was done using a vertical centrifugal casting machine and elevated temperature (350°C) tribological characteristics were reported in unidirectional sliding contact. The operating parameter of tribometers were; constant speed of 1 m/s, constant sliding distance of 350 m, and varying loads of 15, 30, and 45 N. The gradient distribution of FGMMC were evaluated using optical microscopy. Hardness values were obtained from the Brinell hardness tester and found to be well correlated with the obtained microstructures. Two types of wear and friction test pins were selected, one taken from the outer zone of the FGM with maximum particle concentration and another taken from the inner zone of the FGM in a matrix-rich region. Wear results showed that the wear rate increases as the load increases for both the test pins. Also, the wear rate of the test pin taken from the matrix rich zone is found to be higher when compared to the test pin from the particle rich zone for all loads. At elevated temperatures, higher values of coefficient of friction are observed in the case of the test pins of the matrix rich zone and lower values of COF are observed in the test pins of the particle rich zone. The SEM images reveal that for test pins obtained from matrix rich portions, adhesion and metal flow are the main wear mechanisms, and for test pins taken from particle rich portions, delamination and severe plastic deformation.

**Keywords:** Functionally graded metal matrix composites, unidirectional wear, coefficient of friction, SiC<sub>p</sub> particles, A356 alloy.

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**PP-MB-399**

## Effect of MWCNTs on Mechanical Properties of Woven GFRP Laminates

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### ABSTRACT

In this experimental work the influence of multiwalled carbon nanotubes (MWCNTs) on the mechanical properties of woven GFRP is presented. Eight-ply laminates of fiber orientation (00 /900) with neat epoxy, 0.5wt.% and 1wt.% MWCNTs modified epoxy GFRP were fabricated by hand layup assisted by vacuum bagging and tested for their tensile, compression, interlaminar shear, in-plane shear and 3-point bend behaviour. The fracture behaviour of the materials varied depending on the loading circumstances. The laminates embedded with MWCNTs has improved the mechanical properties and determined that GFRP modified with 1wt.% of MWCNTs showed better mechanical properties when compared to 0.5wt.% modified GFRP and neat GFRP.

**PP-MB-400**

## Effect of Milled Glass Fiber on Fatigue Behaviour of Basalt Fiber Reinforced Composites

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### ABSTRACT

In the engineering material advancement, research on influence of bio materials in composites plays a major role due to its renewability. In this study, an attempt is made to replace basalt fibre with glass fibre. Milled glass fiber is used as a filler material to enhance the fatigue behaviour of the basalt fiber. Various weight percent of milled glass fiber such as 3wt.% and 5wt.% were used for this study. Tensile test was performed and found that 3wt.% based filler infused Basalt/epoxy composite has improved tensile strength than the 5wt.% based filler Basalt/Epoxy composite. Fatigue test has been performed to study the effect of milled glass fiber on the basalt/epoxy composite materials and results showed that better fatigue life in basalt fiber embedded with 3wt.% milled glass fiber rather than neat basalt/epoxy and 3wt.% based basalt fiber composites.

**Keywords:** Tensile; Fatigue; Milled Glass Fiber; Basalt Fiber.

**PP-MB-402**

## Effect of Stress Ratio on Creep-Fatigue interaction of Woven Angle Ply GFRP Laminates

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### ABSTRACT

During fatigue process, structural changes has been observed in the material which is due to change in fatigue stiffness, dissipated energy and cyclic creep. Cyclic stress and cyclic strain can be represented in the form of stress-strain hysteresis loop. Hysteresis loops will shift during load-controlled fatigue loading which indicates the presence of creep. In this study, effect of stress ratio on creep-fatigue behaviour of woven angle ply glass fiber reinforced polymer (GFRP) has been investigated. The test specimens were fabricated using bidirectional woven ply (45°/-45°) E-glass fiber of eight layers with 300 GSM and layer thickness of 0.25 mm used as reinforcement and Bisphenol A based epoxy Araldite LY556 and hardener HY951 mixed in the ratio of 10:1 as the matrix material. Specimens were cut from the prepared laminates and tested under constant amplitude fatigue loading for stress ratios 0.1 and 0.3 as per ASTM standard D3479. The results showed that cyclic creep strain was higher at the stress ratio 0.3 than at stress ratio 0.1.

**Keywords:** Angle Ply, GFRP, Cyclic Creep, Stress Ratio.

**PP-MB-403**

## Effect of MWCNTs on Mechanical Properties of Woven Angle Ply GFRP Laminates

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### ABSTRACT

In this study, effect of multiwalled carbon nanotubes (MWCNTs) on the mechanical properties of woven angle ply glass fiber reinforced polymer (GFRP) has been investigated. Eight-ply laminates of fiber orientation (45° /-45°) with neat epoxy, 0.5wt.% and 1wt.% MWCNTs modified GFRP were fabricated by vacuum assisted hand layup technique. Specimens were cut from the prepared laminates as per ASTM standards for mechanical testing such as tensile, compression, interlaminar shear strength and three-point bending test. Addition of MWCNTs in GFRP laminates enhanced the ultimate tensile stress, ultimate compressive stress, ultimate bending stress and interlaminar shear stress. Woven angle ply GFRP modified with 1wt.% of MWCNTs showed better mechanical properties when compared to 0.5wt.% of epoxy modified GFRP and neat GFRP. Damage occurred in the specimen depends on the loading condition.

**Keywords:** Angle Ply, GFRP, MWCNTs, Tensile, ILSS, Compression, Shear.

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**PP-MB-408**

## Investigation of Lightweight Wheel Design using Alloy Materials through Structural Analysis

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### ABSTRACT

Researchers are focusing more on lightweight vehicle design in response to the automotive industry's growing emphasis on energy efficiency and ecological responsibility. Two important considerations, including safety and technical requirements, must be taken into account while constructing a wheel. The rim and spokes make up the construction of the wheel. The creation of cutting-edge wheel and spoke designs for automobiles is the objective of this paper. The wheel has been subjected to a finite element analysis using ANSYS. Each material's stress and strain performances may be determined by taking into account magnesium alloy, aluminium alloy, titanium alloy, and steel. When analysing the three different designs and four different materials, the findings of the equivalent stress and deformation were compared. This study makes some insightful predictions about the dependability of the structural design, and it offers some helpful references for the design and development of alloy wheels.

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**PP-MB-409**

## Knee Simulator Testing Machine

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### ABSTRACT

Recent statistics show that big bones in the lower extremities are affected by more than 70% of osteosarcoma cases (femur and tibia). Most instances are documented in youngsters under the age of 20, and they all call for prosthetic reconstructive surgery. As a result, the creation of artificial prosthetics is the clear-cut solution to this important problem. A mesenchymal-derived primitive altered cell that exhibits osteoblastic differentiation and produces

malignant osteoid is an aggressive malignant tumour known as osteosarcoma. The histological kind of primary bone cancer that is most prevalent is this one and needs to be replaced by prosthetic devices. To sustain 10 years of prosthetic life in the human body, the prosthesis needs undergo testing that amounts to roughly 10 million cycles before being implanted. This artificial prosthesis is tested using a machine called a "knee simulator" that produces a variety of movements.

**Keywords:** Knee simulator, osteosarcoma, prosthetic, knee joint, degrees of freedom.

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**PP-MB-410**

## Medical Assistance Robot for Sanitizing Floors

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### ABSTRACT

Cleanliness and sterilization necessities have forever been the most critical component for humans to be in good health. Lately, the utilization of present day innovation in sterilization has assisted with battling against contagious diseases. One such current innovation is sterilization or cleaning robots. Sterilization robots are progressively utilized altogether all over the world. This robot is motivated on/from a method, which consists of sanitizing puts in independently in service to save human life from diseases. It diminishes human association in all areas. The primary benefits of the proposed robot is to sanitize the floors.

**Keywords:** medical, Contactless, sensors, sanitization, motors.

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**PP-MB-411**

## Drilling System Using 3 D.O.F Parallel Manipulator – A Review

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### ABSTRACT

A parallel robot is made up of a moving platform attached to a stationary base by a set of parallel, identical kinematic chains known as legs. The movable platform is fixed with the end-effector. When the number of legs is greater than or equal to the number of degrees of freedom on the mobile platform, a parallel robot is said to be fully parallel. The majority of these parallel robots applications are flight simulators. When it comes to parallel manipulators, Stewart Platform and Delta Robot are two regularly utilised parallel robots in the sector. In this paper, we will take a glance at drill bit end effectors and how they can be used with parallel manipulators for automation. Parallel robots have a number of advantages over serial, including extremely high speed and acceleration, high rigidity, and greater

accuracy. Since the drill end effector is a highly integrated, compact electro-mechanical system, its architecture should be based on the robot and the process. This study focuses on the effect of the robot's stiffness, payload, accuracy, installed end effector configuration, technical process, and orbital drilling approach.

**Keywords:** Parallel Robots, Drillbit, end effectors, Robot manipulators, Drilling automation, Spherical parallel manipulator, Delta robots, Stewart platform.

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**PP-MB-416**

## Modeling of mode II delamination behavior in laminated composite structures for aerospace applications

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### ABSTRACT

Most of the laminated composite structures are limited by delamination type of failure under different kinds of loading. There have been many attempts to develop modelling methodology for delamination under static and dynamic loading. Most of the early attempts are focused on the unidirectional laminates due to complexity involved in the multi-directional laminates. However, in the real world, most of the time multi-directional laminates are used. This paper is an attempt to develop such delamination modelling methodology for multi-directional carbon composite laminates (with 0-0, 45-45 and 90-90 interfaces) under static and dynamic loading. For delamination modelling of the static loading case, ANSYS software is used with the in-built contact based cohesive zone material model. The Mode II experiments were also conducted on multi-directional carbon composite coupons as per ASTM standards and the load displacement behaviour is validated using the FEA cohesive zone models. Mode II test coupons are modelled, analyzed and the delamination is captured in the simulation. For dynamic loading, LS-DYNA is used with the in-built tiebreak contact-DYCOSS-Option 9 capabilities which are similar to the cohesive zone elements. The results show that cohesive zone models can very well predict the delamination in this kind of materials under static and dynamic loading conditions. The modelling methodology will be further perfected for both situations to make it more robust and ready for applications to aircraft engine components in consideration of delamination.

**Keywords:** Composite Structure, Delamination, Cohesive zone.

**PP-MB-460**

## Review on Metal Matrix Composite (MMC) and Reinforcements

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### ABSTRACT

Compared to steel and nickel-based materials, titanium matrix composites (TMCs) offer excellent specific strength and stiffness. When compared to monolithic superalloys, high-temperature TMCs can save weight by up to 50% while keeping the same stiffness and strength in the propulsion systems of jet engines. Whether continuous fibres or discontinuous particles are used as reinforcement, the special qualities of TMCs have propelled them to the forefront of major research and development projects across the globe. TMCs are among the most researched and sought-after material systems, yet there is a lack of meaningful information regarding their properties, manufacturing processes, and design in the literature. This review discusses significant studies that helped enhance TMCs material systems. Additionally, it offers thorough information on typical reinforcements, production procedures, and reviews.

**PP-MB-471**

## Analysis of the significance of the Imparted Fastening forces and Material properties of plates on the fatigue life of bolted joints using FEM

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### ABSTRACT

The present study attempts to analyze the significance of imparted fastening forces, the friction induced and the material of the plates on the fatigue life of double-lap bolted joints with the aid of numerical analysis. The three-dimensional FE models of the joints were created and subjected to four distinct fastening forces on the bottom face of the bolt stem and a cyclic load with a constant maximum stress for plates made of Aluminium alloy - Al 2024-T3 and Magnesium alloy - Mg AZ31B. The dispersion of stress and strain in the plates stimulated by the imparted fastening forces and the applied cyclic load was assessed utilizing finite element (FE) method with the help of ANSYS software. The order and the combination of parameters to execute the simulations and to ascertain the main effects were formulated using Taguchi's L8 array. The outcomes from the FE analyses were utilized to appraise the fatigue lives of the bolted joints using the Kandil–Brown–Miller multi-axial fatigue criterion. The outcomes of the

FE analysis made clear that the fastening forces and the fatigue life of the joints were positively co-related. The results also revealed the effect of material strength and alloy composition on the fatigue life.

**Keywords:** Fastening Forces; Al 2024-T4; Finite element analysis; Mg AZ31B; Multi-axial criteria.

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**PP-MB-472**

## Effect of process parameters on 3D printed polymeric materials and composites fabricated using FDM process: a review

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### ABSTRACT

Three dimensional printing is one of the rapidly evolved fabrication techniques, in which structures are printed by accumulating the materials layer by layer, based on 3D design data. Fused deposition modeling (i.e., FDM) is one of the frequently employed methodologies of 3D printing technology, in which filament of the material to be printed is fused and structure gets printed layer by layer. Even though, FDM is flexible enough to print wide category of polymer and composite based materials, these printed structures, in some scenarios, exhibit inferior mechanical relevant properties, due to the unsteady binding amidst the generated interior layers. Due to this inferiority w.r.t. toughness, stiffness and functional based attributes, FDM based 3D printed parts are mainly employed as prototypes, for research based investigations etc., and cannot expand its market towards several industrial scenarios, which demand for superior mechanical attributes. In this paper, recent experimental and research based investigations on FDM based 3D printing of PEEK (i.e., Polyether ether ketone) based composites, thermo-setting type polymers and continuous carbon fiber reinforced composites were reviewed. Innovations put forward w.r.t. various parts of FDM based printer like extruder by researchers to enhance the mechanical relevant properties of the printed structures were also addressed in this paper.

**Keywords:** 3D Printing; Fused deposition modeling; Polyether ether ketone; continuous carbon fiber reinforced composites; thermo-setting polymers.

**PP-MB-473**

## Performance evolution in machining parameter of Al-Ai(LM6) alloy using neural network

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### ABSTRACT

In this experiment, the solution is obtained for the cutting machine setup parameters using CNC turning operation utilizing the theories of artificial neural network. The mapping between a group of input and output values can be learnt by using artificial neural network. Once a network is trained, output values can be identified for a given set of input values. All the inputs like cutting speed, feed, depth of cut and coolant fluid rate and their corresponding methodology output like surface finish are included in the program. This technique uses back propagation neural networks to accomplish forward mapping of method inputs and outputs. These networks can then be used interactively to update the foremost effective machine setup parameter. A program has been developed in MATLAB for resolution the model. The result from experiment is valid with neural network.

**Keywords:** LM6 Aluminium alloy, CNC Turning, Neural network, Optimization, Machining parameter.

**PP-MB-479**

## A Brief Review on the reinforcements used in Aluminium Metal-Matrix-Composites

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### ABSTRACT

The prerequisite for low-cost materials with high performance caused the researchers worldwide to switch the focus from monolithic to composite materials. Recently, a remarkable attempt has been made in this direction to produce several combinations of metal matrix composites. Among the MMCs, aluminum-based composites are treated as the most promising structural materials due to their high corrosion, wear resistance, specific modulus, and weight for automobile and aerospace applications. Aluminum MMCs were produced by various fabrication process after considering different reinforcement particles, such as borides, carbides, oxides, nitrides, and their combinations. Aluminum MMCs revealed

excellent mechanical and wear characteristics owing to the formation of stable reinforcement particles in the composites. In the present review article, recent advances in processing, microstructure, wear, and mechanical characterization of aluminum composites reinforced with different particles are addressed. The future scope of these composites is also briefly discussed at the end of the manuscript.

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**PP-MB-492**

## Experimental Study on Mechanical Properties of Woven GFRP Ply Laminates

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### ABSTRACT

In this experimental work the influence of fiber orientation on the mechanical properties of woven GFRP is presented. 12-ply laminates of two fiber orientation (00 /900),  $\pm 450$  were fabricated by vacuum infusion technique and tested for their tensile, compression, shear, ILSS and 3-point bend behaviour. The laminates presented properties are based on fiber orientations. Different loading conditions imparted different fracture behaviour in the materials. (00/900) laminates had the highest of the properties in terms of strength while the lowest in terms of elongation/deflection and vice-versa properties were depicted by laminates with  $\pm 450$  orientation.

**Keywords:** Tensile; Compression, Shear, ILSS; Flexural strength; Fiber orientation; GFRP Composites.

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**PP-MB-493**

## Study the performance of a radiant cooling system using water as a medium in a prototype building

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### ABSTRACT

As the air temperature increases in hot and humid weather, a large amount of energy is needed to provide better cooling of residential and commercial buildings by air conditioning systems. Thus, to reduce energy consumption and provide good comfort cooling to the occupants in the indoor, the method of radiant cooling is a better choice. The concept of

operation of this system is to provide a cooling effect to the room by absorbing sensible heat from the room which is acquired by the room through thermal radiation by passing water through the system. The energy consumption of this system is significantly lower than that of other conventional cooling systems.

**Keywords:** Thermal radiation, Room sensible heat, Cooling effect, Energy consumption, Water.

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**PP-MB-494**

## Study of emission characteristics of a diesel engine run by fuel blends of diesel, jatropha biodiesel and cetane improver

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### ABSTRACT

Biodiesel produced from oils of vegetable seeds has the potential to be a key alternative energy source for CI engines. The calorific value of vegetable oils is somewhat lower than that of diesel fuel. This is due to the existence of oxygen in vegetable oil molecules. The cetane number of vegetable oils ranges from 35 to 40 based on the composition, but diesel does have a cetane number of roughly 45. Enhancing a cetane number in diesel fuel, either by decreasing the aromatic component of the fuel by hydro treatment or by adding cetane improvers, is a low-cost alternative for reducing diesel engine emissions. This study attempts to provide an insight by comparing the engine emission characteristics and performance for diesel - Jatropha biodiesel blend (BD50) with and without cetane improver.

**Keywords:** Jatropha biodiesel, diesel, additive, dimethyl carbonate, Emission, Engine efficiency.

# **4. SURFACE ENGINEERING**

## **PAPER PRESENTATIONS**

OP-SE-045

## Ion beam irradiation induced modification on the properties of GeO<sub>2</sub> thin films deposited by E-beam evaporation

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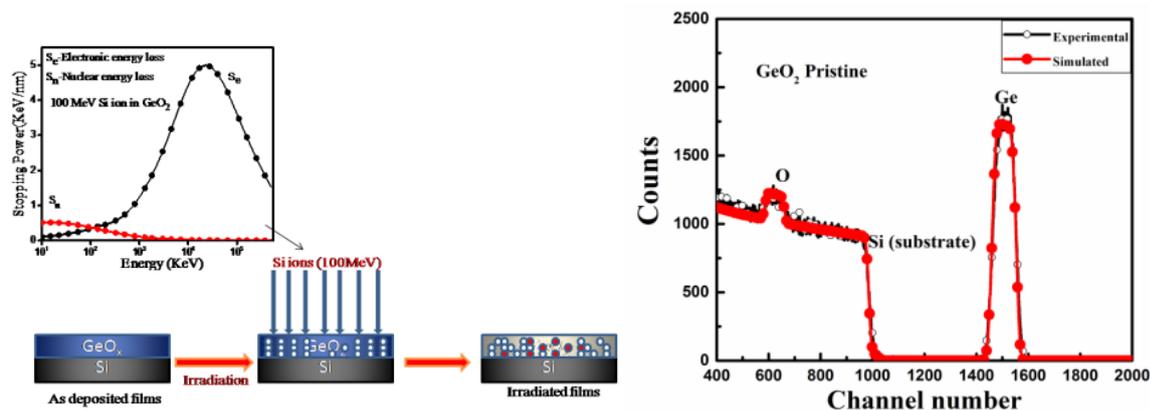
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### ABSTRACT

Swift heavy ions (SHI) of 100MeV Si<sup>7+</sup> irradiation induced modification on the properties of GeO<sub>2</sub> thin films has been investigated. Germanium oxide (GeO<sub>2</sub>) thin films were deposited on to Si substrate by electron beam evaporation techniques. Subsequently deposited films were irradiated with 100MeV Si ions of +7 charge state at various ion fluences ranging from 5×10<sup>12</sup> to 2×10<sup>13</sup> ions/cm<sup>2</sup>. The chemical composition of as deposited films were evaluated by Rutherford backscattering spectroscopy (RBS) and thickness observed around 120 nm. As deposited films were found amorphous in nature and was confirmed from XRD and Raman results. Whereas the films irradiated at 5×10<sup>12</sup> ions/cm<sup>2</sup> shows partial crystallization. The root mean square roughness varies with ion fluences and AFM images show the formation of grains with irradiation. The pristine and irradiated films exhibited strong photoluminescence (PL) in ultra violet (UV) and blue region. The blue shift was observed in PL bands with ion interaction. UV PL band intensity was decreased and blue emission increased with irradiation. The possible mechanism of variation in the PL emission from the GeO<sub>2</sub> thin films with Si ions irradiation has been investigated in details.

**Keywords:** GeO<sub>2</sub> thin film, Ion beam irradiation, Rutherford backscattering spectroscopy, XRD, AFM and Photoluminescence.



**Fig.1:** (a) Schematic Illustration of Si ion irradiation of GeO<sub>x</sub> films (b) RBS spectra of as deposited GeO<sub>2</sub> Film

OP-SE-055

## Structural and Optical Modifications of Ga- doped Al<sub>2</sub>O<sub>3</sub> Thin-film by Electron Beam Evaporation

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### ABSTRACT

The nanostructured Al<sub>1.5</sub>Ga<sub>0.5</sub>O<sub>3</sub> (GaAlO) films deposited by the Electron beam evaporation technique were grown on an Alumina <0001> and p-type Si substrate to ensure the modifications in structural and optical modifications. X-ray diffraction and X-ray photoelectron spectra bands indicated the chemical stability of the GaAlO structure for Ga at Al sites. The interplanar spacing of Al<sub>2</sub>O<sub>3</sub> (104) reduces after annealing the as-deposited films at 550°C, as seen by (104) plane location at approximately 2θ~35.190 greater than the value indicated by conventional spectra (2θ~35.140) for pure α- Al<sub>2</sub>O<sub>3</sub> [1]. R. N Bhowmik et al. found that the lattice parameter (a, c) has decreased from that of pure α- Fe<sub>2</sub>O<sub>3</sub> samples [2], and we also got the same result. The value of average crystalline size increased compared with an as-deposited sample due to strain development in the crystal. Compared with as- deposited GaAlO films, average dislocation density decreases. This structural change may be due to lattice rearrangement after intensity variation, a shift in the 2θ position, lattice parameter variation, and lattice strain confirming Ga atoms' substitution into the Al<sub>2</sub>O<sub>3</sub> matrix [3]. The optical analysis reveals an increase in optical bandgap (3.78-4.04) eV in comparison to as-grown films (3.44-3.86) eV at different substrates, and these obtained bandgaps were less than the optical bandgap of α- Al<sub>2</sub>O<sub>3</sub> thin film was found to be Eg~ 4.74 eV (Eg~ 8.8 eV for defect-free Al<sub>2</sub>O<sub>3</sub>) [4]. The bandgap narrowing might be due to the presence of a Ga<sup>3+</sup> dopant in the Al<sub>2</sub>O<sub>3</sub> crystal lattice, which induces the development of new recombination centers with lower emissions [5]. The structure is stabilized, and the optical bandgap is reduced after Ga- doping in pure α-Al<sub>2</sub>O<sub>3</sub>. The present work shows the crystal structure and optical modification of GaAlO films with Alumina <0001> and p-type Si <100> substrates.

**Keywords:** Ga- doped Al<sub>2</sub>O<sub>3</sub>; Electron beam evaporation, X-ray photoelectron spectra, Optical bandgap.

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### OP-SE-085

## Surface magnetic study of metal (Sr, Sc, and Cr) doped M-type BaFe<sub>12</sub>O<sub>19</sub> hexaferrite thin films

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### ABSTRACT

The hexaferrite thin films of compositions BaFe<sub>12</sub>O<sub>19</sub>, Ba<sub>0.7</sub>Sr<sub>0.3</sub>Fe<sub>12</sub>O<sub>19</sub>, and BaFe<sub>11.5</sub>T<sub>0.5</sub>O<sub>19</sub> (T: Sc and Cr) have been grown on Si<100> substrate have been stabilized in the magnetoplumbite (P<sub>63</sub>/mmc) structure by Pulsed Laser Deposition technique. The undoped thin films are deposited with laser pulse energy of ~ 383 mJ, whereas metal doped thin films are deposited with ~ 740 mJ. The epitaxial growth of deposited thin films was confirmed by GIXRD of the rotation of the thin film, where intensities of (203), (207), (1114), and (405) plane peaks varied with the rotation of thin films. The increase of the laser pulse energy increases the surface roughness and particle size of the deposited thin films. The Magneto-Optical Kerr Effect (MOKE) measurements of the thin films showed the hysteresis loops of a typical ferro/ferrimagnetic material. The saturation magnetization of the thin film surface was not attained within the applied range of ± 300 mT, indicating the hard ferromagnetic nature of the films. Un-doped and Sr doped at Ba-site thin films have the coercivity of ~ 112 mT, whereas Sc, and Cr doped at Fe-site thin films have the coercivity of ~ 146 mT. It has been noted that doping of Sr at the Ba-site does not affect much on the variation of coercivity, whereas doping of the Sc and Cr at the Fe-sites has enhanced the coercivity in the BaFe<sub>12</sub>O<sub>19</sub> thin films. The high coercive thin films can be used in thin film-based permanent magnet applications.

**Keywords:** Metal-doped BaFe<sub>12</sub>O<sub>19</sub>; Pulsed Laser Deposition; MOKE; Surface magnetic properties.

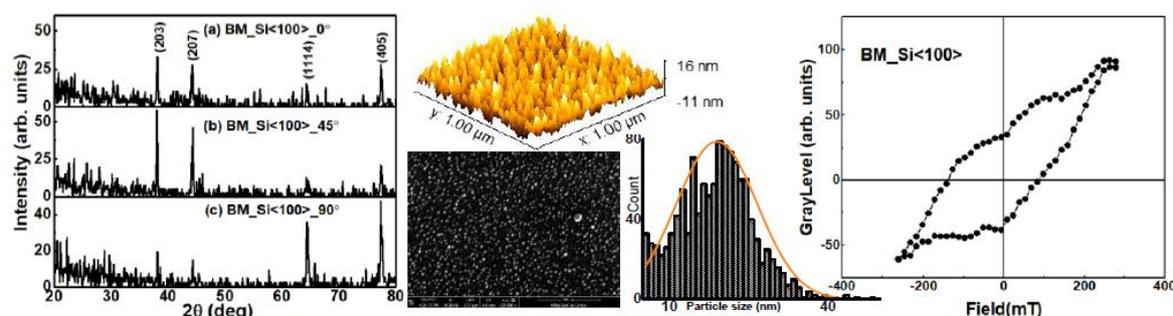


Fig .1: Structural phase, surface morphology, and surface magnetic loop of BaFe<sub>12</sub>O<sub>19</sub> hexaferrite thin film.

OP-SE-146

## Corrosion Behaviour of AA2024 Composites Reinforced with Slag, Calcium Carbonate and Solid Lubricants

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### ABSTRACT

The present study deals with the investigation of corrosion behavior of AA2024 and its composites containing 10 wt.% Slag, 10 wt.% CaCO<sub>3</sub>, and 13 wt.% hybrid reinforcements (10 wt.% Slag + 3 wt.% Graphite, 10 wt.% Slag + 3 wt.% MoS<sub>2</sub>, 10 wt.% CaCO<sub>3</sub> + 3 wt.% Graphite, 10 wt.% CaCO<sub>3</sub> + 3 wt.% MoS<sub>2</sub>). To extend the wettability, commercially pure magnesium (1.5%) was added. Stir casting method was used for the fabrication of AA2024 hybrid metal matrix composites. The corrosion behaviour of the prepared samples at room temperature was investigated using the immersion test and also potentiodynamic polarization technique. Corroded samples were examined using a scanning electron microscope and analyzed. It was observed that the corrosion behaviour of AA2024-Slag-MoS<sub>2</sub> composites show enhanced results than the other composites prepared.

**Keywords:** AA2024 Composites, Slag and CaCO<sub>3</sub>, Solid Lubricants, Corrosion Behaviour.

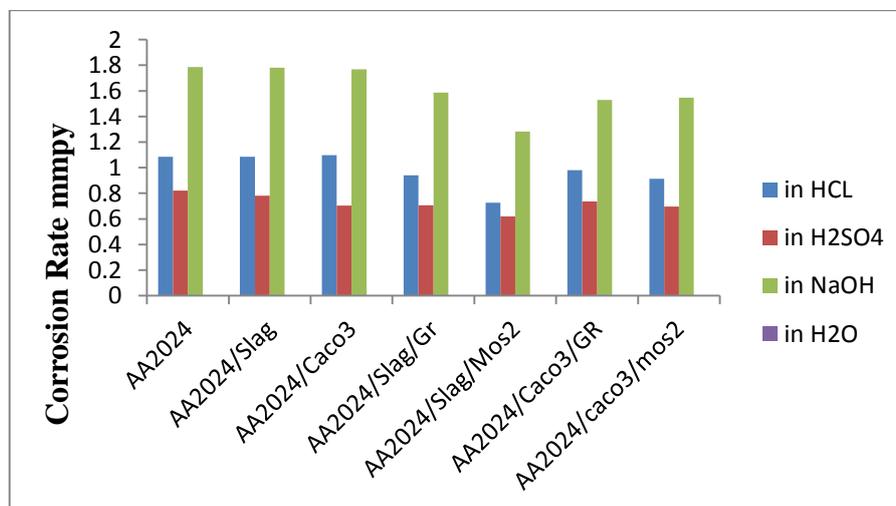


Fig.1: Variation of corrosion rate as a function of reinforcements

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OP-SE-149

## Structural, optical, and electrical properties of $\text{Sn}_{1-x}\text{Sm}_x\text{O}_2$ ( $x = 0, 0.5$ ) nanostructured transparent conducting oxide thin films

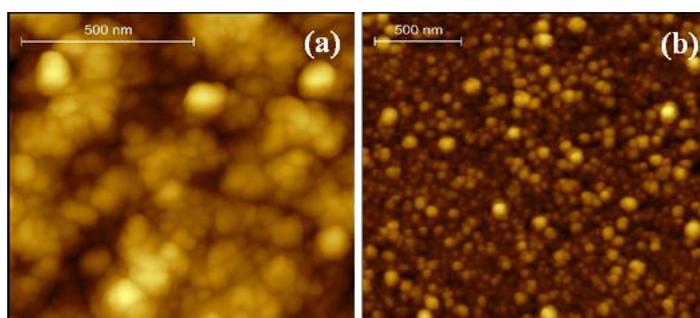
Harish Sharma Akkera<sup>a</sup>, DR. Yathish Kumar<sup>a</sup>, M. Dilip Kumar<sup>a</sup>

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### ABSTRACT

In the present work, pure  $\text{SnO}_2$  and  $\text{Sn}_{0.5}\text{Sm}_{0.5}\text{O}_2$  nanostructured thin films were deposited on a glass substrate using the spin coating method and investigated the structural, optical, and electrical properties. XRD studies revealed that both films exhibited polycrystalline tetragonal crystal structure. The average crystallite size significantly decreased with the Sm doping. XPS and Raman spectroscopic studies were performed in pure  $\text{SnO}_2$  and  $\text{Sn}_{0.5}\text{Sm}_{0.5}\text{O}_2$  thin films. The higher average optical transmittance above 86 % was found in pure  $\text{SnO}_2$ , while  $\text{Sn}_{0.5}\text{Sm}_{0.5}\text{O}_2$  film showed 77%. The optical bandgap energy of  $\text{Sn}_{0.5}\text{Sm}_{0.5}\text{O}_2$  was increased as compared to the pure  $\text{SnO}_2$  film, which is attributed to the Moss-Burstein (MB) effect. Further, the room temperature sheet resistance and the efficiency parameter figure of merit ( $\phi$ ) for both films were calculated.

**Keywords:** Optical transmittance; Sol-gel spin coating; Bandgap energy; Transparent conducting oxides; Sheet resistance.



**Fig. 1:** AFM micrographs of pure  $\text{SnO}_2$ , (b)  $\text{Sn}_{0.5}\text{Sm}_{0.5}\text{O}_2$  thin films

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OP-SE-424

## Influence of Nitriding on Heat treated Ti<sub>6</sub>Al<sub>4</sub>V Alloy

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### ABSTRACT

The Ti<sub>6</sub>Al<sub>4</sub>V alloy sheet of 3 mm thickness in as received, annealed and solution treated and precipitation hardened condition was subjected to plasma and laser nitriding treatments. The plasma nitriding was carried out 850°C for 30 Hrs with 8 Lts/min of Nitrogen flow. Laser nitriding was carried with 8Lts/min of nitrogen gas. The microstructure of the nitrided layer of the annealed Ti<sub>6</sub>Al<sub>4</sub>V alloy showed presence of marginal nitrided layer but the hardness has not enhanced sufficiently. The microstructure of the nitrided layer of the solution annealed and precipitation hardened Ti<sub>6</sub>Al<sub>4</sub>V alloy did not produce nitrided compound white layer. But the hardness has improved to substantial is typical of a plasma nitrided treatment. The microstructure of as received Ti<sub>6</sub>Al<sub>4</sub>V alloy showed presence of marginal nitrided layer but the hardness has not enhanced sufficiently. In the case of vLaser nitriding some hair line thermal cracking observed at the edges of Ti<sub>6</sub>Al<sub>4</sub>V specimens due to thermal cracking. This investigation shows that the hardness of the Ti<sub>6</sub>Al<sub>4</sub>V alloy can be substantially improved through nitriding process, which shall have positive influence on the wear behavior of Ti<sub>6</sub>Al<sub>4</sub>V alloy.

**Keywords:** Ti<sub>6</sub>Al<sub>4</sub>V, hardness, nitriding, plasma, laser, microstructure.

**OP-SE-425**

## Effect of Homogenization on Hardness and Microstructure of Magnesium Ingots

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### ABSTRACT

Magnesium and its alloys are the emerging light weight structural materials, possessing high strength to weight ratio and low specific gravity. They are widely used in aerospace, automobiles, electronics, biomedical implants and other commercial applications. Magnesium is susceptible to corrosion and material deterioration and loss of mechanical properties, leading to unreliability in functional life. Alloying elements like aluminum, manganese, silicon, copper, zinc, etc are added to the magnesium to enhance the mechanical properties, corrosion resistance through grain refinement, strengthening through formation of hard phases and precipitation of hard particles. In this investigation the magnesium ingots were subjected to homogenization heat treatment, to study the microstructural changes and variations in microhardness in the magnesium ingots. The microstructural changes were characterized using optical microscopy (OM).

**Keywords:** Magnesium, ingot, homogenization, microstructure, microhardness.

**OP-SE-459**

## Analysis of the Structural, Optical, and Magnetic Properties of Sol-gel Spin coated rGO Layered V, Ce, and Mn Doped NiO thin films

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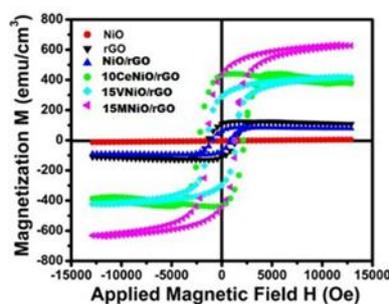
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### ABSTRACT

Graphene is a 2D material that possesses properties such as increased charge mobility, surface area, and mechanical and chemical stability. Therefore, coating of rGO films over Mn, Ce, and V doped NiO thin films can substantially increase the magnetic properties of these doped thin films. NiO/rGO, (V, Ce, and Mn-doped NiO)/rGO bilayer nanocomposite thin films were prepared by sol-gel spin coating method. The XRD patterns reveal the polycrystalline nature of the NiO thin films and rGO layering decrease the crystallite size. The binding energy of all

the thin films are calculated using XPS spectra, confirming the cubic structure of NiO. Raman spectra analysis reveals the presence of increased defects corresponding to rGO in the layered films. The layering and doping changes the band gap values significantly. A PL quenching is observed in the rGO layered undoped and doped NiO thin films. Analysis of the magnetic properties reveal the increased values of saturation magnetization and magnetic moment in the rGO layered thin films. The structural, optical, and magnetic studies disclose that rGO layer contributes a significant effect in enhancing the opto-electronic and magnetic properties of the undoped and doped NiO thin films.

**Keywords:** reduced graphene oxide, NiO thin films, optoelectronic devices, spintronics, saturation magnetization.



**Fig. 1:** Magnetization versus Applied magnetic Field (M-H) curve of NiO, rGO, NiO/rGO, 15VNiO/rGO, 10CeNiO/rGO, and 15MnNiO/rGO thin films prepared by sol-gel spin coating technique

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OP-SE-477

## High-Temperature Tribological Properties of Magnetron Sputtered Novel Nanocomposite Coatings

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Reducing friction and wear is one of the ongoing challenges in many mechanical industries. Recent research efforts have been focused on accelerating the low-friction and antiwear properties of hard coatings through the incorporation of selflubricant materials or the development of new architectures. In this present study, novel nanocomposite of AlCrN and a-C coatings were fabricated using RF/DC magnetron sputtering technique with varying the a-C concentration (up to 25 at%), and studied their structural, mechanical and high-temperature tribological properties. X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), field-emission scanning electron microscopy (FESEM) and Raman spectroscopy were used to evaluate their microstructural properties. The structural results revealed cubic phases of AlCrN was observed, and the crystallinity was tend to decreased with increasing a-C concentration. The enhanced mechanical properties of ~35 GPa of Hardness and 328 GPa of elastic modulus was observed for the coatings with 15.4 at% of a-C coatings due to their refined microstructure. The low-friction of ~0.18 and superior wear resistance ( $4.3 \times 10^{-8}$  mm<sup>3</sup>/N m) of this coating, which are originated from the coexistence of self-lubricating a-C matrix and crystalline AlCrN phases. The tribochemical analysis on the wear tracks revealed that the strong formation of hard tribofilms consist of hard nitride and metal-oxide species on the sliding interface governing the tribological performance at elevated temperature (up to 400 °C).

**Keywords:** Nanocomposite coatings; mechanical properties; tribofilms; friction and wear; AlCrN:a-C.

**PP-SE-187**

## Effect of Processing Parameters on the Morphological Transition of Block copolymer Systems

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### ABSTRACT

Block copolymers consist of two or more immiscible components covalently bonded to each other. They are well known for their self-assembly behavior and have shown a notable development since their first synthesis 60 years ago. The typical phase separation behavior makes these BCPs an ideal material for different technologies including nanolithography, nano porous membranes, superconductors, nano templating, storage media, and anti-reflection coatings. Despite this much potential, there is a limitation in using the widespread usage of BCP thin films in these applications. Different parameters like precise self-assembly control, the influence of process parameters on the formation of nanodomains, and the removal of defects from the nano-ordered templates stop the usage of BCP thin films in more comprehensive applications. This review paper studies about the effect of various parameters such as temperature, pressure, solvent concentration, solvent quality, thickness of the film, and trapped solvent reaction on the morphological transition of these BCPs that causes different morphologies.

**Keywords:** Block copolymer; gyroid; self-assembly; solvent; parameters.**PP-SE-241**

## Influence of Drilling Parameters on Hole Roundness, Perpendicularity in AA7075/TiB<sub>2</sub> Composites

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### ABSTRACT

The framework of automotive, aerospace, electronic packages and industrial products requires the drilling of holes in component assemblies using a typical twist drilling process. A comprehensive examination of drilling parameters and the composition level of TiB<sub>2</sub> particles on AA7075 alloy is performed in this work. This paper examines roundness (hole diameter accuracy), circularity, and perpendicularity errors. The stir casting method is employed to fabricate the AA7075/TiB<sub>2</sub> (4, 6, 8 wt. %) composites. The drilling composite material was studied at various spindle speeds (1250-2850 RPM), cutting speed (80-150 m/min), hole diameters between 6, 8 and 10 mm, and feed rates of 0.15 mm/rev. A fine

dispersion of particles across the matrix material is observed in the fabricated composites under the optical microscope. Increasing the weight percentage of TiB<sub>2</sub> particles had an impact on the drilled holes' roundness, circularity, and surface roughness, according to the results based on the process parameters. The higher tool wear is also influenced by the hard abrasive particles in all spindle speeds and different diameter sizes, the chips are decreased in size. Due to the broader cutting edge in the drill bit, the roundness error is observed to be greater with a larger diameter at the maximum weight percentage TiB<sub>2</sub> content.

**Keywords:** AA7075, TiB<sub>2</sub>, Stir Casting, Hole diameter, Drilling, Surface Quality

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**PP-SE-247**

## **Influence of Organosulphur Stabilizers on the Characteristics of Autocatalytic Copper Nano Film Deposition**

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### **ABSTRACT**

This paper aims at studying the influence of structurally related two azole additives such as 2-Mercaptopyridine (2-MP) and 2-Mercaptoindole (2-MI) on the rate of autocatalytic copper depositions and the nature of copper nano deposits. The effect of these additives on the various other characteristics of electroless plating bath is analysed as well. Dimethylamine borane (DMAB) is employed used as the reducing agent and eco-friendly xylitol as complexing agent in the copper methanesulphonate bath. Potassium hydroxide is employed to regulate the pH and to modify the characteristics of copper nano deposits. 1 ppm of the mercapto additives are administered to this plating bath and optimized at a pH of  $11.75 \pm 0.25$  at a temperature of  $28 \pm 2$  °C. Analysis of the results obtained from different studies show that 2-MP acts as an inhibitor for copper deposition, however 2-MI accelerates the rate of deposition. The physical characteristics such as rate of deposition and thickness of copper deposits are calculated to validate the stabilizing effects of 2-MP and 2-MI. Surface morphology of the copper deposits is characterized using Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM) techniques. Structural properties such as crystallite size and specific surface area of plain bath and additives added baths are investigated using X-ray diffraction studies.

**Keywords:** 2-mercaptoindole; 2-mercaptopyridine; dimethylamine borane; surface morphology; xylitol.

**PP-SE-252**

## Intercalated Water Mediated Electromechanical Response of Graphene Oxide Films on Flexible Substrates

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### ABSTRACT

Under uniaxial strain, quasi periodic crack arrays have been observed in film of layered 2D materials, with potential application in nano-electronic sensing devices, and crack-based lithography. Confined water can be intercalated in the sub-nanometer spaces between layered two-dimensional materials such as graphene oxide by subjecting them to humid environments. Here, we examine the mechanical and electromechanical response of reduced graphene oxide films, prepared with two different oxidative states and coated on polydimethylsiloxane substrate, when these films are subject to different humidity environments, from 5 % to 90 % RH in a custom-designed setup. The application of uniaxial strain resulted in the formation of quasi-periodic wrinkles at low strain and creation of new surfaces or quasi-periodic cracks at high strains (up to 5 % strain). The extent of water intercalation was dependent on the oxidative state of the system as well as the relative humidity exposure. We demonstrate that water intercalation determines the density of cracks induced in the film and thereby also determines the electromechanical response in these electrically conductive films. Our observations are reconciled based on a model that considers the decrease in the in-plane elastic modulus of the system due to confined water, whose microscopic origin lies in the modified network of hydrogen bonding between the graphene oxide layers.

**PP-SE-261**

## Structural and Optical Properties of Nanoscale CdO:Mn Thin films Prepared by Spray Pyrolysis Technique

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### ABSTRACT

A great deal of research efforts was directed towards investigation of the physical properties of thin film to improve the quality and performance of the device and for finding new applications. In this study, undoped cadmium oxide (CdO) and manganese doped with cadmium oxide (CdO:Mn) films were deposited onto cleaned glass plates used as substrate by home built spray pyrolysis technique at 250°C temperature. The structure of the undoped CdO and Mn doped films were studied by X-ray diffraction have polycrystalline structure

with (111) and (200) highly orientations. X-ray peak line was studied to estimate grain size, strain. The transmittance in visible and NIR region with direct optical band gap were estimated for CdO and Mn doped CdO thin films. The results were analyzed for three different molarity of precursor solution of Mn doped CdO films and are reported. **Keywords:** Thin film, Spray pyrolysis, CdO, X-ray diffraction.

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**PP-SE-358**

## Electrochemical and Surface Modification of Hybrid Composite Doped Sol-Gel Coatings for Protection of Aluminium Metal from Corrosion in 3.5% NaCl Medium

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### ABSTRACT

Now-a-days hybrid materials contribute significantly to the domain of material science especially in the area of corrosion protection, thin film etc. In the present work, a hybrid material was synthesized by using polyaniline (PANI) as organic part with hydroxyapatite (HAP) as inorganic part in sodium dodecylsulfonate (SDS) micellar solution. The water soluble hybrid polymer (PANI/HAP) so obtained was doped in to 3-glycidoxypropyltrimethoxysilane (GPTMS) sol-gel matrix and the resultant hybrid gel was coated on aluminium surface by dip coating method. The hybrid PANI/HAP as well the hybrid doped sol-gel was characterized by Ultraviolet-Visible spectrophotometry (UV-VIS) and Fourier transform infrared analysis (FT-IR) and X-Ray diffraction analysis (XRD) techniques. The corrosion protection of hybrid-doped sol-gel coating on aluminium in 3.5% NaCl was characterized by using electrochemical polarisation and impedance measurement. The electrochemical studies revealed the excellent corrosion protection ability of the as-prepared hybrid doped GPTMS based sol-gel coating. Scanning Electron Microscope (SEM) studies also confirmed the formation of protective layer of PANI-HAP doped GPTMS based sol-gel coating on aluminum surface.

**Keywords:** Sol-Gel, Hybrid Polymer, Corrosion Protection, Impedance, Polarisation.

**PP-SE-359**

## Influence of Thiourea Doped Silane Based Sol-Gel Coating for Protection of Al Surface

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### ABSTRACT

Aluminium based materials undergo natural process of deterioration on exposure to corrosive environment. Among the strategies of corrosion control, sol-gel coatings have become popular as they have successfully replaced toxic hexavalent chromate coatings used hitherto. The adherent ability of sol-gel coatings combined with their ability to prevent the access of electrolyte thereby preventing the localized corrosion has made sol-gel coatings a promising and valuable method of corrosion control. The present work makes use of 3-glycidoxypropyltrimethoxysilane (GPTMS) as a precursor for sol-gel coating and thiourea was incorporated into a sol-gel matrix. Thiourea doped GPTMS based sol-gel coating was applied over aluminium by dip coating method. The resultant coating was studied by FT-IR, XRD and SEM & EDX. The protective nature of the coating was evaluated in 3.5% NaCl environment using electrochemical impedance and polarization studies. The study has revealed the efficiency of thiourea doped GPTMS based sol-gel coating in the protection of aluminium metal especially in neutral media.

**Keywords:** 3-glycidoxypropyltrimethoxysilane (GPTMS), Thiourea, Sol-gel coating, Corrosion protection, Electrochemical studies.

**PP-SE-387**

## Structural and Optical properties of Gd doped ZnO thin films by Spin Coating Technique

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### ABSTRACT

Zinc oxide (ZnO) being a wide direct band gap compound semiconductor have widespread applications in optoelectronics, photonics, spintronics, and quantum devices. In this work, sol-gel derived pure and Gadolinium doped Zinc oxide (GZO) thin films were prepared via spin coating method. The starting material used was Zinc acetate dihydrate, 2-Methoxy Ethanol as solvent and Monoethanolamine (MEA) as a stabilizer, and the dopant source used was Gadolinium trinitrate with varying concentration (0 mol% - 3 mol%). The structural

properties of the as prepared thin films were studied using X-ray diffractometer (XRD) and UV-Visible spectrophotometer was employed to study the optical properties of the prepared thin films.

**Keywords:** ZnO; Gadolinium; Thin films; Spin Coating; GZO

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### PP-SE-483

## Enhanced corrosion resistance of CPC coatings modified with risk husk ash for rebar applications in marine environment

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### ABSTRACT

This work evaluated the performance of cement polymer composite (CPC) coatings modified with supplementary cementitious materials (SCMs) over steel reinforcements in a corrosive environment. Four types of coatings were prepared and designated as OC (100 wt. % Ordinary Portland Cement), PC (100 wt. % Portland Pozzolana Cement), OPF (OC replaced with 20 wt. % fly ash), OPR (OC replaced with 20 wt. % rice husk ash). The coatings were prepared with the help of a commercially available polymer solution and applied on to the steel rebars in triplicate. Electrochemical studies like open circuit potential measurements, electrochemical impedance spectroscopy (EIS) and potentiodynamic polarization measurements were carried out on all the coated rebars and compared with uncoated rebars under marine exposure conditions. The coated surfaces were characterized with optical microscopy, Field Emission Scanning Electron Microscope and Atomic Force Microscopy. The results showed that the addition of rice husk ash enhanced the corrosion performance of CPC coatings as compared to others. OPR coated rebars had a significantly lower  $I_{corr}$  value of  $8.92 \times 10^{-7} \mu A$  (two orders of magnitude lower than uncoated rebars) and the highest impedance value and polarization resistance, implying more corrosion resistance than the others. The characterization of the surfaces revealed the smooth morphology of the OPR coating. Our

results suggest the important benefits of using SCMs in CPC coatings for improving the anti-corrosive properties of rebars.

**Keywords:** Coatings, rice husk ash, rebar, corrosion.

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**PP-SE-488**

## **A comprehensive review on effect of nanoparticles over the thermal characteristics of heat pipes**

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### **ABSTRACT**

Many engineering applications, including heat exchangers, air conditioners, chemical reactors, and refrigeration systems, use improved heat transfer surfaces. As a result, numerous techniques have been researched to increase heat transfer rate while reducing the size and cost of the corresponding equipment, particularly in heat exchangers. It is well acknowledged that using heat pipes to collect waste heat is a great approach to conserve energy and stop global warming. Nanomaterials improved surface-to-volume ratio confers greater corrosion prevention characteristics. This review paper helps us to study the corrosion reaction happening in the presence of nanoparticles coating at the top of the surface. When exposed to various corrosive substances and conditions, SS304 exhibits good corrosion resistance. Environments with chlorides can lead to pitting and crevice corrosion. Above 60°C, stress corrosion cracking might happen. Al<sub>2</sub>O<sub>3</sub> & TiO<sub>2</sub> are the nanoparticles selected in this project. The key issue of this endeavour is determining whether corrosion occurs when nanoparticles are coated on the heat pipe's surface.

**Keywords:** heat exchangers, heat transfer rate, waste heat, nanomaterials, corrosion, corrosion prevention.

# **5. FUNCTIONAL MATERIALS**

## **PAPER PRESENTATIONS**

## OP-FM-041

**Structural, magnetic, electrical and dielectric properties of Sr<sub>3</sub>Cr<sub>2</sub>O<sub>8</sub>**

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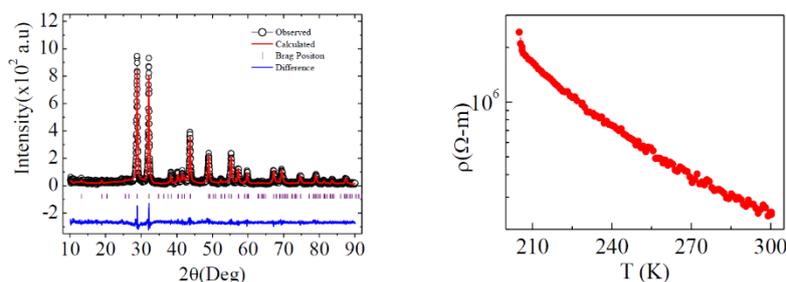
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**ABSTRACT**

The structural, magnetic, electrical and dielectric properties of Sr<sub>3</sub>Cr<sub>2</sub>O<sub>8</sub> material have been investigated. The polycrystalline sample Sr<sub>3</sub>Cr<sub>2</sub>O<sub>8</sub> was synthesized in single phase using conventional solid-state method. The crystal structure of the sample was analysed by Rietveld refinement of powder X-ray diffraction pattern which confirms that Sr<sub>3</sub>Cr<sub>2</sub>O<sub>8</sub> crystallizes in hexagonal phase. Lattice parameter obtained from refinement are  $a = 5.5717 \text{ \AA}$ ,  $b = 5.5717 \text{ \AA}$ ,  $c = 20.1679 \text{ \AA}$  and  $\alpha = \beta = 90^\circ$  and  $\gamma = 120^\circ$ . Homogeneity of the sample has been confirmed with scanning electron microscopy (SEM) images. The temperature (T) dependent magnetization (M-T) data displays antiferromagnetic transition of the sample [3]. The resistivity of the sample was measured in the temperature range from 300K to 204K. Below 204 K the resistivity of the sample was not measurable, thus showing highly insulating behavior. We plotted another graph of  $\log(\rho)$  vs  $T^{-1/4}$  and fitted it from temperature 218 K to 300 K. Using Variable Range Hopping Model we find the value of characteristic temperature  $T_0$  is  $1.79 \times 10^6 \text{ K}$ , confirming the insulating behavior of Sr<sub>3</sub>Cr<sub>2</sub>O<sub>8</sub>. The dielectric constant measured in a frequency ranges from 1 KHz to 1 MHz at temperatures from 15 K to 300 K reveal a relaxation process of frequency dependence of dielectric constant  $\epsilon_r$  [2].

**Keywords:** Insulator, Dielectric Material, Antiferromagnetic material, Variable Range Hopping Model.



**Fig.1:** Reitviold Refinement of XRD Pattern, and Resistivity versus Temperature plot of the sample.

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OP-FM-046

## Magnetic and structural studies of $Y_3Fe_{5-x}Mn_xO_{12}$ garnet nano powder

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### ABSTRACT

Yttrium iron garnet (YIG) play an important role for development of modern spin-based electronic (spintronics), magneto-optical, and high frequency devices<sup>1,2</sup>. In this study, the structural and magnetic properties of a series of  $Y_3Fe_{5-x}Mn_xO_{12}$  ( $x = 0, 0.05, 0.1, \text{ and } 0.25$ ) nano powders are reported. The powders were synthesized by the citrate combustion method and calcined at 800°C for garnet phase formation. It has been observed that Mn doping helps in stabilization of pure garnet phase in these nano powders. The effect of Mn doping on structural and magnetic properties of YIG garnet is studied using XRD, TEM, SEM, VSM, and EPR measurements.

**Keywords:** Garnet, Ferromagnetism, TEM, EPR.

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OP-FM-051

## Tuning the synthesis conditions of Calcium Aluminum Layered Double Hydroxide for potential use in antibacterial drug delivery

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### ABSTRACT

Layered double hydroxides (LDHs) gained attention as a carrier for drug delivery applications due to their advantages, such as high drug loading capacity, pH sensitivity, and sustained release of the intercalated drugs. In this study, Calcium (Ca) and Aluminium (Al), having higher tolerable upper intake values compared to other conventional metals such as Mg and Zn were chosen for the preparation of LDH. Pristine CaAl-LDHs were synthesized by co-precipitation method at different pH (9 and 10) and aging times (16 h and 24 h).

Structural characterization of the synthesized pristine LDHs by XRD analysis revealed that pH 9 and aging time of 24 h yielded LDH with high crystallinity (51.40 %) and d-spacing (0.77 nm), beneficial for high drug loading efficiency. Ofloxacin (OFX), an antibiotic drug, was loaded into CaAl-LDH via regeneration (CaAl-LDH-OFX<sub>(RG)</sub>: 28.3 %) and co-precipitation (CaAl-LDH-OFX<sub>(CPT)</sub>: 36.5%) routes. The drug loaded LDHs were characterized by XRD, FTIR, FETEM, FESEM and TGA analysis. The release behaviour of OFX from CaAl-LDH formulations was examined in simulated conditions representing gastrointestinal tract. Prolonged release of the drug (less than 60 % in 8 h) was observed in pH 1.2, 6.8 and 7.4 from CaAl-LDH-OFX<sub>(RG)</sub> formulation. Moreover, CaAl-LDH-OFX<sub>(RG)</sub> showed less initial burst release of drug at pH 1.2 (38.87 % in 10 min) and pH 7.4 (26.26 % in 10 min) compared to CaAl-LDH-OFX<sub>(CPT)</sub> (60 % release in 10 min at pH 1.2; 50 % release in 10 min at pH 7.4). Furthermore, the antibacterial activity of CaAl-LDH-OFX<sub>(RG)</sub> against *Escherichia coli* and *Staphylococcus aureus* demonstrated its exceptional potential for antibacterial drug delivery.

**Keywords:** Layered double hydroxide; Ofloxacin; Drug delivery; Regeneration method; Co-precipitation method.

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**OP-FM-056**

## Fabrication and Characterization of Nanohydroxyapatite and its Polymeric Composites using the Coral Skeleton and its *in-vitro* Studies for Biomedical Applications

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### ABSTRACT

Recycling of waste materials into usable products promotes a dual-sided advantage of Waste management and environmental protection. Due to excellent bioactivity and biocompatibility characteristics, calcium phosphate-based ceramic materials, such as nanohydroxyapatite (nHAp) and Tricalcium phosphates (TCP), are now widely used in biomedical applications. In this study, the coral skeleton was used as a calcium precursor in the sol-gel process to fabricate nHAp (pure) and its polymeric composites. FTIR, XRD, TG-DTA, SEM/EDX, HR-TEM, and XPS were used to characterize the prepared materials, such as nHAp (pure), PEG/PVA-capped nHAp to determine their phase, functional groups, thermal stability, phase transition, size, shape, and bonding types. Additionally, the apatite-forming capability, antibacterial efficiency, and hemocompatibility of the synthesized samples were tested using simulated bodily fluid analysis, antimicrobial assay and hemolytic test respectively.

According to the findings of the XRD examination, the average crystallite size (nanorod diameter) attained for PVA-capped nHAp (PVA/nHAp) is around 36.22 nm. Additionally, it demonstrated a rod-shaped morphology that was supported by HR-TEM and SEM analyses with particle diameters of 44.23 nm and 48.29 nm respectively. The findings of the present study suggest that it may be possible to create innovative HAp polymeric nanocomposites that have higher biocompatibility and osteoconductive properties that mimic the structure of the real human bone. Therefore, it is possible to produce bone and dental implants at a lower cost using the skeleton of dead corals.

**Keywords:** Nanohydroxyapatite, Sol-gel, hemocompatibility, XPS, Thermal stability, SBF analysis.

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**OP-FM-058**

## Preparation and microstructural characterization of ZrB<sub>2</sub>-SiC composite using ZrO<sub>2</sub>, B<sub>4</sub>C and Si via a single-step reduction process

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### ABSTRACT

In the present investigation, the ZrB<sub>2</sub>-SiC based composites were formed by boro/carbo thermal reduction method at 1300-1500°C using ZrO<sub>2</sub>, B<sub>4</sub>C, and Si in inert atmosphere. The effect of molar ratio of reactants and forming temperature on the residual oxides and microstructure were characterized. The molar ratio of ZrO<sub>2</sub>:B<sub>4</sub>C:Si was increased from 2:1.5:0.5 to 2:1.67:1.34 at 1300-1500°C, resulting SiC content increased and average grain size reduced. The impurity free composite was synthesized with decreasing the molar content and increasing the fabrication temperature, which was correlated with the microstructure of the samples investigated FESEM. The results revealed that a homogenous layer of uniformly dispersed SiC particles was exhibited over the surface of rod and spherical granulation of ZrB<sub>2</sub>, which restricted the grain growth of ZrB<sub>2</sub> particles during synthesis. The feasibilities of different molar ratios of different reactions were satisfied through the thermodynamic calculation.

**Keywords:** ZrB<sub>2</sub>; SiC; Molar ratio, Morphology; Synthesis.

**OP-FM-059**

## Synthesis and characterization of samarium substituted Ni-Cu ferrites

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### ABSTRACT

The rare earth samarium-substituted Ni-Cu spinel ferrites are synthesized by using the citrate-assisted sol-gel auto combustion technique. The obtained powders are calcinated at 500°C for 4 h. These ferrites' structural, spectral, morphological, and magnetic characterizations were done by using XRD, FTIR, FESEM with EDAX, and VSM instrumentations. The XRD spectra revealed that the pristine Ni-Cu ferrite exhibited a tetragonal structure with CuO and Fe<sub>2</sub>O<sub>3</sub> secondary phases and, with samarium substitution, progressively transformed into the cubic spinel structure. The average crystallite size observed to be decreased with increasing samarium content. The spinel structure of these ferrites was confirmed by the two metal-oxygen vibrational band frequencies observed in the FTIR spectra. The morphology shows that it is agglomerated with nanoscale grain structures. The existence of elements according to their chemical composition was verified by using EDAX spectra. Because of the replacing of ferromagnetic Fe<sup>3+</sup> by nonmagnetic Sm<sup>3+</sup>, the saturation magnetization was observed to be decreased with samarium content.

**Keywords:** spinel ferrites; samarium: tetragonal structure; magnetic properties.**OP-FM-063**

## Tunable magnetic properties of Y-doped ZnO thin film by varying Ar:O<sub>2</sub> ratio

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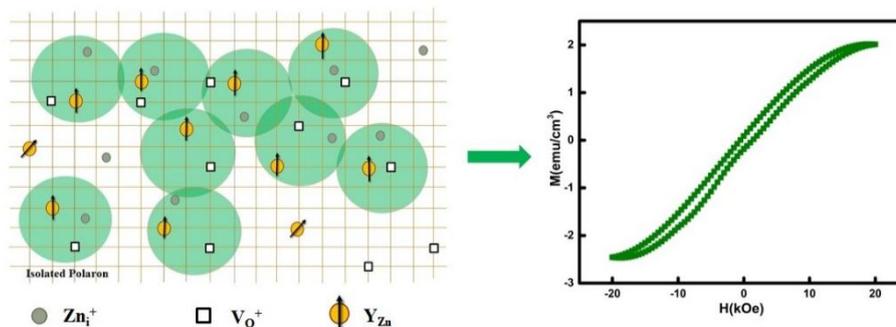
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### ABSTRACT

Y-doped ZnO thin films were fabricated by RF magnetron sputtering on Si(111) substrate at different Ar:O<sub>2</sub> ratios (75:25, 50:50, and 40:60). We report that the Ar:O<sub>2</sub> ratio in the sputtering chamber during the growth of thin films is found to influence their structural, optical, morphological and magnetic properties which were studied using X-ray diffractometer (XRD), photoluminescence (PL) spectroscopy, field emission scanning electron microscope (FESEM), and vibrating sample magnetometer (VSM) respectively. The XRD pattern shows that the films are oriented along (002) diffraction plane. PL spectra show the presence of oxygen vacancy (VO<sup>+</sup>) and zinc interstitial (Zn<sup>i+</sup>) in the grown films. The number of donor defects (VO<sup>+</sup> and Zn<sup>i+</sup>) in the samples was found to decrease with the increase in O<sub>2</sub> content in the working gas. From the VSM results, 4 at. % Y doped ZnO thin film deposited at Ar:O<sub>2</sub>

ratio of 75:25 shows ferromagnetic nature with saturation magnetization value of 2.01 emu/cm<sup>3</sup> while the films deposited at Ar:O<sub>2</sub> ratio of 50:50 and 40:60 shows a blend of paramagnetic and weak ferromagnetic behaviour. The donor defects account for the ferromagnetism in the films. The observed magnetic properties of 4 at. % Y doped ZnO thin films are explained by bound magnetic polaron (BMP) model.

**Keywords:** Y doped ZnO; Donor defects; Diluted magnetic semiconductors; Ferromagnetism; RF Sputtering; Spintronics.



**Fig. 1:** The illustration of BMP model and M-H curve of 4 at. % Y doped ZnO thin film.

#### OP-FM-064

### Small Angle Neutron Scattering Studies on RGO incorporated PVB Matrix Nanocomposites

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#### ABSTRACT

RGO) reinforced Polyvinyl Butyral (PVB) Matrix based nanocomposites. The RGO is incorporated (0.5 and 1.0 wt%) in to the PVB matrix in presence of Methyl trichloride (CHCl<sub>3</sub>) organic solvent. Solution casting technique is used to prepare the Nanocomposite films in Teflon Petri dishes at ambient temperature.

Small-angle neutron scattering experiments were carried out at the SANS diffractometer at Guide Tube Laboratory, Dhruva Reactor, Bhabha Atomic Research Centre, Mumbai, India. The instrument covers a Q-range of 0.01–0.3 Å<sup>-1</sup>. The scattering data shows power law behavior in the low Q region, suggesting the presence of surface fractal kind of structure. The data are analyzed using traditional two stage network model of the correlated structures, comprising two terms as described below.

$$I(Q) = \frac{I_1(0)}{(1 + Q^2\xi^2)} + \frac{I_2(0)}{(1 + Q^2\zeta^2)^2}$$

The first term represents a Lorentzian function, and known as Ornstein Zernike equation. This term accounts the scattering originating from the compositional fluctuation. The Fourier transform of this term provides the correlation length ( $\xi$ ). The space characterized by  $\xi$  can be considered small inhomogeneities where the excluded volume effects are present and the scattering from this term usually appears in the intermediate or low Q region.  $I_1(0)$  represents the forward scattering. The second term is square of the Lorentzian function, called Debye–Bueche function, accounting for the scattering from larger inhomogeneities.  $\zeta$  is the characteristic dimension of these inhomogeneities. However, in the present data no low Q cut off is observed, therefore, characteristic dimension corresponding to the larger inhomogeneities are kept fixed to a value more than  $2\pi/Q$ . The data have been analyzed by comparing the scattering from different models to the experimental data and the parameters have been optimized using nonlinear least square fit.

### Fitted parameters

| Sample              | Correlation length $\xi$ (Å) | Characteristic length $\zeta$ (Å) | $I_1(0)$ |
|---------------------|------------------------------|-----------------------------------|----------|
| 0.5 wt% of RGO +PVB | 08.5                         | > 50 nm                           | 0.30     |
| 1.0 wt% of RGO +PVB | 12.0                         | > 50 nm                           | 0.35     |

**Keywords:** PVB; RGO; Nanocomposites; SANS; Correlation length.

**Acknowledgement:-** The Authors are very much thankful to Dr. V. K. Aswal, SSP Division BARC for providing the laboratory facilities.

### OP-FM-066

## First Principles Investigations on Half-Metallic Ferromagnetism Properties of Cubic VLaO<sub>3</sub> Compound

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### ABSTRACT

In this paper, we present the study of structural, mechanical, magneto-electronic, thermodynamic and thermoelectric properties of the perovskite VLaO<sub>3</sub>. The calculations were

performed by the full potential augmented plane wave method, implemented in the WIEN2k code which is based on density functional theory, using generalized gradient approximation. The computed compound has been found stable in ferromagnetic (FM) phase since it possesses lower energy in FM phase compared to non-FM phase and their stability is also confirmed by calculating the enthalpy of formation and elastic constants indicate the synthesizability and mechanical stability of VLaO<sub>3</sub>. The electronic structures of the compound are analyzed with Tran and Blaha modified Becke–Johnson potential (TB-mBJ) for both spin up and spin down channels, which indicate its half-metallic characters. Analysis of density of states (DOS) shows major contributions of O-2p states in the valence band and V-3d-state, La-f state in conduction band. Moreover, our results showed that the investigated compound is a half-metallic material with half-metallic gap of 2.56 eV and an integer magnetic moment of  $\sim 4\mu_B$  per unit cell. In addition, the volume, bulk modulus, heat capacity, thermal expansion and the Debye temperature are analyzed using the quasi-harmonic Debye model. In the end, thermoelectric parameters are computed for 100K–1200K temperature range to explore potential of this compound for applications in renewable energy devices.

**Keywords:** Perovskites, half-metallic character, mechanical stability, electronic properties; thermodynamic properties, thermoelectric properties.

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### OP-FM-069

## Preparation and Characterization of ZnO/PVB Nanocomposite films

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### ABSTRACT

ZnO nanoparticles can be added to polymer matrices to develop materials employed in various high-performance engineering applications. In this study, Zinc Oxide (ZnO) nanoparticles were reinforced for a range of content (0.5, 1.0, 1.5 and 2.0 wt.%) in Polyvinyl Butyral (PVB) matrix to synthesize nanocomposite films using solution casting method. The effect of ZnO nanofiller on the morphology and UV shielding performance of PVB nanocomposite films was examined through different characterizations. The ZnO nanoparticles are very well dispersed in the PVB polymer matrix, as demonstrated by the XRD pattern and SEM micrographs. The EDX analysis confirms the quantitative presence of ZnO in the composite films. It was identified that the absorption peaks in the FTIR spectra of nanocomposites change to a higher or lower wavenumber than those observed in pure PVB. The observed shifts were linked to the interaction between ZnO and molecular chains of PVB. UV-Visible absorption spectroscopy was used to determine optical characteristics, film transparency and UV shielding performance. In particular, the composite films containing 2.0 wt.% of ZnO in PVB provides a 21.4% improvement in UV shielding than pure PVB with acceptable transparency. So, these nanocomposite films can be used in different engineering applications, such as in UV-shielding devices and optoelectronics.

**Keywords:** ZnO/PVB nanocomposite films, XRD, SEM, FTIR, UV-Visible spectroscopy, UV-shielding.

### OP-FM-070

## Effect of Mn substitution on Structural Behavior of LaCrO<sub>3</sub>

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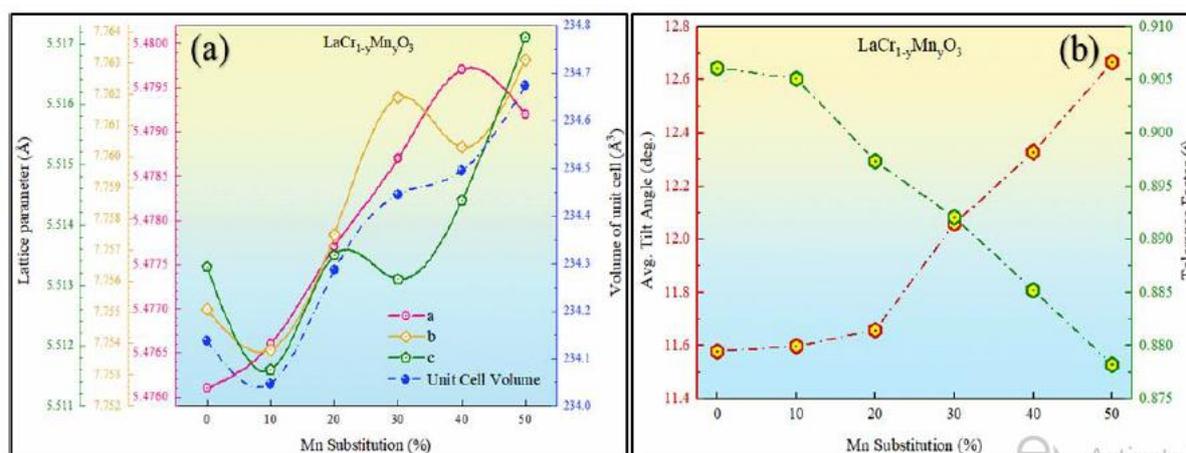
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### ABSTRACT

The study of rare-earth chromates (RCrO<sub>3</sub>) has attained the researchers' attention due to their extensive range of applications as magnetic refrigeration materials, sensors, catalysts, and multiferroic applications. An essential distortion observed in these perovskites is CrO<sub>6</sub> octahedra tilting, which motivates to engineer these materials. LaCrO<sub>3</sub> is one of the well-known perovskite-type materials having G-type AFM order. In this work, Mn substituted LaCrO<sub>3</sub> samples were synthesized using the co-precipitation technique. The as-synthesized perovskite-type LaCr<sub>1-y</sub>Mn<sub>y</sub>O<sub>3</sub> samples were characterized by x-ray powder diffraction and Raman spectroscopy. The Rietveld fitted powder XRD pattern for LaCr<sub>1-y</sub>Mn<sub>y</sub>O<sub>3</sub> samples assures the formation of the single-phase orthorhombic structure with the Pnma space group. The lattice parameter, unit cell volume, and average tilt angle increase with increasing Mn, whereas the value of tolerance factor (t) decreases. Raman spectra show a decrease in the intensity of Raman modes with increasing Mn concentration, as these modes strongly depend on the tilting of CrO<sub>6</sub> octahedra and stretching vibrations of Cr-O cations.

**Keywords:** Perovskite; Rare-earth chromate; Rietveld; Orthorhombic; Raman spectroscopy.



**Fig. 1:** (a) Variation in lattice parameter and volume of unit cell with Mn substitution. (b) Variation in average tilt angle and tolerance factor (t) with Mn substitution.

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## OP-FM-072

### Interfacial tension driven adsorption of MnO<sub>2</sub> nanoparticles at the liquid/liquid interface to tailor ultra-thin polypyrrole sheets

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## ABSTRACT

The liquid/liquid interface-assisted method represents an efficient and facile route for synthesizing two-dimensional (2-D) thin films of potential materials.<sup>1</sup> The underlying mechanism behind thin film formation at the liquid/liquid interface involves the preferential adsorption of nano-sized particles at the interface.<sup>2</sup> The spontaneous tendency of the interface to minimize high interfacial tension acts as a driving force for the adsorption and subsequent thin film formation at the interface.<sup>3</sup> Here, a water/chloroform interface-assisted method is employed for the one-pot synthesis of highly crystalline polypyrrole/manganese dioxide (PPy/MnO<sub>2</sub>) sheets. The synthesis strategy uses pyrrole as the monomer and potassium permanganate as the oxidant. The time-dependent decrease in the dynamic interfacial tension (from  $32.35 \pm 0.23 \gamma$  mN/m to  $17.63 \pm 0.62 \gamma$  mN/m) observed in pendant drop tensiometry proved the preferential adsorption of PPy/MnO<sub>2</sub> sheets at the water/chloroform interface.<sup>4</sup> The ultra-thin sheet-like morphology and uniform distribution of  $\sim 6$  nm MnO<sub>2</sub> nanoparticles were evidenced by transmission microscopy and atomic force microscopy images.<sup>4</sup> UV-Visible spectroscopy and Raman spectroscopy were employed to assess the mechanism of polymerization and interfacial adsorption of nanoparticles during the synthesis of PPy/MnO<sub>2</sub> sheets.<sup>4</sup> The predominance of interfacial polymerization in retaining the electrochemical activity of the PPy/MnO<sub>2</sub> sheets is elucidated for the electrochemical detection of nicotine.<sup>4</sup> Thus, the proposed synthesis strategy can be utilized to synthesize ultra-thin films of a wide range of multi-functional polymer nanocomposites.

**Keywords:** liquid/liquid interface; two-dimensional; interfacial tension; PPy/MnO<sub>2</sub> sheets.

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**OP-FM-075**

## Influence of Titania and Hydroxyapatite Nanoparticle Fillers on the Mechanical Strength, Physicochemical, In vitro Cytocompatibility, Antimicrobial, Hemocompatibility Properties of PVDF-PMMA Composite foam for Biomedical Applications

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### ABSTRACT

Titania and hydroxyapatite are known biomaterials which when added to polymer matrices in optimized quantities can substantially imbue biocompatibility property. In this work, titania and hydroxyapatite nanoparticles are used as fillers to imbue biocompatibility and overall mechanical strength properties to PVDF-PMMA (Polyvinylidene fluoride – polymethyl methacrylate) polymer matrix. Various quantities of nanofillers were added to the PVDF-PMMA polymer matrices and different morphologies namely, films, foams, sponges and nanofiber were prepared. The effect of each nanofiller concentration on the overall improvement in the mechanical strength, in vitro cytocompatibility, hemocompatibility, physicochemical, surface morphology, wettability, dielectric behavior, antimicrobial properties of all the prepared materials were studied using in vitro cell line assays, antimicrobial assays and various material characterization techniques. From the studies, it was found that various nanofiller concentrations affect the in vitro cytocompatibility, hemocompatibility, antimicrobial activity, tensile strength, flexural strength and the dielectric properties of all the prepared materials. It was found that, increase in the nanofiller content from 3 – 12.5 Wt.% improve the above mentioned properties of the composite foams except for mechanical strength properties. The obtained results shed limelight on using various concentrations of titania and hydroxyapatite nanoparticles as fillers for PVDF-PMMA matrices in order to engineer the above mentioned properties suitable for various biomedical applications.

**Keywords:** PVDF-PMMA, titania, hydroxyapatite, polymer matrix, mechanical strength.

**OP-FM-076**

## Highly porous superhydrophobic and superoleophilic Barium titanate functionalized carbon nanotube-polyvinylidene fluoride foam for clearing immiscible oil/solvent spill on water applications

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### ABSTRACT

Prolonged exposure of the localized oil/solvent spills on water bodies severely affects the surrounding environment and the ecosystem. Hence, rapid clearing of the oil/solvent spills on water bodies with large perimeter is a challenging task. Despite the availability of various methods and several other novel materials/organisms to clear the spills, the acute necessity of oleophilic as well as hydrophobic sorbent materials with relevant properties (porosity, mechanical stability, cost effectiveness, reusability) persists. The same shall also be regarded as need of the hour, considering the incessant oil/solvent spill incidents around the world.

Thus, in the present research work, aforementioned necessity is addressed by presenting the preparation and characterization of Barium titanate (BaTiO<sub>3</sub>) functionalized carbon nanotube (CNT)/Poly(vinylidene fluoride) (PVDF) foam with relevant properties. CNT/PVDF-BaTiO<sub>3</sub> foams were prepared by two step organic solvent free, Sodium chloride template assisted salt leaching method. The phase, structure, morphology of the prepared CNT/PVDF-BaTiO<sub>3</sub> foams were investigated using XRD, FTIR, and SEM. The found to exhibit superhydrophobic and superoleophilic properties besides good mechanical stability and high porosity. The foams were also found to be highly resistant towards Ultraviolet radiation (UV) and various corrosive (acidic, alkaline, salty) solutions. The ascertained properties of the foam suggest its optimistic usefulness as an oleophilic adsorbent in handling oil/solvent spills on water under stable as well as hostile conditions.

In the present research work, development of highly porous and hydrophobic CNT/ PVDF foam functionalized with hydrophobic BaTiO<sub>3</sub> nanoparticles and its usefulness as an oil/solvent absorbent, is discussed.

**Keywords:** CNT/PVDF; BaTiO<sub>3</sub>; hydrophobic; oleophilic; sorbent; mechanical stability.

OP-FM-077

## Influence of terminal substituents on WORM Memory behaviour of Functionalized Imidazoles

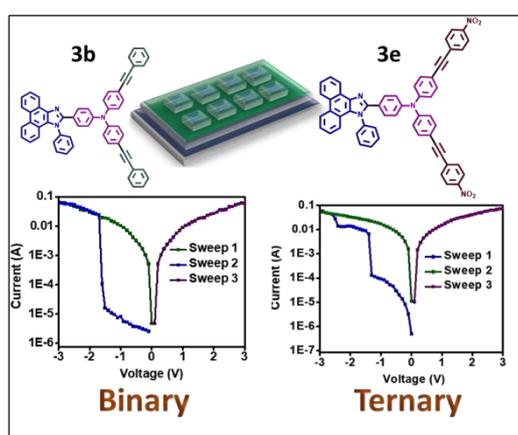
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### ABSTRACT

Resistive memory devices are a goal of future memory electronics due to their good scalability, low power consumption, and faster-switching speed. In small organic molecules, D-A (Donor-Acceptor) based system has been a key constituent for the development of non-volatile ternary memory characteristics. Herein, we have synthesized the triarylamine and imidazole-based compounds for the application of a resistive memory device application. Triarylamine was employed as a donor and imidazole were employed as an acceptor unit in the A-D- $\pi$ -D and A-D- $\pi$ -A architectures. For the comparative investigation, different terminal phenylalkynes were incorporated in the arrangement of A-D- $\pi$ -D (3a- phenyl, 3b- tert-butylphenyl, 3c-methoxyphenyl) and A-D- $\pi$ -A (3e-nitrophenyl, 3f-fluorophenyl, 3g-trifluorophenyl) based compounds. The fabricated devices ITO/3a-e/ Ag exhibited the binary (3a-d and 3g) and ternary (3e and 3f) WORM (write-once-read-many) memory behaviour. The compounds 3e and 3g displayed a very low threshold voltage of -1.31, 2.40 and 1.21, 2.29 eV with the ON/OFF ratio of 105 and exhibited good endurance (100 cycles) and retention (2000 sec) against the electrical simulations. The compounds possess higher HOMO levels ( $\sim$ 5.0 eV) and the irreversible anodic peak (0.9-1.3 V) facilitates the charge injection and less threshold voltage of the devices. Furthermore, our findings in this study provides the significance of trapping centres in the compounds on tuning the multilevel memory.

**Keywords:** Organic electronics; memory device; WORM memory; imidazole; triarylamine.



OP-FM-078

## Investigating the magnetic properties of rGO, and rGO-ZnO nanocomposite

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### ABSTRACT

In the present work, magnetic properties of graphene oxide (GO), chemically reduced graphene oxide (rGO), rGO-ZnO hybrid (RGZ) nanocomposite and ZnO nanorods have been investigated. A simple hydrolysis method is used to synthesize (RGZ) nanocomposite and ZnO nanorods. The structural and the morphological studies are performed using XRD, TEM, FTIR, TGA and FESEM. Magnetic properties of the samples have been investigated through SQUID magnetometer. The as synthesized GO, rGO samples show diamagnetic behavior with weak ferromagnetic component at room temperature (RT) while at low temperatures (10 K) these samples exhibit paramagnetic behavior with small ferromagnetic signature. As synthesized ZnO nanorods exhibit weak ferromagnetism at RT. The RGZ nanocomposite exhibits weak ferromagnetic behavior at RT and the magnetization value is found greater than that of ZnO. Moreover, RGZ nanocomposite shows higher value of magnetization than GO, rGO and pure ZnO samples at low temperatures. Further, we have investigated the zero field cooled and field cooled (ZFC-FC) temperature dependent magnetization (M-T) curves for ZnO nanorods, GO, rGO and rGO-ZnO samples at an applied magnetic field of 100 Oe. The possible mechanisms for magnetic behavior of rGO-ZnO composite are discussed and described in this manuscript.

**Keywords:** Composites; Graphene oxide; Magnetism; Transition temperature; ZnO.

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OP-FM-081

## 1D Vertically Aligned Electrically Conducting Nanostructured Diamond Cathodes for Plasma Displays

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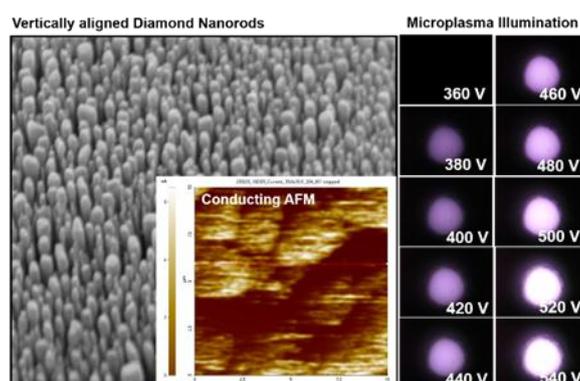
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### ABSTRACT

Displays are an essential interface in machine-based communication. There have been major developments in display technology [1,2]. In this regard, plasma displays (PDs) are very attractive for display technology. The advantages of plasma display are sharper image, wider screen option, better contrast ratios, high-definition quality, less visible motion blurs, superior uniformity, and wider viewing angle than cathode ray displays and liquid crystal displays. However, their relatively high operating voltage and poor plasma stability have limited their widespread use [3]. To mitigate these issues, several studies have been conducted to find a suitable cathode material, which possesses a high proficiency in producing secondary electrons through plasma ion bombardment for a longer duration.

In this work, vertically aligned electrically conducting microcrystalline diamond (MCD) nanorods are fabricated using the reactive ion etching method utilizing Au nanodots as masks. Superior electrical conductivity is obtained for MCD nanorods. The conducting AFM studies reveal that high emission sites are observed from the MCD nanorods. The microplasma cavities using MCD nanorods as cathode show enhanced plasma illumination characteristics of low threshold voltage of 360 V and high lifetime stability of 51.28 min. The excellent performance of the MCD nanorods as cathode for the microplasma devices is mainly attributed to the high aspect ratio of one-dimensional nanostructures and a high proportion of graphitic phase present in each nanorod. Such superior electrical properties of MCD nanorods with high aspect ratios potentially make a significant impact on the diamond-based plasma display technology.

**Keywords:** Vertically aligned nanostructure; diamond nanostructures; reactive ion etching; microplasma illumination; lifetime stability; Hall measurement of diamond.



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**OP-FM-087****Performance analysis of nickel doped ZnO self-powered photodetector under feeble light exposure**

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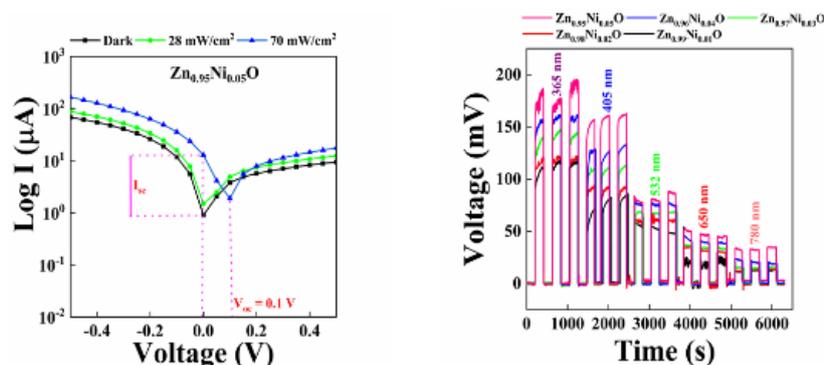
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**ABSTRACT**

In this work, a simple hydrothermal method was employed to grow nickel doped vertically aligned 1D ZnO nanorods on p-Si substrate to fabricate Ni doped ZnO/ p-Si heterostructure type self-powered photodetector. The Scanning Kelvin Probe system was employed to study the contact potential difference that arise under dark and exposure to light. The current-voltage (I-V) characteristics for all the devices showed a non ohmic behavior and it was noticed that current increased for the Zn<sub>0.95</sub>Ni<sub>0.05</sub>O device considerably at reverse bias region. The dependence of light intensity on the photocurrent response at zero bias confirm the self-powered nature of the device as shown in Figure 1 (a). Here for low light intensity, self-powered nature is over ruled. The Zn<sub>0.95</sub>Ni<sub>0.05</sub>O device exhibited a maximum I<sub>sc</sub> of 12.81 μA under 70 mW/cm<sup>2</sup> light intensity at a V<sub>oc</sub> of 0.1 V. Aiding to this self-powered nature, the broad-band absorption of the doped nanorods and p-Si combination, the detection range is observed from the UV-A and violet to red region of the visible spectrum (365–780 nm), shown in Figure 1 (b). Hence, our analysis clearly explains the applications of such heterojunctions to be used in the self-powered mode for detection of ultra violet and visible light in optoelectronic application.

**Keywords:** Nanorods; Scanning kelvin probe; Zero bias condition; Contact potential difference; Built-in electric field.



**Figure.1 (a):** Semi-log current versus voltage at dark, low and high intensity (28 mW/cm<sup>2</sup> and 90 mW/cm<sup>2</sup> respectively) for 5% Ni doped ZnO nanorods device, (b): Time evolution of the Open circuit voltage with respect to varying light wavelength for all the doped devices

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## OP-FM-090

### Impact of Yttrium Ions Substitution on the Structural, Optical and Magnetic Properties of Ni-Mg Nano Spinel Ferrite

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#### ABSTRACT

Nanocrystalline yttrium doped nickel-magnesium spinel ferrites (Ni<sub>0.65</sub>Mg<sub>0.35</sub>Fe<sub>2-x</sub>Y<sub>x</sub>O<sub>4</sub>) were synthesized via sol-gel auto combustion technique. The striking changes in the various properties of the mixed nickel-magnesium ferrite due to the incorporation of yttrium ions in the spinel lattice were investigated through characterization studies like X-ray diffraction (XRD), Fourier transform- infrared spectroscopy (FTIR), Scanning electron microscopy-Energy dispersive X-ray analysis (SEM-EDAX), UV- Visible spectroscopy (UV-Vis) and Vibrating sample magnetometry (VSM). The X-ray diffraction patterns of the synthesized magnetic ceramics indicated the formation of spinel structure with cubic symmetry and various structural parameters were also calculated from the obtained diffraction patterns. FTIR spectra showed the characteristic absorption bands of metal-oxygen stretching vibrations which also confirmed the formation of spinel ferrites. Their morphology was analyzed by SEM micrographs and their elemental compositions were revealed by EDAX. The optical properties and the impact of yttrium ions substitution on the band gap energy of the prepared nickel-magnesium ferrites were investigated through UV-Vis spectra. The magnetic

properties of the spinel nanoparticles and their dependence on the yttrium ions substitution were explored through VSM.

**Keywords:** Nanomaterials; Spinel ferrites; Yttrium doping; Sol-gel auto combustion.

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### OP-FM-105

## Preparation and Characterization of Blended Thin Films of Chitosan and Cellulose Nanocrystals from Marine Origin

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### ABSTRACT

Films reinforced with chitosan and cellulose nanocrystals (CNC) were produced using the casting process. The chitosan was extracted from *Portunus pelagicus* shells using the methodology of Kaya et al., 2015 [1,2] and the cellulose nanocrystals were prepared by using the methodology of Szymanska-Chargot et al., 2017 [3,4]. In this study the impact of plasticizers and sizing agent such as glycerol and Polyvinyl Alcohol (PVA) respectively on morphological structural, thermal and mechanical properties was investigated. The UV spectroscopy showed 65% transmittance for chitosan/PVA & glycerol films while the film of CNC/PVA & glycerol showed transmittance of 40% [5]. The transmittance of chitosan/CNC/PVA & glycerol showed 75%. The films formed by the combination of CNC/PVA & glycerol showed better stress/strain properties than other films. The films of all combinations showed good thermal stability between the ranges of 350 to 450 °C [6]. The morphological study using SEM revealed smooth texture for all the films. The films prepared with the blends of CNC/PVA & glycerol showed better transmittance and the mechanical properties were also observed to be better than the other 2 films and hence, these films can be used in application towards food packaging.

**Keywords:** Biopolymer, Chitosan, Cellulose Nanocrystals, Mechanical Property, Thermal Stability, Waste management

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**OP-FM-112****Growth and Characterization Sodium Potassium Niobate single crystals near Morphotropic phase boundaries**R.Saravanan<sup>a\*</sup>, R.Perumal<sup>b</sup><sup>a</sup>*Department of Physics, University College of Engineering, Pattukkottai, Tamil Nadu 614 701, India.*<sup>b</sup>*Division of Physics, Department of Science and Humanities, Saveetha School of Engineering, Saveetha University, Chennai 602 105, Tamil Nadu, India.***ABSTRACT**

Growth of lead free single crystals of sodium potassium niobate  $K_xNa_{(1-x)}NbO_3$  at three different phase boundary compositions ( $x = 0.17, 0.35, 0.50$ ) by high-temperature solution method has been given. The crystal structure corresponding to the compositions  $x = 0.17$  and  $x = 0.50$  exhibit monoclinic and orthorhombic structures respectively. The incorporation of  $KNbO_3$  content in  $NaNbO_3$  crystal induces ferroelectricity at lower temperatures and reduces the critical electric field required to induce ferroelectric transition. Scanning Electron Microscope (SEM) and Atomic Force Microscope (AFM) studies reveal the morphological growth pattern of the sodium potassium niobate (KNN) crystals. The average step size decreases with the increase in the concentration of potassium in KNN system. Dielectric studies were carried out on the KNN crystals using impedance analyzer. Dielectric loss was observed to decrease with increase in concentration. Piezoelectric coefficient ( $d_{33}$ ) for the compositions with potassium concentrations  $x=0.50, 0.35$  and  $0.17$  were found to be 72 pC/N, 63 pC/N and 52 pC/N respectively.

**Keywords:** Single Crystal, Scanning Electron Microscope, Dielectric Studies.

**OP-FM-171**

## Green synthesis and characterization of titanium dioxide nanoparticles using Punica granatum extract

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### ABSTRACT

Green synthesis of nanoparticles (NPs) has several potential applications in environmental and medical specialty fields. Eco-friendly green synthesis aims especially at decreasing the usage of harmful chemicals. In this research analysis paper, we focus on the synthesis of titanium dioxide (TiO<sub>2</sub>) nanoparticles from the extract of Punica granatum using the green synthesis method. The obtained TiO<sub>2</sub> nanoparticles have been characterized by Fourier transform infrared spectroscopy (FT-IR), X-ray Diffractometer (XRD), UV-Visible Spectroscopy (UV-Vis), and Scanning electron microscope (SEM) and Electron dispersive spectroscopy (EDS).

**Keywords:** Green synthesis; Punica granatum; Titanium dioxide; UV-Visible; XRD; SEM; EDS.

**OP-FM-177**

## Preparation of Magnetic Diglycolamic Acid functionalized Fe<sub>3</sub>O<sub>4</sub>@TiO<sub>2</sub> Nanocomposites

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### ABSTRACT

Iron oxides like magnetite (Fe<sub>3</sub>O<sub>4</sub>), maghemite ( $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>), and hematite ( $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>) are currently gaining attention for environment remedial applications due to their outstanding properties such as high removal capacity, excellent surface area, quick kinetics, relative low cost, and distinctive magnetic responsivity [1]. Magnetic oxides provides additional benefits for environmental safety during process operation, such as speedy separation of the adsorbent through an external magnet at the completion of the process [2]. Considering these facts, herein we report the synthesis of diglycolamic acid (DGA) functionalized Fe<sub>3</sub>O<sub>4</sub>@TiO<sub>2</sub> nanocomposites for environmental applications. The nanocomposites were prepared by a facile three step procedure. First step, is the synthesis of Fe<sub>3</sub>O<sub>4</sub> nanoparticles by co-precipitation method. Secondly, Fe<sub>3</sub>O<sub>4</sub>@TiO<sub>2</sub> nanocomposites were then synthesized by hydrothermal route. Finally, DGA functional group was then incorporated on the surface of the nanocomposites. The Fe<sub>3</sub>O<sub>4</sub>@TiO<sub>2</sub>-DGA nanocomposites was thoroughly characterized by

SEM - EDAX, VSM, XRD, BET, TG-DTA and the presence of DGA functional group was confirmed by FTIR. Functional groups with hard donor atoms such as O, N can easily form complexes with heavy metals [3]. Thus, the nanocomposite reported in the present study will definitely show high performance for the uptake of toxic heavy metals from aqueous solutions.

**Keywords:** Fe<sub>3</sub>O<sub>4</sub>, TiO<sub>2</sub>, Diglycolamic acid, nanocomposite, adsorption, heavy metals

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## OP-FM-179

### Theranostic NIR-II Responsive Immune Nanomedicine for Targeted Activation of Photothermal Immunotherapy against Heterogenic Tumor Microenvironment and Renal Clearance

Raju Vivek<sup>\*a</sup>

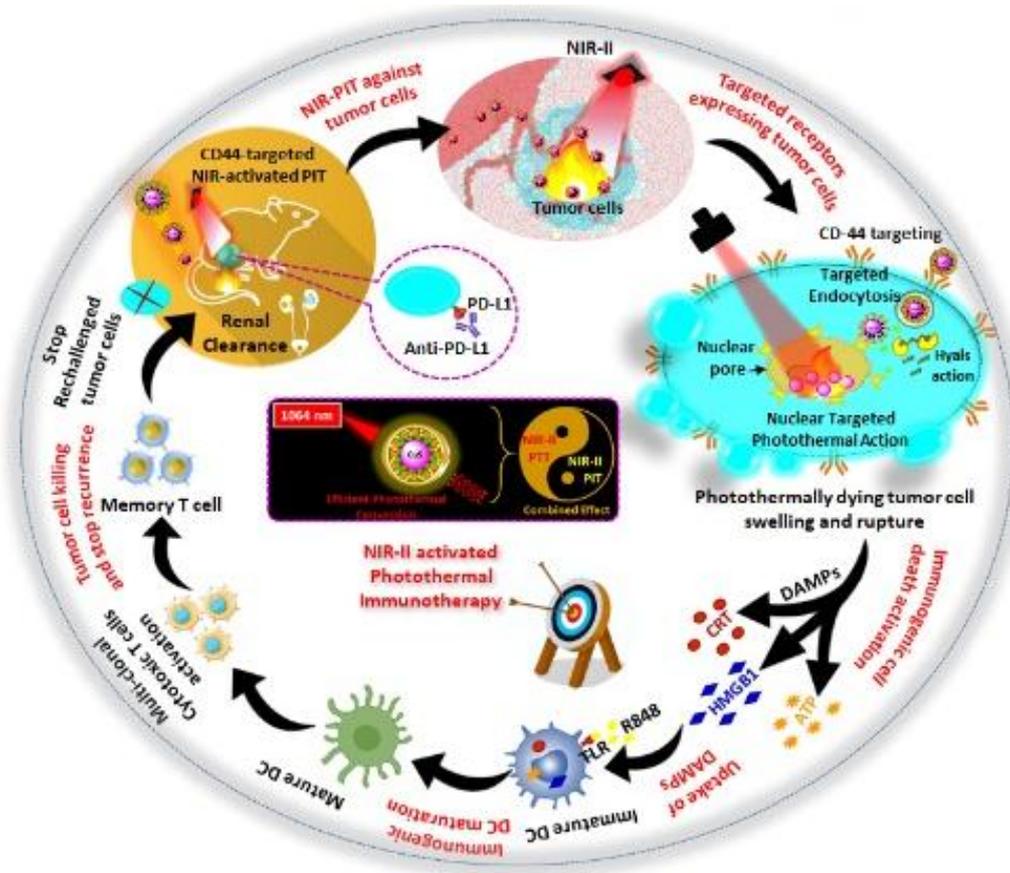
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## ABSTRACT

The ultimate goal is to meet successful cancer therapy, which is not only treating the primary tumor but also preventing metastatic tumors, therefore the concept of combining photothermal therapy (PTT) with immunotherapy is of great interest.<sup>[1]</sup> Presently, the treatment of TNBC is more challenging due to the lack of clinical markers for molecularly targeted therapies. Therefore, developing a new nanotherapeutic approach of targeted combinational therapy could be an effective alternative nano-strategy.<sup>[2,3]</sup> Hence, we designed a combination of NIR-II responsive renal clearable ultrasmall copper sulfide (CuS) particles conjugated TAT peptides decorated hyaluronan (HA) and co-encapsulated with ICG/R848 denoted as CuS-TAT-ICG/R848-HA nanocomposite (NC) that exhibited an adequate photothermal conversion efficiency (PCE) that is highly beneficial for selective CD44-mediated photothermal ablation of TNBC tumors. Furthermore, co-encapsulation of ICG/R848 (immune adjuvant) molecules also triggers an improving photothermal response against the tumor and activation of TLR7/8a agonist R848 for antitumor immune response. The formed CD44-targeted NC selectivity incinerates the CuS-TAT mediated nuclear-targeted tumor cells. With a 1064 nm laser leads to effective photothermal ablation towards specific tumor cells. Concurrently, NIR-II responsive photothermal effects further elicit effective antitumor immunity by inducing ICD at tumor tissues, wherein dying tumor cells release

distress signals of damage-associated molecular patterns (DAMPs). The co-presence of R848 and CuS causes dendritic cells maturation (DCs) to stimulate cytotoxic T cell activations, which promote an immune response. Thus, the NIR-II activated photothermal ablation combined with anti-programmed death-ligand 1 (aPD-L1) immunotherapy is a promising therapeutic platform for effective targeted immunotherapy and had great potential for cancer therapy.

**Keywords:** Near-infrared-II; Nanomedicine; Photothermal therapy; Immunotherapy; Cancer



**Fig. 1:** Schematic depiction of the NIR-II dependent photothermal ablation for cancer immunotherapy.

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**OP-FM-426****Sprague Dawley Rat animal Using Wound Healing Activity of Silk Fibroin/gelatin Composite Nanofiber Incorporated the Silver and gold Nanoparticles**

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**ABSTRACT**

Nowadays, electrospun assisted fabrication of composite nanofiber matrix has been proposed for a variety of biomedical applications including wound healing, drug delivery, tissue engineering, and bone regeneration. The silk fibroin and gelatin materials are highly biocompatible behaviour it hence easily enhanced in terms of biological activity. The fabrication of composite nanofiber morphological studies for analysis by scanning electron microscopy (SEM,) and transmittance electron microscopy (TEM) microscopic images. The SF/GL/Ag-Au composite nanofiber matrix average diameter size at the inter-layer length of 220.85±82.65nm. The X-ray photoelectron (XPS) spectrum was identifying the element presented in C1s, N1s, O1s, Ag3d, and Au4f and also binding energy of carbon were observed at 284.68eV, nitrogen at 399.93eV, oxygen at 531.89 eV, silver at 366.36eV, and gold at 83.13 eV. The fabrication of SF/GL and SF/GL/Ag-Au composite nanofiber was used in male sprague dawley rat animals was analyzed by invivo studies for wound healing activity. The wound healing was treated in three different groups as well as Group A (Control), Group B (SF/GL), and Group C (SF/GL/Ag-Au). The wound healing dressing material of composite nanofiber matrix was used as the positive control, while medical gauze was used as the negative control. Additionally, histopathological staining of hematoxylin and eosin for wound healing is extremely beneficial for a rapid response to tissue regeneration and reepithelization. Finally, this finding indicates that the SF/CL/Ag-Au composite nanofiber matrix made an excellent wound dressing material, and also effective for all biomedical applications.

**Keywords:** Nanofiber; silk fibroin; gelatin; silver with gold nanoparticles; wound healing activity.

**OP-FM-433****Synthesis of polyanion interleaved MgAl-PSS-LDH composites and their evaluation of Ni<sup>2+</sup> sorption performance**

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<sup>b</sup> *Academy of Scientific and Innovative Research (AcSIR), Ghaziabad 201002, Uttar Pradesh, India.*

**ABSTRACT**

Layered double hydroxide (LDH) polystyrene-4-sulfonate nanocomposites were prepared by restacking delaminated LDH nanosheets under hydrothermal conditions by two different methods (i) direct intercalation of polystyrene-4-sulfonate (PSS) and styrene-4-sulfonate (SS), and (ii) in-situ polymerization of SS. The intercalation and interaction between the PSS and the nanosheets of the layered double hydroxides were evaluated using different physicochemical techniques such as powder X-ray diffraction (PXRD), Fourier-transformed infrared (FT-IR) spectroscopy, <sup>13</sup>C, and <sup>27</sup>Al CP/MAS-NMR and thermogravimetric methods. Thus prepared LDH/PSS nanocomposites were subjected/utilized for the adsorption of Ni<sup>2+</sup>. It demonstrated that the LDH/PSS composite synthesized by in-situ polymerization method using APS (ammonium persulfate) initiator showed higher Ni<sup>2+</sup> uptake of 49.5 mg/g than direct polymer intercalated LDH/PSS composites (45 mg/g) from aqueous solution. This composite material removes Ni<sup>2+</sup> from both aqueous and organic mediums. This encouraging result shows that the LDH/PSS composites could be utilized for the removal of cations from aqueous solutions.

**Keywords:** layered double hydroxide; delamination; polymer composite; polymer intercalation; in-situ polymerization; nickel uptake.

**OP-FM-434****Growth and Optical characterization of a novel organic single crystal: 4-Methylanilinium trichloroacetate**

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**ABSTRACT**

4-Methylanilinium trichloroacetate (4MATCA) an enhanced NLO material was synthesized and single crystal was grown by slow evaporation method. Crystal structure and crystalline

perfection of 4MATCA were studied and interpreted from XRD studies. UV-Visible transmittance, Bandgap energy, Photoluminescence (PL) and Laser damage threshold (LDT) studies were performed on grown material to ascertain its optical diligence. Nonlinear optical parameters of 4MATCA crystal were estimated by Z-scan test.

**Keywords:** Crystal growth, XRD, FTIR, Optical properties.

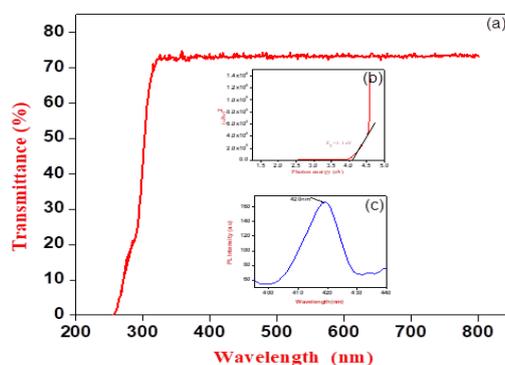


Fig. 1: (a) UV-Vis transmission (b) Bandgap and (c) PL spectrum of 4MATCA crystal.

#### OP-FM-444

### Sol-gel auto-combustion produced $\text{Ni}_{1-x}\text{Cd}_x\text{Fe}_2\text{O}_4$ nanoparticles: Nelson-Riley, W-H plot and BET analysis

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#### ABSTRACT

In this paper, citric acid ( $\text{C}_6\text{H}_8\text{O}_7$ ) assisted sol-gel auto-combustion approach was used and  $\text{Ni}_{1-x}\text{Cd}_x\text{Fe}_2\text{O}_4$  nanoparticles were effectively created. Using the powder X-ray diffraction technique, the phase purity and structural characteristics were examined, and it was shown that the primary reflections (220) and (311) conform to the single-phase cubic spinel structure. The Nelson-Riley extrapolation function was applied for calculating a linear regression in the lattice constant. The crystallite size ( $t$ ) was calculated by employing Debye-Scherrer's formula was found in the range of  $\sim 22.81$  nm. From the Brunauer–Emmett–Teller analysis, the surface area of the  $\text{Ni}_{1-x}\text{Cd}_x\text{Fe}_2\text{O}_4$  nanoparticles was found to be in the range of  $\sim 10$  m<sup>2</sup>/gm to  $\sim 20$  m<sup>2</sup>/gm. Precisely, the Williamson–Hall plot and size–strain plot was drawn to estimate the peak broadening in  $\text{Ni}_{1-x}\text{Cd}_x\text{Fe}_2\text{O}_4$  nanoparticles.

**Keywords:** Solgel; Nanoparticles; Nelson-Riley; W-H plot; BET analysis;

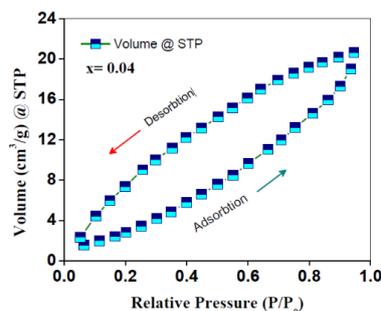


Fig. 1: The BET isotherm for  $\text{Ni}_{1-x}\text{Cd}_x\text{Fe}_2\text{O}_4$  nanoparticles

### OP-FM-446

## X-ray diffraction study of $\text{Co}_{1-x}\text{Cu}_x\text{Fe}_2\text{O}_4$ ( $x = 0.15$ ) produced by the standard double-sintering solid state reaction

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### ABSTRACT

In this investigation, Co-Cu ferrites with the general formula  $\text{Co}_{1-x}\text{Cu}_x\text{Fe}_2\text{O}_4$  ( $x = 0.15$ ) was prepared utilizing the conventional double-sintering solid state reaction procedure at the pre-sintering range  $800\text{ }^\circ\text{C}$  for 12 h and double-sintering at  $1100\text{ }^\circ\text{C}$  for 16 h to determine their structural features.  $\text{Co}_{1-x}\text{Cu}_x\text{Fe}_2\text{O}_4$  was verified to exist as a single phase with cubic geometry, spinel structure, and ferrite phase by XRD. The crystallite size ( $t$ ) was discovered to be between 32.21 nm. The X-ray density ( $d_x$ ) of the prepared sample was recorded to be  $8.5703\text{ gm/cm}^3$ . The lattice parameter ( $a$ ) was determined to be  $8.3572\text{ \AA} \pm 0.002\text{ \AA}$ , which is close to the reported literature. The structural parameters bulk density, X-ray density, porosity, cation distribution, bond length, and hopping length of the tetrahedral (A) site and octahedral [B] site were estimated using the XRD pattern. The IR shows that the unique ferrite bonds were confirmed. The average crystalline size was calculated using Scherrer's formula. The Infrared spectra has supported the XRD data and confirmed the formation of ferrite phase with the help of obtained intrinsic and extrinsic vibrational peaks. The SEM analysis has suggested the fused particles throughout with an averagely distributed size.

**Keywords:** Ferrite; XRD; Structural Property; Infrared spectra; SEM;



Fig. 1: Synthesis of the  $\text{Co}_{1-x}\text{Cu}_x\text{Fe}_2\text{O}_4$  ( $x = 0.15$ ) using double-sintering solid state reaction procedure.

### OP-FM-455

## Synthesis and materials characterization studies of a new $\text{TiO}_2$ dispersed sodium ion conducting nanocomposite polymer electrolytes

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### ABSTRACT

Synthesis and materials characterization studies of a new  $\text{Na}^+$  ion conducting nanocomposite polymer electrolytes (NCPEs):  $(1-x) [75\text{PEO}:25\text{NaPO}_3] + x \text{TiO}_2$ , where  $0 < x < 18$  wt.%. are reported. The present NCPEs have been synthesized using a recently developed hot-press technique in place of the traditional solution-cast method. Two orders of conductivity enhancement have been achieved after the dispersion of nano filler  $\text{TiO}_2$  in the pure host polymer: (75PEO:25NaPO<sub>3</sub>). The maximum ionic conductivity ( $\sigma \sim 2.3 \times 10^{-5} \text{ S.cm}^{-1}$ ) have been obtained at the composition:  $[95(75\text{PEO}:25\text{NaPO}_3) + 5 \text{TiO}_2]$  and this has been referred to as optimum conducting composition (OCC). Material characterizations have been done with the help of X-ray diffraction (XRD) and scanning electron micrograph (SEM) analysis. The ionic conductivity enhancement in NCPEs has been discussed with the help of ionic mobility ( $\mu$ ), mobile ion concentration ( $n$ ) and ionic transference number ( $t_{ion}$ ) measurements. To compute the activation energy ( $E_a$ ) value of NCPE OCC, temperature dependent ionic conductivity measurement has been carried out.

**Keywords:** Nanocomposite polymer electrolyte; XRD; SEM; ionic transference number; activation energy.

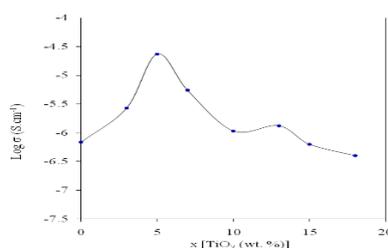


Fig. 1: 'Log  $\sigma$ -x' plot for hot-pressed NCPEs:  $(1-x) [75\text{PEO}:25\text{NaPO}_3] + x \text{TiO}_2$ , where  $0 < x < 18$  wt.%.

**PP-FM-122**

## Bioinspired green synthesis of CaO nanoparticles & their application: a critical review

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### ABSTRACT

In the recent Era, green synthesis become the most popular in the research and the green synthesis of the metal and non-metal oxides. Among all the nanoparticles, Calcium Oxide is become the most popular and gaining more records in the many applications. There are so many physical and chemical method which can be used to identify different morphology of metal oxides but it can be disused due to their toxic nature. For now, green synthesis plays a very important role in shaping the environment with no toxicity and also make use of pollution free chemicals. Now a days CaO NPs can be synthesized by the green technology (plant extract, biomolecules etc.), and its properties can be identified through analytical techniques. This review also clear that the synthesis of CaO NPs their properties, application and various use in the environment.

**Keywords:** Green Synthesis, Nanoparticles, Cao, Plant Extract, Antimicrobial Activity.

**PP-FM-223**

## A protein based transient and non-volatile memory device

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### ABSTRACT

Biodegradable and transient nature of green electronics has got its momentum in recent decades with a vast application towards the bioelectronic devices with a sustainable solution towards hazardous e-wastes. In this research work we employed a biocompatible material Protamine Sulfate (PS) as the active layer to design resistive switching memory device having device structure Au/PS/ITO. Interestingly the device showed transient, WORM memory behavior. It has been observed that the WORM memory performance of the device was very good with high memory window ( $4.57 \times 10^3$ ), data retention (experimentally  $> 10^6$  s, extrapolated  $> 10^8$  s), device yield ( $\sim 87.5\%$ ), read endurance ( $> 3.6 \times 10^4$ ), device stability ( $> 210$  days). Bias induced charge trapping followed by conducting filament formation was the key behind such switching. Transient behavior analysis showed that electronic as well as optical behaviour were completely disappeared after 8 minutes' dissolution of the device in aqueous solution. As a whole this work suggests that PS based WORM memory device could play a key role for the development of designing biodegradable transient memory device.

**Keywords:** Biodegradable, Green Electronics, WORM, Resistive switching, Protamine Sulphate.

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**PP-FM-224**

## Adsorption of uranium from aqueous medium using g-C<sub>3</sub>N<sub>4</sub>-acid treated/TiO<sub>2</sub> nanocomposite

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<sup>b</sup>Department of chemistry, Sri Sivasubramaniya College of Engineering, Kalavakkam, Tamilnadu, India.

### ABSTRACT

Herein, we report the adsorption capacity of Uranium (VI) from aqueous medium by using g-C<sub>3</sub>N<sub>4</sub>-acid treated/TiO<sub>2</sub> nanocomposite. The g-C<sub>3</sub>N<sub>4</sub> and TiO<sub>2</sub> nanomaterials were synthesized via heat treatment and solvothermal methods respectively. Further, the synthesized was acid treated i.e., HNO<sub>3</sub> and then nanocomposite adsorbent (TiO<sub>2</sub>+ acid treated g-C<sub>3</sub>N<sub>4</sub>) was prepared by mixing equal quantity of TiO<sub>2</sub> and acid treated g-C<sub>3</sub>N<sub>4</sub>. This nanocomposite adsorbent was thoroughly characterized by XRD, FTIR, UV-VIS and FE-SEM. The adsorption of uranium on the nanocomposite adsorbent was investigated as function of contact time at different temperature, equilibrium pH, and adsorbent dosage. The results showed that, the maximum adsorption of U(VI) observed at pH 6. Moreover, temperature kinetic data reveals that U (VI) adsorption on g-C<sub>3</sub>N<sub>4</sub>-acid treated/TiO<sub>2</sub>nanocomposite is endothermic in nature and kinetic data best fitted with pseudo second order kinetics. The equilibrium adsorption capacity of g-C<sub>3</sub>N<sub>4</sub>-acid treated/TiO<sub>2</sub>nanocomposite for U(VI) calculated from kinetic experiment (79.6 mg g<sup>-1</sup>) is very close to pseudo second order kinetics model (78 mg g<sup>-1</sup>) at 323K . The kinetics of U(VI) adsorption on nanocomposite as a function of temperature and kinetic parameters derived by fitting kinetic data using four kinetics models such as pseudo first order, pseudo second order, Elovich and intra-particle diffusion model are discussed in details in this paper.

**Keywords:** Nanocomposite, Uranium, Adsorption, Kinetic, Carbon nitride, TiO<sub>2</sub>.

PP-FM-230

## Biosynthesis of MnSO<sub>4</sub> doped CeO<sub>2</sub> nanoparticles – electrochemical studies and antibacterial mechanism

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### ABSTRACT

Greener approaches of mixed oxide ceramic nanomaterial synthesis are the focus of recent developments. Cerium Oxide nanoparticle (Nanoceria) has a wide range of applications in different fields, especially in catalysis, opto-electronic devices, and biomedical division. As, a matter of concern, it has a major impact on human health and environment. The aim of this work is to address the doping of Manganese sulphate (MnSO<sub>4</sub>) in CeO<sub>2</sub> nanoparticles, by green synthesis method followed by characterization and the application for Electrochemical studies and antibacterial activity. The MnSO<sub>4</sub> doped CeO<sub>2</sub> nanoparticles has been inspected by powder X-ray diffraction (PXRD), Scanning electron microscopy (FE-SEM), FTIR Spectroscopy, UV-Visible spectrophotometer (UV-Vis) for optical studies. The cubic fluorite structures of the CeO<sub>2</sub> nanoparticles were determined by XRD with average crystallite size 'D' of 18nm for undoped CeO<sub>2</sub> and 17nm 15nm 14nm and 12nm for different concentrations of Mn-CeO<sub>2</sub>. FE-SEM images displayed the prepared nanoparticles which has a cube structure and uniformly allocated with small clusters. The structural bond vibrations with intense bands confirmed the existence of CeO<sub>2</sub> phase were analyzed by FTIR spectroscopy. Optical activity of synthesized sample was measured, which shows strong UV absorption from 200-1200nm. From the optical spectrum, band value was calculated. The capacitive characteristics were analyzed by Cyclic voltammetry (CV) which deliver outstanding capacitance value of 479 F g<sup>-1</sup> at a scan rate 10 mV/s. MnSO<sub>4</sub> doped CeO<sub>2</sub> NPs also resulted good antibacterial activity against pathogenic bacteria.

**Keywords:** MnSO<sub>4</sub> doped CeO<sub>2</sub>, Nanoceria, FESEM, UV spectroscopy, Cyclic voltammetry (CV), Antibacterial activity.

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PP-FM-246

## Structural Investigation of Sm and Sn Doped BaTiO<sub>3</sub>

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### ABSTRACT

(Ba<sub>0.9</sub>Sm<sub>0.1</sub>) (Sn<sub>0.05</sub>Ti<sub>0.95</sub>) O<sub>3</sub> (BSSTO) ceramics were prepared by solid state reaction route and sintered at 1673 K. The BSSTO thin film was prepared by electron beam evaporation technique by using the sintered pellets. X-ray diffraction of the BSSTO investigated and confirmed the material has formed crystalline nature and also in single phase. Raman spectroscopy was used to study the morphology, structural and phase transition behaviour of BSSTO bulk as well as thin film. The Raman analysis indicated that the film formed at 973 K by electron beam evaporation is less crystalline than that of the bulk BSSTO.

**Keywords:** BaTiO<sub>3</sub>, Structural properties, E-beam evaporation technique.

PP-FM-259

## Enhancement of an environmentally friendly polymer rubber hybrid composite

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### ABSTRACT

Natural rubber's (NR) adaptability as an elastomer is crucial in the contemporary environment. It is crucial to reinforce elastomers with fillers that have many functions in order to enhance their distinctive features. In the current investigation, butadiene and styrene-butadiene by using a two-roll mixing hydraulic press under specific operating conditions, rubber-reinforced natural rubber hybrid composites were created. Additionally, filler loading in natural rubber (NR) was demonstrated for the creation of rubber composites. They were looked into in terms of morphological research and mechanical qualities. The findings

demonstrated that when WTR loading increased, tensile strength and elongation at break dropped. With WTR loading, the tensile modulus and hardness significantly increased.

**Keywords:** Ground Tyre Particles, Natural Rubber Composite Material, And Mechanical Qualities; Morphological Studies.

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**PP-FM-267**

## Investigation on testing and analysis of polypropylene fibre under tensile

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### ABSTRACT

An extensively used thermoplastic polymer is polypropylene (PP). Premature failure of polymers and polymer composites is caused by the development of cracks and microcracks during the course of their lifetime. A material failure caused by the development of cracks and microcracks could be disastrous. To ensure the performance reliability, cost-effectiveness, and safety of polymer constructions, cracks and microcracks must be found and effectively repaired. This article examines the most recent methods for detection and observation and focuses on the beginning and growth of cracks in polypropylene structures. Due to its weak fracture behaviour, its usage as an engineering thermoplastic is somewhat constrained. Among scientists, there is still disagreement over the failure mechanism. This is because polypropylene fractures are complicated. Through the use of three-point bending tests, the fracture mechanism of polypropylene has been investigated in this work. The outcome of a three-point bending test reveals the presence of a large damage zone in front of the notch. Due to the significant plastic zone that is present in the area around the fracture tip, the elastoplastic fracture mechanics technique will be used.

**Keywords:** Polypropylene, Cracks, Three-Point Bend, Elasto Plastic Fracture Mechanics.

PP-FM-270

## Synthesis and characterization studies of glycine 4- nitrophenolate crystal doped with nickel chloride

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### ABSTRACT

Crystals with nonlinear optical characteristics have wide applicability in laser optics and communication. Glycine - 4- Nitrophenolate crystals doped with Nickel chloride were synthesized from the aqueous solution by using a slow evaporation technique at constant temperature. The various characterisation studies were carried out for the crystal synthesised using the proposed approach. The crystallinity nature of doped synthesised crystals were determined using XRD Pattern. The existence of different functional groups for this synthesised crystal was observed with the help of Fourier Transform Infrared Spectroscopy (FTIR) which is in the range of 500-4000  $\text{cm}^{-1}$ . The synthesized crystal also exhibits good optical transmittance which was examined using ultraviolet and visible (UV-Vis) absorption spectroscopy. The band gap energy was calculated to be 3.37 eV. The thermal stability characteristics of the complex Glycine - 4- Nitrophenolate crystals doped with Nickel chloride crystals were studied using thermogravimetric analysis (TG) and differential thermal analysis (DTA) and it was noticed that it is stable up to 230°C. The SEM studies were also carried out to study the morphology of this synthesised crystals. Thus, synthesized crystals exhibits favourable features for nonlinear optical applications observed from the characterization studies.

**Keywords:** Glycine - 4- Nitrophenolate, UV-Vis, TG-DTA, SEM, FTIR, Powder XRD.

PP-FM-271

## Fabrication of Eu<sup>3+</sup> doped SrS: A View on Structural, Morphological, and Hemocompatibility Properties

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### ABSTRACT

Three different concentrations of Strontium Sulphide nanocrystals (Sr<sub>1-x</sub>Eu<sub>x</sub>S, where x = 0, 0.01, and 0.02) doped with europium were synthesized in the current work using the simple and easy sol-gel technique. Powder X-ray diffraction tests verified the monoclinic structure of the material with the space group of C2/c. Calculations were made for structural factors such as lattice strain, dislocation density, morphological index, crystallite size, and crystallinity.<sup>[1]</sup> The crystallinity and morphological index increase together with the increase in europium content, whereas the lattice strain and dislocation density decrease. Thus, the structural metrics indicate that europium doping enhanced the crystalline nature of the samples. The morphology was examined using AFM analysis. The AFM images revealed that the sample had distinct and well-defined faces. The roughness parameters decreased with an increase in dopant concentration, which supported the PXRD results. The monoclinic structure shown in the AFM image confirmed the PXRD findings, and the average grain size was determined to be 131.02nm.<sup>[2]</sup> To ensure that the samples were biocompatible, the hemocompatibility test was conducted.<sup>[3]</sup> The percentage of hemolysis inhibition rises as dopant concentration rises. The Hemocompatibility test findings confirmed that the samples were biocompatible.

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## PP-FM-272

**Crystal growth and UV-visible spectrophotometer, FT-IR spectrophotometer, TG-DTA, SEM-EDAX, P-XRD, optical image, characterization of pure and l-tryptophan doped zinc bithiourea sulphate (ZBTS) crystal**

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**ABSTRACT**

The pure and L-Tryptophan doped Zinc Bis Thiourea Sulphate (ZBTS) crystals were grown successfully by slow evaporation method at room temperature. The nonlinear optical material of crystal L-Tryptophan doped zinc Bis (Thiourea) sulphate (ZBTS) were grown. The grown crystals were subjected to various studies such as UV-Visible spectra, FTIR, thermal analysis (TG-DTA), SEM-EDAX spectra, and Powder X-ray diffraction. The optical properties of (ZBTS) were determined by UV-Visible spectral studies. The functional group of L-Tryptophan doped ZBTS crystals were observed and recorded by FTIR analysis. The presence of functional groups like as C-S stretch, N-H plane in bend, C-N stretch, N-H stretch, C-O asymmetric stretch, N-O stretch, C=S stretch, N-H asymmetric stretch etc., were revealed by FTIR analysis. The TG-DTA studies shows that the (ZBTS) has good thermal stability up to 220 with the major weight loss 98% is observed in the temperature ranges 210°C-310°C. Powder X-ray diffraction analysis to confirm the crystallization of the synthesized materials and to determine its unit cell parameters. The crystalline nature and purity of the grown crystals are confirmed by powder X-ray diffraction pattern. It is examined using XRD studies powdered crystals the values of hkl, relative intensity and 2θ values for the reflection peaks of the powder XRD pattern are given. This is the most desirable property of the crystals used for nonlinear optical application. Scanning electron microscope study reveals that the grown crystals are of good quality with layer like structure. The effect of L-Tryptophan doping on the morphology of the ZBTS crystals has been studied.

**Keywords:** ZBTS Crystal, Optical image microscope, UV-Visible Spectrophotometer, Fourier Transform –Infra Red Spectrophotometer, SEM-EDAX, TG-DTA, P-XRD.

PP-FM-273

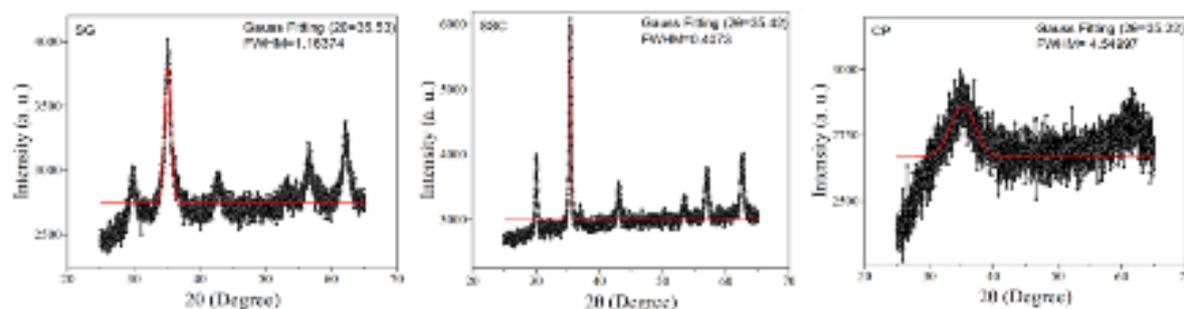
## Synthesis and characterization of nanoparticles via bottom-up methods

Athira Suresh<sup>a</sup>, Mary Metilda<sup>b</sup>, L S Kaykan<sup>c</sup>, Julia Mazurenko<sup>d</sup> and Sijo A K<sup>b</sup><sup>a</sup>Department of Physics, Devaswom Board Pampa College, Parumala, 689626, India.<sup>b</sup>Department of Physics, Mary Matha Arts and Science College, Mananthavady, 670645, India.<sup>c</sup>Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk 76018, Ukraine.<sup>d</sup>Ivano Frankivsk National Medical University Halytska, Ivano-Frankivsk 76018, Ukraine.

### ABSTRACT

Nanosized ZnFe<sub>2</sub>O<sub>4</sub> powder has been prepared by bottom-up methods such as sol-gel, solution self-combustion, and co-precipitation methods. Citric acid is used as fuel. The structural properties of the samples were studied by a Rigaku Mini Flex X-ray Diffractometer using the Ni filter with Cu K<sub>α</sub>-radiation. XRD pattern provided clear evidence of the formation of ferrite spinel phase in samples synthesized by sol-gel technique and solution combustion method. The broad XRD peak indicates that the ferrite particles are of fine nano-size. The crystallite size of the samples was calculated using the Scherer formula as well as Rietveld fitting within 3-35 nm.

**Keywords:** Nanoparticle synthesis, Bottom-up methods, X-ray spectroscopy, Nanomagnetism.



**Fig.1:** XRD pattern of ZnFe<sub>2</sub>O<sub>4</sub> synthesized by sol-gel (SG), solution-self combustion (SSC), and co-precipitation (CP) methods.

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**PP-FM-277**

## Silver functionalized titania nanoparticles reinforced PMMA based nanocomposite denture base material with clinically relevant properties for dental implant application

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### ABSTRACT

Poly (methyl methacrylate) (PMMA) is useful as a denture material and several other implant developing materials in dentistry. Yet, the properties of pristine PMMA denture base is far away from being regarded as the implant material in dentistry with ideal clinically relevant properties (phase, structure, surface morphology, high mechanical strength, fluid absorption-retention, antifungal, biocompatibility, antibiofilm formation properties). In the present research work, Silver (Ag) functionalized titania (Ag-TiO<sub>2</sub>) nanoparticles and powder PVDF (Polyvinylidene fluoride) as binding agent are used to reinforce pristine PMMA to obtain a nanocomposite denture base material for developing test specimens (as per ISO standard) and dentures (prototypes). The physicochemical, surface morphology and mechanical strength characterizations of the test specimens and dentures reveal that the developed nanocomposite denture base material have significantly improved above mentioned properties, compared to pristine PMMA and commercially available reinforced PMMA denture base materials. The nanocomposite is tested to resist growth of *Candida albicans*. The results indicate that the intrinsic properties and the optimal nanofillers concentration in the PMMA matrix are passively responsible for the enhanced properties. To conclude, our study justifies the usefulness of the material in developing lightweight dentures and other dental implants with high mechanical strength and antifungal properties.

**Keywords:** Ag-TiO<sub>2</sub>; reinforced; Nanocomposite; Denture Base; Mechanical Strength; Antifungal.

PP-FM-280

## Evaluation of ankle foot orthosis using experimental and computational methods (AFO)

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### ABSTRACT

The human ankle, which supports the rest of the body, is the most important part of the body. A device known as an ankle foot orthosis (AFO) stretches from the knee to the heel and supports the ankle and foot areas. AFO is utilised to control instability in the lower limb of the human body by maintaining precise ankle alignment and controlling body motion. The first component of this study focuses on creating an ankle foot template mould using 3D printing, and the second aspect deals with creating an actual ankle foot orthosis (AFO) model out of glass fibre for those who have partially lost a foot due to diabetes, war veterans, or vascular deficiencies. In the test rig, various loading conditions were applied to the real Ankle Foot Orthosis made. The model was designed using Unigraphics in the second aspect, and it was analysed using ANSYS 16.0. The load was applied to the foot portion, and the heel was fixed, because the foot was thought of as partially severed. Using a vernier calliper in the test rig, the findings of deformation on the heel and toe were evaluated and measured. For 200 N and 600 N loads, the deformation was measured at the toe and heel. Both analytical and experimental evaluations of the deformation were found to be positive. For those who have had their feet amputated, the AFO model consisting of glass fibre aids in the restoration of their natural gait cycle. In the present study, it was discussed how inexpensively and quickly an orthosis may be produced in a developing nation.

**Keywords:** FO (Foot Orthosis), Foot Plate, Composite Materials, AFO (Ankle Foot Orthosis), Glass Fiber.

**PP-FM-284**

## Toxicity and teratogenicity investigation of methanolic bark extract of terminalia arjuna (ROXB) wight & arn in zebrafish (*danio rerio*) embryo model

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### ABSTRACT

The present research work aims to establish the teratogenic effect of the T.arjuna bark extract using fish embryos through zebrafish embryo model. In the present study, selected Zebrafish embryos were exposed to a range of methanolic extract of T.arjuna bark and the changes the embryos undergo were identified by comparing with an untreated control group. The embryo toxicity was assessed by observing morphological abnormalities after 24, 48, 72 and 96 hours exposure and end teratogenicity points were assessed after 48 h exposure. All the embryos were imaged and analyzed for various developmental anomalies such as coagulated embryos, lack of somite formation, non-detachment of the tail, and lack of heartbeat, image analysis was done using imagej software. From the results obtained, it was found that the embryos exposed with 10 mg/L of T.arjuna showed regular developmental patterns similar to untreated control upto 72 h. 5% mortality was observed post 72h period. 50 and 100 mg/L showed 100 % mortality after 96 h and 72 h respectively. At 48 h, Embryos treated with 50 mg/L of T.arjuna showed 5.58% decreased heart beat rate, 7.89 % of decrease in eye diameter decreased head trunk angle of 3.56 % and increased yolk sac width of 0.79%. After 48 h exposure to 50 and 100 mg/L of T.arjuna extract, 45% and 85% of the embryos showed the teratogenic endpoint of coagulation respectively with bent tail. Increased yolk sac width was observed in 100 mg/L treated embryos with 1.01% after 24h, also at 48 h decreased heart beat rate of 4.02%,16.8% of increased eye diameter, with decreased head trunk angle of 2.35%, decreased yolk sac width of 5.13% were observed. After 48 h exposure of T.arjuna bark extract, the morphological, physiological changes and teratogenic end points were eminent in 50 and 100 mg/L treated embryos, thus the results signify that methanolic bark extract of *Terminalia arjuna* possess teratogenic effects at this concentration in zebrafish embryos.

**Key words:** Zebrafish, Teratogenicity, Larvae, Embryo, Terminalia.

**PP-FM-288****Green synthesis of magnesium – zinc nano ferrites ( $Mg_{0.5}Zn_{0.5}Fe_2O_4$ ) using *azadirachtaindica* (NEEM) leaf extract**

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**ABSTRACT**

The spinel ferrite having composition  $Mg_{0.5}Zn_{0.5}Fe_2O_4$  was successfully synthesized by green synthesis method using *Azadirachtaindica* (Neem) leaf extract. XRD (X-Ray Diffraction) spectroscopy confirmed the formation of single phase spinel cubic ferrites. Various XRD parameters were calculated using most intense peak i.e. characteristic peak (311). SEM (Scanning Electronic Microscope) images showed agglomeration and cluster formation in the sample. FTIR (Fourier Transform Infra-Red) spectroscopy showed bands at about  $600\text{ cm}^{-1}$  and  $400\text{ cm}^{-1}$  due to intrinsic stretching vibrations of metal ions at tetrahedral and octahedral sites respectively. The absorbance from UV-Visible spectroscopy around 310 nm and optical band gap near 2.32 eV were obtained.

**Keywords:** Spinel; Ferrite; SEM; FTIR.

**PP-FM-290****Effect of EVA-TiO<sub>2</sub> composite interfacial buffer layer in improving the bond strength between PMMA denture base and PDMS liner**

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**ABSTRACT**

Denture liners are often used with acrylic dentures to offer comfort to patients with ridge atrophy, thin-non resilient mucosa, bony undercuts. It is also used in tissue conditioning during implant healing and for patients with bruxism and xerostomia. A strong bond between the denture base and the liner is a must, for the proper functioning and the longevity of the prosthesis. Polydimethylsiloxane (PDMS) is the most common dental liner that is used with acrylic dentures. Debonding of the liner may occur due to an inefficient bond to the denture, or low cohesive strength. The PDMS liners suffer debonding from the acrylic denture surface due to increased wettability/hydration and water/liquid storage-retention properties. The

increased wettability/hydration pass on the moisture to the acrylic boundary surface causing initiation of debonding. Hence, in order to prevent the debonding due to wettability/hydration a novel method of introducing a hydrophobic polymer interfacial buffer layer between the acrylic denture surface and the PDMS liner surface is suggested. In, the present research work, ethylene vinylacetate (EVA) reinforced with titania (TiO<sub>2</sub>) polymer composite layer is prepared by solution casting method. The thin polymer film is placed between the acrylic denture surface and the PDMS liner surface and heat cured together to obtain a hydrophobic interfacial buffer layer. Wettability, fluid absorption and retention tests were performed to investigate the hydrophobic properties of the composite interfacial buffer layer. Mechanical strength properties on the prepared specimen (as per ISO 178) revealed that the EVA-TiO<sub>2</sub> layer offered superior bonding and also improved the overall mechanical properties of the acrylic dentures without disturbing the mass and density of the denture.

**Keywords:** EVA-TiO<sub>2</sub>, debonding, hydrophobic, wettability, ISO 178, mechanical strength.

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**PP-FM-293**

## Synthesis, characterization, and antibacterial activity of silver nanoparticles (AGNPS)

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### ABSTRACT

Inorganic nano-metals can be effective alternatives to drug-resistant organic antibiotics due to their broad-spectrum antimicrobial activity against pathogenic gram-negative bacteria. In this study, silver nanoparticles (Ag NPs) were successfully synthesized by chemical reduction method at room temperature using silver nitrate as a precursor and PVP as a reducing and stabilizing agent. The structural and optical investigation of AgNPs was done by various analytical techniques. The X-ray diffraction (XRD) pattern of the prepared sample confirmed the formation of a cubic phase without any impurity. Fourier transform infrared microscopy (FTIR) was used to get the infrared spectrum of the sample indicating the composition of the sample. The presence of surface plasmon resonance (SPR) peak has been investigated through UV-Visible spectroscopy. The antibacterial activities of the nanoparticles were investigated against E. coli using an agar well diffusion test. AgNPs demonstrated profound antibacterial activity against E. coli. The outcomes of this study indicated that the synthesized AgNPs could be applied as an effective antibacterial agent.

**Keywords:** Silver Nanoparticles, PVP, E. Coli, Antibacterial Activity.

**PP-FM-294**

## Preparation of metal doped nanoparticles using flower extract of *piper betle* and its anti-bacterial investigations

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### ABSTRACT

Biological reduction method using plant extract is an emerging research field for the synthesis of metal and metal oxides nanoparticles due to its availability, eco-friendly and cost-effective nature. In the present work preparation of silver, Gold and Zinc oxide nanoparticles was carried out using medicinally valuable flower extract of *piper betle* as reducing cum capping agent. Plants possess phytochemical constituents such as carbohydrates, phenolics, amino acids and proteins which can behave as reducing cum capping agents. Metals and metal oxide nanoparticles preparation were carried out at room temperature. The successful formation of AgNPs, AuNPs and ZnONPs have been characterised by UV-Visible spectrophotometer (UV-Vis), Fourier Transform Infrared (FT-IR), Scanning Electron Microscope (SEM) and Energy Dispersive X-ray (EDX). The crystalline nature of AgNPs, AuNPs and ZnONPs were examined by an X-ray diffraction study (XRD). The anti-bacterial activities were examined on gram-positive and gram-negative bacteria using disc diffusion method. The outcomes of anti-bacterial studies revealed the potentiality of metals and metal oxide nanoparticles.

**Key Words:** Piper Betle Flower, AgNPs, AuNPs, ZnONPs, Anti-Bacterial Activity.

**PP-FM-297**

## Radioactive parameter analysis in soil samples at the cauvery river

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### ABSTRACT

Cauvery, one among the major rivers, passing through three states, namely Karnataka, Tamil Nadu and Kerala. This river has importance for irrigation, drinking and electricity. River sand is used as a major material for building construction in India. The natural radionuclides such as uranium, thorium and potassium (<sup>238</sup>U, <sup>232</sup>Th, <sup>40</sup>K) are investigated through gamma ray spectrometer with NaI(Tl) detector and analysed. This analysis were already published. As per the report of United States Department of Agriculture (USDA) sediment and sand grain size is divided into several types, which include gravel medium sand (250–500 μm), fine sand (100–250 μm), very fine sand (50–100 μm), silty sand (2–50 μm) and clay (<2 μm). The range of gravel medium sand to fine sand (>125 μm) and non-magnetic grains were separated with the help of American Society for Testing Materials standard sieve and strong electromagnet.

Those two samples for each site were subjected to Gamma ray spectroscopy and analysed. The average values of radionuclides and in-situ dose are measured. Related parameters like absorbed dose ( $AD_{in}$  &  $AD_{out}$ ), Annual Effective Dose Equivalent ( $E_{in}$  &  $E_{out}$ ), and also hazard indices to assess radiation exposure to human such as average radium equivalent ( $R_{eq}$ ), external ( $H_{ex}$ ) and internal ( $H_{in}$ ) hazard indices, Radioactive heat production (RHP), internal and external Excess Lifetime Cancer Risk ( $ELCR_{in}$  and  $ELCR_{out}$ ), Alpha ( $I_{\alpha}$ ), Gamma Index ( $I_g$ ) and Annual Gonadal dose (AGDE) are computed and correlated. This study exhibits that almost all the radioactive parameters are in control by comparing to the world average. Nevertheless, the Cauvery River except site no.20 does not produce a radiological hazard.

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**PP-FM-298****pH-dependent, cytotoxicity, and antimicrobial activity of mononuclear ruthenium(II) polypyridine complexes**F. Catharine Priya<sup>a</sup> and D. Suresh Kumar<sup>a</sup><sup>a</sup> Department of Chemistry, Loyola College, Chennai 600034, India.**ABSTRACT**

To analyze the *in vitro* cytotoxicity, antibacterial, Spectrophotometric studies and antifungal activity of the prepared mono-nuclear ruthenium (II) polypyridine complexes. The 96-well plate method is used to test the two synthetic ruthenium (II) complexes, CP and CB, for *in vitro* antiproliferative activity against the cervical cancer cell line (HeLa). By using the disc diffusion method for antimicrobial activity. Ruthenium complexes with imidazophenanthroline based ligands are expected to exhibit pH-dependent properties due to the presence of labile proton. The spectrophotometric titrations of the complexes C1 and C2 are carried out in Britton Robinson buffer over the pH range 2-10. IC 50 value for the (HeLa) cell line for CP1 is 24.5 and CB1 is 99.80 in a dose- dependent manner. The growth of Gram positive (G+) and Gram negative (G-)moderately suppressed by both the complexes. The examined fungus respond well to the ruthenium polypyridyl complexes for antifungal properties. In  $P^H$  studies changes observed are due to two successive deprotonation processes taking place to the protonated and neutral imidazophenanthroline rings in the complexes. Among the two complexes CP1 is more reactive than CB1.

Keywords: cancer cells (HeLa), cytotoxicity, MTT assay, antibacterial activity, antifungal activity, ruthenium polypyridyl complexes.

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PP-FM-307

## Structural, optical and magnetic properties of mg-doped and Sm co-doped bismuth ferrite nano particles prepared by sol-gel via auto-combustion method

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### ABSTRACT

Bismuth ferrite (BFO) is a multiferroic magnetoelectric material that exhibits simultaneous magnetic and electric properties at room temperature. This property has enhanced tremendous attraction to the material and makes them suitable for various applications such as memory devices, spintronics and sensors. In this work  $\text{Bi}_{1-x}\text{Mg}_x\text{FeO}_3$  ( $x=0, 0.05, 0.10, 0.15$ ) and  $\text{Bi}_{1-x-y}\text{Mg}_x\text{Sm}_y\text{FeO}_3$  ( $x=0.15, y=0.05$ ) nanoparticles are synthesized by sol-gel via auto-combustion method to evaluate the importance of  $\text{Mg}^{2+}$  doping and  $\text{Mg}^{2+}$ -  $\text{Sm}^{3+}$  co-doping on the structural, optical and magnetic properties of BFO nanoparticles. The nanoparticles are characterized using techniques such as XRD, UV-Visible analysis, photoluminescence (PL) spectroscopy and VSM. The XRD pattern of pure BFO, Mg-doped BFO and Sm co-doped BFO confirmed the formation of a rhombohedral distorted perovskite structure. The average crystalline size is calculated using XRD data. A decrease in particle size (in nano regime) is observed with increase in doping concentration. From the UV-Vis analysis, Tauc plot is used to find the bandgap. It is observed that there is a decrease in bandgap with increase in doping concentration. Photoluminescence spectroscopy is used to study emission properties of magnesium doped and samarium co-doped bismuth ferrite. The PL spectra of all samples exhibit emission in UV and visible region. A decrease in ferromagnetic behaviour is observed on making an A-site substitution with  $\text{Mg}^{2+}$  ions. A slight increase in magnetic properties from the Mg doped sample is observed in co-doped sample. From these analysis, it could be suitable for memory storage, energy storage, and have applications in photocatalyst and optoelectronic devices.

**Keywords:** BFO, sol-gel, multiferroic, VSM, spintronics.

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**PP-FM-308**

## Structural, optical and magnetic properties of undoped and molybdenum doped bismuth ferrite nanoparticles prepared by sol-gel via auto combustion method

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### ABSTRACT

Bismuth ferrite (BFO) nanostructures have gained attraction as promising materials for energy storage and energy conversion due to their high energy storage efficiency, thermal stability and low dielectric loss. BFO is the only single-phase multiferroic material exhibiting multiferroicity at room temperature due to magneto-electric coupling [1]. MoO<sub>3</sub> is a 2D material having a wide bandgap with increasing demand as an electrode material for both supercapacitors and lithium-ion batteries [2]. Pure BFO was prepared by Sol-gel via autocombustion method. MoO<sub>3</sub> nanoparticles are prepared by citrate sol gel method and is doped with BFO in different percentages. XRD analysis of the samples reveals that both undoped and doped samples have rhombohedral perovskite structure with R3c space group and preferential orientation along (110) direction. SEM analysis shows an agglomerated grain growth mode for both undoped and doped samples of BFO. The elemental composition of the samples were investigated with EDX analysis. The surface area was calculated by BET analysis and samples are identified as mesoporous in nature. The UV-Vis spectra of BFO shows an absorption edge around 500 nm. The doped samples show an enhanced absorption in the visible region. The Tauc-plot analysis shows that bandgap energy increases with increase in doping concentration. The Photoluminescence spectra of BFO shows an intense emission in the blue region for higher doping concentration of Mo. The average decay lifetime for all the samples varies with doping concentration. The magnetic properties of the material investigated with the help of VSM analysis shows the ferromagnetic behaviour of the material.

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**PP-FM-309****Green synthesized metal silver nano particles for fabric coating and its applications**S. Chandra Mohan<sup>a</sup>, Namrata Jain<sup>a</sup> and Thrisha Venkatajalapathi<sup>b</sup><sup>a</sup>*Department of Chemistry, Sarvepalli Radhakrishnan University, NH-12, Hoshangabad Road, Jatkheddi, Bhopal, Madhya Pradesh- 462026, India.*<sup>b</sup>*Department of Biochemistry, Ethiraj College for Women (Affiliated to University of Madras), Egmore, Chennai, Tamil Nadu- 600008, India.***ABSTRACT**

Green synthesis of nanoparticles is one of the most eco-friendly and safer methods. Utilizing plant sources as reducing agents will replace the use of toxic chemicals and thus prevents causing environmental toxicity. Silver NPs takes the most fascinating position because of its unique antimicrobial properties. The present study reports biosynthesis of silver nanoparticles (AgNPs) using bark extract of *Barringtonia acutangula* and coated on pure cotton fabric by dip coat method. Initially, the synthesis of AgNPs was confirmed by visual observation of change in colour. Further, the morphology of the nanoparticles, average size and presence of elemental silver were characterized by FT-IR, UV-Visible spectroscopy, scanning electron microscopy, transmission electron microscopy. The average particle size and the face centered cubic crystalline nature of green synthesized AgNPs was confirmed by XRD. In vitro antimicrobial effect of AgNPs coated fabric was investigated against both Gram-positive and Gram-negative bacterial strains. The result shows that biosynthesized AgNPs have significant antibacterial and antifungal activity. The excellent killing effect of bacteria was demonstrated. The coated fabric can have potential applications in wound dressing, bed lining and as medicinal bandages. The coated fabric can also be recommended for the purification of medical and food equipment, domestic cleaning, etc. Furthermore, the materials involved in the preparation are cheap, non-toxic and are commonly available.

**Key words:** Silver Nano, Green Synthesis, XRD, Antimicrobial, Wound Dressing.

**PP-FM-311****Enhanced performance of hysteresis controlled single phase ac/dc buck converter system using cubic boron arsenide semiconductor material**R.Suganya<sup>a</sup> and J. Ranjith Kumar<sup>b</sup><sup>a</sup>*Department of Electrical and Electronics Engineering, IFET College of Engineering, Villupuram and 605108, India.*<sup>b</sup>*Department of Electrical and Electronics Engineering, IFET College of Engineering, Villupuram and 605108, India.***ABSTRACT**

This paper presents a single phase AC-DC buck converter using Hysteresis controller for superior response. The single phase AC/DC buck converter becomes more and more popular and it is seen as an alternative to the DC-grid. The AC output of rectifier is applied to a buck

converter (BC) and it is filtered using  $\Pi$  filter. Higher order harmonic components are present in the power drawn by nonlinear and unbalanced loads, which in turn raises the supply current's total harmonic distortion level.

In comparison to other controllers, hysteresis current controllers are well known for their robustness, faster error tracking, greater dynamic response and simplicity of implementation. This paper deals with modeling and simulation of single phase buck converter system with Proportional integral controller (PIC) and hysteresis controller (HC). The performance of buck converter with PIC and HC are compared and their results are presented. The results indicate that HC- controlled BC gives superior response. Wide band-gap semiconductors are utilised in switching devices as a result of advances in material science and a drive for greater performance. This paper also deliberates the semiconductor material of cubic boron arsenide which have high thermal conductivity, high mobility for electrons and holes to fabricate the power electronic switches that are cast-off in the AC-DC Converter.

**Keywords:** Buck converter (BC), Proportional integral (PI), Hysteresis controller (HC), Pulse width modulation (PWM), Semiconductor material, Pulse generator

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### PP-FM-312

## Delamination of $Ti_3C_2$ mxene by in situ polymerisation

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### ABSTRACT

MXenes ( $M_{n+1}X_nT_x$ ) are a new family of 2D carbides, nitrides or carbonitrides which has attracted wide attention since its discovery in 2011 from their respective MAX phases ( $M_{n+1}AX_n$ ) by the selective etching of A layer. Unlike other 2D materials discovered so far, MXenes have an exclusive set of properties like metallic conductivity, hydrophilicity and structural diversity, making them unique and enabling their use in potential applications.  $Ti_3C_2T_x$  is the first MXene discovered and is the most stable with exceptional properties.  $Ti_3C_2$  few-layer MXene is subjected to DMSO intercalation, which increases the interlayer spacing. The intercalated sample is then subjected to in situ polymerisation. The polymerisation occurs at the interlayer spacing of the MXene. It leads to an increase in the spacing, followed by better delamination in the presence of an oxidant. The Physico-chemical investigations of the

delaminated MXene-polymer sheets are compared with that of fewlayer MXene. The detailed results on polymerisation, morphology and chemical are discussed.

**Keywords:** MXenes,  $Ti_3C_2T_x$ , Intercalation, Interlayer Spacing, In Situ Polymerisation.

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### PP-FM-317

## Characterization of magnesium barium nanoferrites prepared via co precipitation method

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### ABSTRACT

In present work,  $Mg_{0.5}Ba_{0.5}Fe_2O_4$  spinel nanoferrites have been prepared using co-precipitation method. The sample was calcinated at 700°C for 3 hrs. The structural and morphological properties of these nanoferrites were studied by X-Ray Diffraction Method (XRD) and Scanning Electron Microscopy (SEM) techniques. Through XRD the spinel structure were determined. The DLS (Dynamic Light Scattering) technique determined the distributive size of small particles in solution. UV spectroscopy gives the absorbance at 380 nm and band gap value around 3.12 eV using Tauc plot. The applications of following nanostructures are in microwave absorption, gas sensing, photo catalysis and magnetic recording devices.

**Keywords:** Nanoferrites, XRD, SEM, UV, DLS.

**PP-FM-319****Magnetic entropy change in frustrated magnets: a case study on AgCrO<sub>2</sub>**

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**ABSTRACT**

The proper choice of regenerator plays a crucial role in the conversion efficiency of environmental friendly solid state magnetic refrigerator. Recently, a great attention is attracted towards the suitability of frustrated magnets as a regenerator. The less availability of experimental reports on this perspective motivated the present study. The magnetic entropy change linked with the magnetic transition of frustrated delafossite, AgCrO<sub>2</sub> is studied systematically. The Heisenberg triangular lattice antiferromagnet undergoes a magnetic transition around 21 K. The absence of long range interaction and frustration is observed in  $T_N < T < 125$  K range. The magnetic entropy change ( $\Delta S_m$ ) calculated from the isothermal magnetization measurements is 0.067 J kg<sup>-1</sup>K<sup>-1</sup> for a field change of 70 kOe. The release of frustration induced by the structural distortion to a low symmetry structure acts a cause for the noticed  $\Delta S_m$ .

**Keywords:** Frustration, Delafosite, Entropy Change, Magnetocaloric Effect.

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**PP-FM-323****Synthesis and structural, optical analysis of barium zirconate by precipitation method**

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**ABSTRACT**

The Barium Zirconate was synthesized by the precipitation method. Then the samples are sintered for 180°C (sample- B) and 220°C (Sample-C). They are compared with the sample which doesn't sinter (sample- A). The structural characterization was done by XRD. XRD pattern was compared with JCPDS. The XRD profile matches with the standard data #PDF240131 and it shows tetragonal structure. From the XRD data, the structural parameters

such as grain size, lattice strain, and dislocation density were calculated <sup>[1]</sup>. UV-Vis spectroscopy was used to find the band gap of the sample. Tauc plot was drawn using UV absorption data and the direct band gap was found to be 3.98 eV for A and it get decreases as 3.97eV for B and 3.95eV for C. PL analysis shows red shift as increase in sintering temperature. <sup>[2]</sup> Elements such as Ba, Zr, and O were present in the EDX spectra confirming the formation of Barium Zirconate without impurity. Surface Morphology was analyzed by SEM. SEM micrograph showed that the sample has well-defined faces in the powder form. <sup>[3]</sup>

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## PP-FM-324

### Synthesis of hexamine (HMTA) derived carbon dots and their optical properties

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#### ABSTRACT

In the present study, synthesis of fluorescent carbon dots (CDs) was carried out by a simple hydrothermal approach using Hexamethylenetetramine (HMTA) as the carbon source. A detailed investigation on the characterization of CDs using Ultraviolet-visible (UV- Vis), Photoluminescence (PL), Fourier transform infrared (FT-IR) and Raman spectroscopy. Further, optical properties were carried out using the third-order nonlinear optical (NLO) responses of CDs were examined using continuous-wave (CW) laser. From these results, found that, the use of CDs in optical devices would be explained and also expanded by these tunable qualities.

**Keywords:** Hexamethylenetetramine, Hydrothermal Synthesis, Carbon Dots, Optical Property.

**PP-FM-335****The structural, microstructural and magnetic properties of NiO-SrFe<sub>12</sub>O<sub>19</sub> nanocomposites**

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**ABSTRACT**

The  $x\text{NiO}-(1-x)\text{SrFe}_{12}\text{O}_{19}$  ( $x = 0.0, 0.2, 0.4, 0.6, 0.8$  and  $1.0$ ) nanocomposites were prepared by using microwave-hydrothermal method. The structural and morphological studies were carried out using X-ray diffraction and field emission scanning electron microscopy. The prepared samples were sintered using microwave at 2.45GHz. The solubility of Ni<sup>2+</sup> into hexaferrite crystal lattice is observed for  $x = 0.2$  and  $0.4$  from the diffraction patterns. The coexistence of both SrFe<sub>12</sub>O<sub>19</sub> and NiO phases were observed for  $x > 0.4$ , thus confirming the formation of NiO-SrFe<sub>12</sub>O<sub>19</sub> composites. The intensities of the peaks were increased with its constituent phase and vice versa. Magnetic properties show that the saturation magnetization decreased with increasing Ni<sup>2+</sup> doping content upto  $x = 0.4$  and increased with further doping. The coercive field ( $H_c$ ) is decreased from 2200 Oe to 594 Oe as  $x$  increased from 0.0 to 0.4.

**Keywords:** Hexaferrites, Hydrothermal Method, X-Ray Diffraction, Microstructural, Magnetic Properties.

**PP-FM-338****Thermal degradation of bio-filler based rubber composites: recent developments and future perspectives**

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**ABSTRACT**

Rubber scientific community are working towards on growing significance of tackling global environmental concerns such increasing energy consumption and emissions, the scientific researchers in the field of rubber is actively striving towards sustainable development. One of the potential new ways that may enhance product performance and reduce environmental effect is the increased use of renewable alternatives as fillers. Recently, Bio fillers are used as reinforcement for rubber instead of carbon black to minimize the carbon footprint and fossil fuel consumption. Sustainable filler materials like lignin, Nano Crystalline Cellulose (NCC), Micro Crystalline Cellulose (MCC), etc. are increasingly employed as reinforcing filler in rubber composites as the industry strives to meet the Zero Carbon Challenge. In this study, we reviewed the stability and rate of thermal degradation of several bio filler reinforced rubber composites for use in high temperature applications. Recent literature is analyzed to determine the impact of several factors, such as filler size, microstructures, influence the

rubber-filler interactions and degradation. Moreover, the compound preparation and filler modification for rubber-filler interface required to make a thermally stable bio composite are also reviewed from recent articles.

**Keywords:** Bio-Filler, Cellulose, Sustainable Rubber, Thermal Degradation

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### PP-FM-350

## Triarylamine-based Non-volatile Resistive Memory Controlled by a Redox-Gated Switching Mechanism

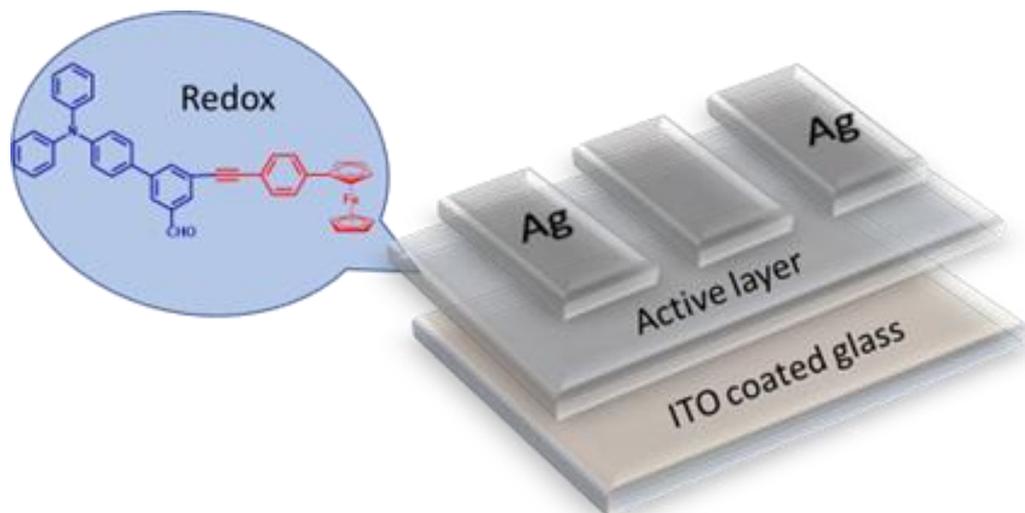
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### ABSTRACT

Organic resistive memory devices have gained more attention in recent years due to their high-density data storage, simple device structure, and low fabrication cost. The organic resistive memory devices can possess multi-level data storage which can be modulated with different donor and acceptor structural arrangements. Here we have designed and synthesized a series of triarylamine (TAA) based redox-active rewritable for FLASH memory. To obtain a redox system-based rewritable memory, ferrocene has been incorporated with the TAA moiety. The redox-responsive nature of iron (Fe) in ferrocene changes the oxidation state once subject to an external electric field. When an external electric field is applied, Fe<sup>2+</sup> gets oxidized to Fe<sup>3+</sup> indicating the conductive state and by using a reverse voltage, Fe<sup>3+</sup> can return to the Fe<sup>2+</sup> state. The ferrocenium ion (Fe<sup>3+</sup>) can remain stable without an external magnetic field and thus provide the possibility of non-volatility of the fabricated devices. The ITO/Organic layer/Ag-based devices have been fabricated and evaluated for their memory performance. The compounds exhibited a redox-controlled switching mechanism with a lower threshold voltage, high ON/OFF current ratio, and excellent retention time. Thus, the design of a redox-active compound provides an alternative strategy for the development of organic memory materials and devices.

**Keywords:** Organic electronics; memory device; flash memory; triarylamine; ferrocene; redox system

**OP-FM-351****Carbon dot classification, synthesis techniques, properties and applications in biotechnology and related fields**

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**ABSTRACT**

Researchers have been interested in carbon dots since they were discovered in 2004, a new member of the carbon family with a size smaller than 10 nm. Nanomedicines, energy storage, sensors, solar cells, in vitro and in vivo bio imaging, as well as photodynamic and photo thermal treatments, are a few of the biological and non-biological uses of carbon dots. Because of its many advantageous physiochemical properties, including excellent biocompatibility, distinctive optical features, low cost, environmental friendliness, a large number of functional groups, high stability, and electron mobility, carbon dot is one of the most promising nanomaterials for biomedical applications. We will cover the synthetic procedures, optical qualities including high absorption, photo luminance, and phosphorescence, as well as some other characteristics throughout this review. We will also briefly discuss so many types of carbon dots. More importantly, we will inform readers on current CD developments in medical applications, including their major and prominent roles in drug/gene delivery, bio imaging, electrochemical and optical bio sensing and photodynamic/photo thermal treatment. This view, in our opinion, will offer crucial information that will encourage more CD discoveries and pave the way for a larger range of biological applications.

**Keywords:** Carbon Dots, synthesis, classification, properties, applications, biotechnology.

**PP-FM-355**

## Density, viscosity and thermo acoustical study of styrene-ethylene-butylene-styrene in cyclohexane solution at various concentrations at 303K

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### ABSTRACT

Ultrasonic investigation of polymer mixtures consisting polar and non-polar components is of considerable importance in understanding intermolecular interaction between the mixtures and they find applications in several industrial and technological process. Many investigators have been studies in the collecting more data and discussion in terms of the properties of liquid mixtures. In view of growing interest, the results of an ultrasonic velocity, density and viscosity to study the related thermodynamic properties that is inter molecular free length (Lf), compressibility, surface tension, and viscosity. The measurement of ultrasonic velocity of ultrasonic waves in liquids enables determination of some useful acoustic and thermodynamic parameters that are found to be very sensitive to molecular interactions. Hence these measurements are useful to study the strength of molecular interactions in liquid mixtures. The thermodynamic studies of binary liquid mixture have attracted much attention of scientist and experimental data on number systems are available from review and publication. The measurements were carried out by using the ultrasonic interferometer technique at a frequency of 2MHz. The nature of polymer/solvent interaction and the effect of concentration on the molecular interaction are studied. The observed variation in acoustical parameters shows the non-linear behavior with increase in concentration of SEBS polymer in solvent cyclohexane at different concentrations.

**Keywords:** Ultrasonic studies-molecular interaction-cyclohexane-intermolecular free length.

**PP-FM-362**

## Structural and Magnetic Studies of Doped BiFeO<sub>3</sub>

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### ABSTRACT

Multiferroic materials have gained much interest recently, due to their applications in spintronics, information storage, sensors, etc. BiFeO<sub>3</sub> is a well-known multiferroic material, but it has weak magnetic properties at room temperature and it has the problem of secondary phase formation during the processing. In this paper, we report the synthesis of BiFeO<sub>3</sub> and

the effects of codoping of lanthanum for Bi and transition metals for iron on structural and magnetic properties. These samples are prepared by an eco-friendly citrate combustion method. It is observed that doping also helps in phase stabilization. BiFeO<sub>3</sub> shows a paramagnetic character, which modifies the ferromagnetic nature after doping. Magnetic transition temperature (T<sub>N</sub>) increases with the transition metal dopants. **Keywords:** Multiferroic Materials, Citrate Combustion Method, Ferromagnetism.

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### PP-FM-372

## Synthesis and Characterization of Au Nanoparticles, Mediated by the Fruit Extract of Citrus limon (Lemon)

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### ABSTRACT

Green Synthesis of nanoparticles makes use of environmental friendly, non-toxic and safe reagents, generating particles with diverse nature and greater stability. Fruit extracts are perfect candidates for the synthesis of metal nanoparticles due to their availability and cost efficiency, even on industrial grounds. In this work, an environmental friendly approach for the synthesis of Gold nanoparticles (Au NPs) using Citrus limon (Lemon) fruit extract is reported. The extract itself serves as a reducing and stabilising agent. The synthesized Au NPs characterized using X-ray diffractometer confirms the crystalline face centered cubic phase. Spherical morphology in the nanometer regime was evident from the SEM analysis. UV Visible reflectance spectrum shows three bands, two in visible region and one in near Infra-Red region substantiating the formation of gold metal nanoparticles. The presence of characteristic stretching modes of Carboxylic acid group and other Amine groups in the FTIR spectrum further confirms the bioreduction and stabilization of gold nanoparticles. Thus, the prepared gold metal nanoparticles have good physical characteristics which can be further taken for biological studies.

**Keywords:** Citrus limon; Gold Nanoparticles; Green synthesis

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**PP-FM-373****Ambient Biogenic Synthesis of Cobalt oxide using Aloe barbadensis Miller Extract: A Green Synthesis Approach**

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**ABSTRACT**

The one pot synthesis of Cobalt oxide nanoparticles was achieved using a green approach. The method employed was benign, innocuous and sustainable. Here the Cobalt oxide nanoparticles were synthesized from Aloe vera leaf extract (Aloe barbadensis Miller) by using Cobalt Nitrate ( $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ ) as a precursor under appropriate and ambient temperature conditions. The synthesized nanoparticles show great stability and was confirmed by using various techniques like UV-Visible Spectrometer, Fourier transform infrared spectroscopy (FT-IR), X-ray diffraction analysis (XRD) and Scanning electron microscopy (SEM). The synthesized nanoparticles are having many potential applications in the field of medicine, in batteries etc. The most satisfying condition is that there are synthesized non toxically and hence can be used safely.

**Keywords:** Aloe vera leaf extract (Aloe barbadensis Miller); Cobalt oxide nanoparticles; Green approach



**Fig.1:** Preparation of cobalt oxide nanoparticles from aloe vera extract and cobalt nitrate solution

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**PP-FM-374****Preparation of eco-bricks with a topical coating of silver nanoparticles**Kannan K<sup>a</sup>

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**ABSTRACT**

Oyster mushroom, *Pleurotus ostreatus* was cultivated using paddy straw as the substrate. The cultivated oyster mushroom was utilized for the preparation of eco-bricks or mycelium bricks. Eco-bricks or mycelium bricks are organic bricks synthesized from organic wastes, mine wastes and fungal mycelia including cultivated mushrooms and/or mushroom spawn. Mycelia are thin root like fibers from fungi which run underneath the ground. When dried they can be used as a super strong, water, mould and fire resistant building material that can be grown into specific forms thereby reducing the process requirements. Eco-bricks or mycelium bricks are non-pollutant, eco-friendly and more efficient. Eco-bricks or mycelium bricks are novel constructs which alleviates the problems arising during construction such as poor quality raw materials, reduced strength, low water absorption capacity and decreased shelf life due to increase in the internal as well as external cracking. Eco-bricks helps to overcome the environmental threats posed by the conventional brick making methods. They are a novel class of renewable biomaterial prepared using fungal mycelia and low-value non-food agricultural materials thereby contributing to sustainable agriculture or sustainable environment. Eco-bricks are also susceptible to microbial contamination. Hence, a topical coating of microbially synthesized silver nanoparticles was applied on the surface of the eco-bricks in order to enhance its purity. The synthesized nanoparticles were characterized by UV visible spectrophotometry, Transmission Electron Microscopy, Fourier Transform Infrared Spectroscopy and X Ray Diffraction analysis. The compatibility of the synthesized eco-bricks were determined by carrying out tests such as compressive strength test, water absorption test and drop test. These eco-bricks are strong, cost effective, eco-friendly, biodegradable and replenishable giving rise to an efficient brick formulation which can serve as a suitable next generation alternative for construction.

**Keywords:** Oyster mushroom; *Pleurotus ostreatus*; Mine wastes; Eco-bricks; Eco-friendly; Silver nanoparticles; Topical coating.

PP-FM-376

## Bismuth (III) Oxide Decorated Graphene Oxide Nanocomposites for Nuclear Radiation Shielding

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### ABSTRACT

The advancement in nuclear science and technology have fostered the use of ionizing radiations in diverse sectors ranging from medical radiation facilities to nuclear research laboratories, making radiation exposure indispensable for the mankind. Considering its adverse effects on human health, radiation shielding and protection are the issues of paramount importance. In view of this, non-lead nanocomposites are emerging to be a state-of-the-art X-ray and  $\gamma$ -ray shielding alternatives to conventional materials such as lead and expensive metallic materials. In this study, bismuth (III) oxide ( $\text{Bi}_2\text{O}_3$ ) decorated graphene oxide (GO) nanocomposites were synthesized as novel radioprotective materials for shielding applications. XRD, FTIR and Raman spectroscopy confirmed the successful decoration of 3D  $\text{Bi}_2\text{O}_3$  particles on 2D graphene oxide. SEM-EDX results revealed the formation of  $\text{Bi}_2\text{O}_3$  decorated GO nanocomposites formed by integration of microstructured organic-inorganic phases. The resultant nanocomposites were found to have high thermal stability up to 450 °C. The formation of continuous network-like structure in decorated nanocomposites compared to neat  $\text{Bi}_2\text{O}_3$  particles significantly improved the X-ray and  $\gamma$ -ray shielding properties in the wide energy range of medical interest (30 – 1332 keV). Appreciable enhancement in radiation attenuation characteristics of the newly developed material is mainly due to the synergistic shielding effect of combining high-Z metal oxide fillers and GO. Therefore, these decorated nanocomposites can be used as fillers/additives in structural matrices (metals, glasses, concrete, polymers and so on) to develop high performance composites for shielding applications.

**Keywords:** Bismuth oxide; graphene oxide; surface decoration; X-/ $\gamma$ -ray shielding.

**PP-FM-391**

## Synthesis and characterization of Almond gum based solid bio polymer electrolyte doped with NH<sub>4</sub>SCN

### ABSTRACT

The possibility of developing a biodegradable polymer electrolyte in the manner of a sustainable future has grown due to the availability, cost effectiveness, biodegradability, highly intriguing electrochemical, pharmaceutical applications, and the requirement for the replacement of synthetic polymers. In comparison to conventional bio-polymers, the bio-polymers made from naturally occurring tree gums are said to be very effective. In keeping with this, the solid polymer film made from almond gum (*Amygdalus communis*) and doped with NH<sub>4</sub>SCN salt in the current study exhibits improved ionic conductivity. The thermal stability of the film was guaranteed by Thermogravimetry investigations, and the XRD and FTIR analyses validated the structure and the presence of functional groups.

**Keywords:** Almond gum, Bio-degradable polymer, structural analysis, Thermogravimetry, ionic conductivity, solution casting.

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**PP-FM-392**

## Cobalt Ferrite nanoparticles for hyperthermia applications: A review

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### ABSTRACT

Magnetic nanoparticles have been widely explored for biomedical applications. Magnetic hyperthermia is a method in which material is heated by using an external magnetic field. This method is explored to treat cancer cells by the use of magnetic nanoparticles heated with alternating magnetic fields. Cobalt ferrite nanoparticles have remarkable properties, such as moderate saturation magnetization, high coercivity, high magneto crystalline anisotropy, good thermal properties, and high stability. Using suitable surfactants, cobalt ferrite nanoparticles could be manipulated to produce the required heat amount for magnetic hyperthermia-based treatment. The present study discusses the synthesis, properties, and hyperthermia applications of cobalt ferrite nanoparticles have been discussed.

PP-FM-393

## Target Specific Tumor Seeking Nanomedicine for Triple-Therapeutic Effects

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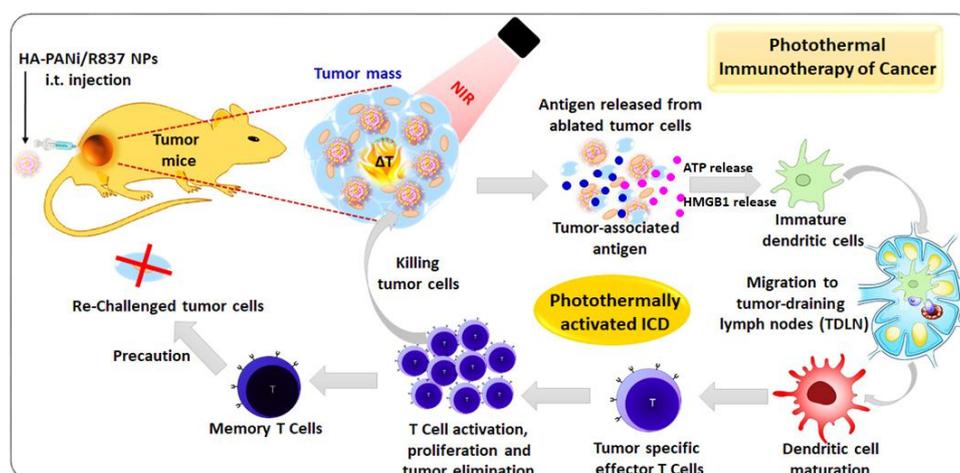
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### ABSTRACT

Triple-negative breast cancer (TNBC) is a breast cancer subtype. At presently, TNBC patients do not have approved targeted therapy. Therefore, patients primarily depend on forceful systemic chemotherapy that has unavoidable harmful side effects shows inadequate therapeutic outcomes leading to high mortality rate. Hence, there is an urgent need to develop targeted therapies for TNBC populace. Developing the new nanotherapeutics approach of combinational therapy could be an effective alternative strategies. Therefore, we designed combination of hyaluronan-polyaniline-imiquimod (R837) named as HA-PANi/R837 NPs exhibited high extinction coefficient and adequate photothermal conversion efficiency (PCE) made it an efficient photothermal agent (PTA), which is highly beneficial for selective CD44-mediated photothermal ablation of TNBC tumor. Furthermore, co-encapsulation of R837 (Toll-like receptor 7 agonist) immunoadjuvant molecules to trigger immune response against tumor. The formed CD-44 targeted HA-PANi/R837 NPs selectivity incinerates the tumor under NIR-triggered photothermal ablation, generating tumor-associated antigens, also triggers R837 combination with anti-CTLA4 for the immunogenic cell death (ICD) activation to kill the remaining tumor cells in mice to protect tumor relapse and metastasis. Our results demonstrated that novel HA-PANi/R837 NPs induced photothermal ICD achieved in CD44-targeted TNBC is a promising application.

**Keywords:** Polyaniline, Hyaluronan, Near-infrared, Photothermal therapy, Immunotherapy, Triple-negative breast cancer



**Fig. 1:** Schematic picture summarizing the mechanisms of NIR-mediated PTCT with CTLA-4 checkpoint blockade for cancer immunotherapy.

**PP-FM-412****Work function analysis of photo-enhanced TEA adsorption impact on Au embedded CeO<sub>2</sub> coated on ZnO hybrid nanostructures: an investigation by scanning kelvin probe**

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**ABSTRACT**

Detecting volatile organic compounds (VOCs) could be a straightforward way to diagnose life-threatening disorders, including lung cancer, ulcers, diabetes, etc. Triethylamine (TEA) and ethanol are breath biomarkers for diabetes and cancer. Adsorption studies of TEA utilizing SKP were conducted on a hybrid composite layer composed of ZnO/Poly/CeO<sub>2</sub>/Poly/Au. The effect of visible-light on the adsorption of volatile organic compounds such ethanol, n-hexane, and TEA was studied and characterized. The results reveal that the prepared hybrid layer has a high adsorption towards TEA in both dark and light situations. Intriguingly, ZnO/Poly/CeO<sub>2</sub> has demonstrated improved adsorption capability towards TEA under irradiation with visible light compared to the dark condition. In addition, the produced hybrid layer was more effective at adsorbing TEA than either ethanol or n-hexane.

**Keywords:** VOCs, TEA, SKP, CPD.

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**PP-FM-413**

## Microwave-Assisted Synthesis and Characterisation of CdO- Mn<sub>3</sub>O<sub>4</sub> Nano Composites

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### ABSTRACT

Microwave-assisted technique is most energy efficient and less time consuming method for preparation of nanomaterial and nanocomposites Present work is an attempt to prepare nanosized CdO- Mn<sub>3</sub>O<sub>4</sub> nanocomposite materials using Cadmium chloride manganese chloride along with urea. These materials are prepared by microwave combustion process using ethylene glycol as a fuel. The composite sample was prepared and then it was annealed for various temperatures 350°C, 450°C, 550°C using a muffle furnace. The obtained materials were characterized by XRD, FTIR, UV-Vis and Photoconductivity studies. Photoluminescence spectroscopy for potential applications in electronic devices.

**Keywords:** nanocomposites, XRD, FTIR, UV-Vis studies.

**PP-FM-417**

## Spectroscopic Properties of Coumarin 1 and Coumarin 2 laser dyes embedded in sol-gel glass

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### ABSTRACT

Laser dyes are the active centres in the dye laser operation. Many laser dyes have been used in the liquid solutions in the past as the source of coherent tunable radiation. However, a solid state dye laser has technical advantages over liquid dye laser.

Much research work has been done on solid state dye lasers based on dyes of the Rhodamine and Pyrromethene families, with emission in yellow and red spectral regions. Less attention has been paid to the development of solid state dye lasers with emission in the technologically important blue-green spectral regions. Some studies on the lasing properties of a number of blue-green emitting dyes incorporated into sol-gel materials have appeared over last few

years. Coumarin and stilbene 3 laser dyes are very efficient laser dyes for the spectral response in the blue-green region of the electromagnetic spectrum.

Organic laser dyes incorporated in sol-gel matrices prepared at low temperature have a number of applications in the field of science and technology. The development of dye/sol-gel host materials with better laser performance constitutes one of the important areas of research in solid-state dye laser field. This is due to the possibility of developing high power tunable solid-state lasers. The present work mainly consists of preparation coumarin-1 and coumarin-2 laser dye embedded in sol-gel materials, studying their spectroscopic properties, development of dye embedded solid materials and their extensive study as solid-state dye laser materials.

**Keywords:** Dye Laser, Coumarine Dye, Sol-gel Glass.

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**PP-FM-439**

## **Unidirectional growth, optical and mechanical studies on L- Threonine Lithium Chloride single crystal by Sankaranarayanan–Ramasamy method**

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### **ABSTRACT**

The bulk single crystal of L-Threonine Lithium Chloride (LTLC), an efficient semiorganic nonlinear optical (NLO) material was grown successfully in unidirectional by Sankaranarayanan Ramasamy (SR) method. Single crystal X-ray diffraction study reveals that LTLC crystallizes into orthorhombic system with the space group P212121. The unidirectional growth along the plane (1 1 0) was confirmed from the powder XRD pattern with the sharp peak having maximum intensity. Optical absorption spectrum shows that LTLC has highly transparent in the entire visible region with a wide band gap of 3.75 eV for large photon absorption. Photoconductivity measurements carried out on the grown crystal reveals positive photoconductivity. Photoluminescence study establishes that LTLC exhibit green emission in the wavelength region 535 nm. Vickers micro hardness measurement was performed to know the mechanical strength of the crystal. Dielectric constant and dielectric loss were calculated by varying frequency at different temperatures. The SHG efficiency of the crystal is also examined by Kurtz's powder test using Nd:YAG Laser.

**Keywords:** Organic compound, Crystal growth, Nonlinear optical material, Microhardness Optical properties.

PP-FM-443

## A Biogenic One Pot Synthesis of Stable Nickel Oxide using Aloe Barbadensis Miller Extract in Ambient Condition

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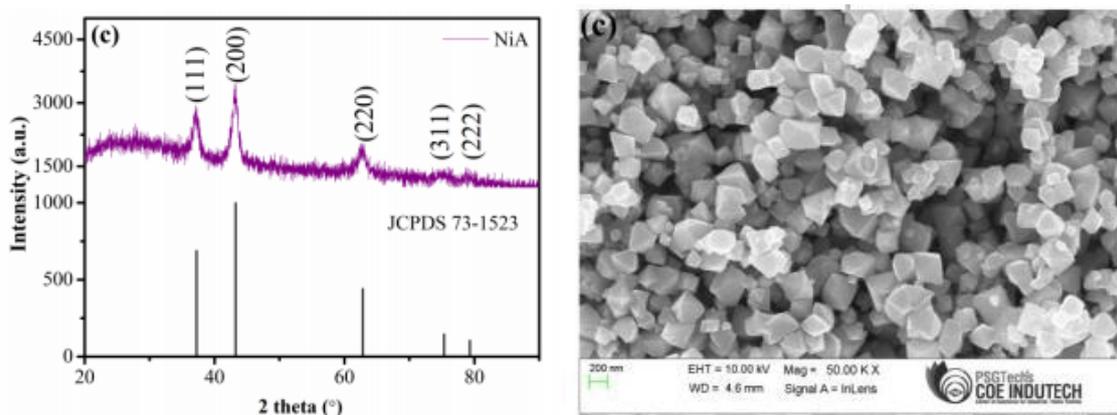
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### ABSTRACT

Green methods for nanoparticle synthesis using enzymes, microorganisms and plant extract are a non-polluting alternative to conventional physical and chemical methods. The latter methods of synthesis require toxic reducing agents, high temperature conditions etc. Hence, in this endeavor we have focused on synthesis of Nickel Oxide nanoparticles (NiO NPs) via green approach. Highly stable metal oxide nanoparticles were synthesized by using Aloevera extract and nickel nitrate as precursor solutions respectively. The synthesized metal oxides were characterized using X-ray Diffractometer (XRD), UV-visible spectrophotometer, FT-IR, and Scanning electron microscope (SEM) analysis.

**Keywords:** Green synthesis, Aloevera extract, metal oxide nanoparticles, Nickel Oxide.



**Fig. 1:** (a) XRD spectra of green synthesized NiO NPs and (b) its SEM image.

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PP-FM-447

## 100 kGy $\gamma$ -irradiated $\text{Co}_{1-x}\text{Zn}_x\text{Fe}_2\text{O}_4$ nanoparticles: AFM and BET analysis

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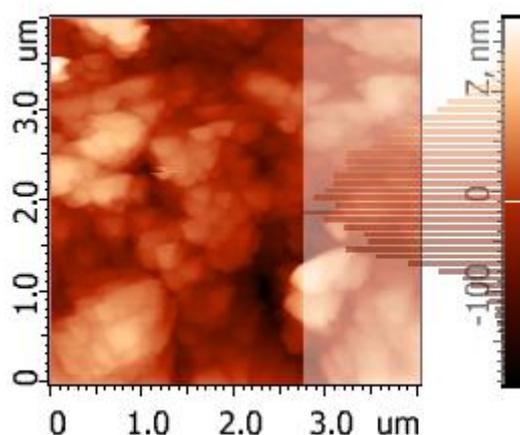
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### ABSTRACT

$\text{Co}_{1-x}\text{Zn}_x\text{Fe}_2\text{O}_4$  nanoparticles were effectively created using sol-gel technology. The effect of 100 kGy gamma irradiation on the structural and morphological properties have been discussed herein with the help of atomic force microscopic analysis (AFM). As per the Hook's law, the AFM works on the principle of Wonder-Wall forces; that produced in the atomic structure at the surface of the material. The surface study was performed by using BET analysis. From the Brunauer–Emmett–Teller analysis, the surface area of the  $\text{Co}_{1-x}\text{Zn}_x\text{Fe}_2\text{O}_4$  nanoparticles was found to be in the range of  $\sim 20 \text{ m}^2/\text{gm}$ . Precisely, the pore-volume ratio was calculated using the BET chart, which gives the information ragardin the gamma ray effect on the surface of the  $\text{Co}_{1-x}\text{Zn}_x\text{Fe}_2\text{O}_4$  nanoparticles. The on-site topological survey results presented in the paper indicated the effect of 100 kGy gamma irradiation on the microstructure, texture, roughness, smoothness, textural property, appearance, etc.

**Keywords:** Solgel; Nanoparticles; AFM; BET analysis; Gamma irradiation.



**Fig.1:** The AFM image of 100 kGy gamma irradiated  $\text{Co}_{1-x}\text{Zn}_x\text{Fe}_2\text{O}_4$  nanoparticles.

**PP-FM-448**

## A review on structural modification of himachalene present in Cedrus deodara

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### ABSTRACT

Cedrus deodara, often known as "deodara," is native to the Western side of the Himalayas. It is a medicinal herb, with a wide range of pharmacological activities that have proven to be beneficial in treating various health problems. The demand for essential oils is growing at a rapid pace. The leaves and wood of Cedrus deodara contain a variety of essential oils. The three components are  $\alpha$ -himachalene,  $\beta$ -himachalene, and  $\gamma$ -himachalene. Cedrus deodara essential oils have a wide range of applications, particularly in stress-related diseases. The main purpose is to collect and report all the essential information about various Himachalene in Cedrus Deodara. To construct this study, an exhaustive literature search was undertaken, utilizing linked publications published in various journals. The review's findings compile the chemical modification and synthesis of different Himachalene in C.deodara. This study brings together and gives an up-to-date evaluation of key sesquiterpenes isolated from cedar essential oil, a family of plentiful and accessible natural materials.

**Keywords:** Anti-microbial activity, Cedrus deodara, Chemical reactions, Essential oils, Himachalol, Himachalene, Sesquiterpenes.

**PP-FM-467**

## Structural and biological effects of Rutile ( $\alpha$ -TiO<sub>2</sub>) nanoparticles synthesized by co-precipitation method

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### ABSTRACT

Rutile ( $\alpha$ -TiO<sub>2</sub>) nanoparticles have been synthesized by the co-precipitation method using titanium propoxide and Hydrochloric acid as a precursor. The structural properties and biological effects of the Rutile ( $\alpha$ -TiO<sub>2</sub>) nanoparticles were studied using Powder X-ray diffraction, Fourier transform infra-red analysis, UV- Visible analysis, scanning electron microscopy, transmission electron microscopy and antibacterial study. The crystallite size of the Rutile ( $\alpha$ -TiO<sub>2</sub>) nanoparticles was 18.3 nm, which was confirmed by Powder X-ray

diffraction analysis. The morphology was confirmed by Field Emission scanning electron microscopy (FESEM), and the elemental composition of the nanoparticles was found by energy dispersive X-ray (EDAX) analysis. The rutile form of the nanoparticles was confirmed by the bandgap 3.2 eV, which was measured using UV–visible analysis. The bond between metal and oxygen was confirmed by the peaks at 485 and 606  $\text{cm}^{-1}$  analyzed by Fourier transform infrared analysis (FTIR). High-resolution Transmission Electron Microscope (HRTEM) with Selected Area Electron Diffraction (SAED) clearly shows the presence of Rutile ( $\alpha\text{-TiO}_2$ ) nanoparticles. The so-prepared  $\alpha$  Rutile ( $\alpha\text{-TiO}_2$ ) nanoparticles are tested against bacteria like *K.pneumoniae*, *E.coli* and *Staphylococcus aureus* and shows that the antimicrobial potential of nanoparticles has high activity on those bacterial strains.

**Keywords:** Nanoparticles;  $\alpha\text{-TiO}_2$ , co-precipitation method; structural properties, optical properties, antimicrobial activity.

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**PP-FM-481**

## Manoeuvring the properties of calcium phosphate/titanate composite for biomedical applications

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### ABSTRACT

The nanostructured bioceramics of calcium phosphate are current themes of research and they are becoming important as bone matrix in regeneration of tissues in orthopedic and dental applications. Nanocomposite powders of calcium phosphate, reinforced with nanometric particles of titanium oxide, silica oxide and alumina oxide, are being widely studied because they offer new microstructures, nanostructures and interconnected microporosity with high superficial area of micropores that contribute to osteointegration and osteoinduction processes. This study is about the synthesis of nanocomposites powders of calcium phosphate reinforced with titanium oxide and its characterization through the techniques of X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM), The metal ion-doped TCP demonstrated the potential for better performance in tissue engineering, such as increasing osteoconductivity for bone in growth, enhancing osteoinductivity for bone mineralization with ion release control, and encapsulating drugs or growth factors.

**Keywords:** Nano-hydroxyapatite synthesis, Calcium Phosphate/Titanate composite, metal ion-doped TCP, biocompatibility.

PP-FM-482

## Synthesis of Hydroxyapatite Nanoparticles derived from white Cockle Shell

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### ABSTRACT

Hydroxyapatite [Hap] is considered one of the most efficient biomaterials with a commonly accepted formula  $\text{Ca}_{10}[\text{PO}_4]_6 [\text{OH}]_2$ . It has gained popularity due to the recovery of bone and tooth tissues. In this study, nano-hydroxyapatite powder was synthesized using white cockleshell as its calcium precursor and tested for its antibacterial properties. Antibacterial activity was determined using *S.aureus*, *E.coli*, *B. subtilis*, *Listeria monocytogenes*. The XRD spectra showed the formation of hydroxyapatite in the range 37.32 - 49.27 nm. The nanohydroxyapatite functional groups are characterized using FTIR, the analysis indicate the presence of OH,  $\text{CO}_3^{2-}$  and  $\text{PO}_4^{3-}$ . The molar ratio Ca/P is obtained of 1.71 approaching theoretical hydroxyapatite of 1.67. The resulted nano-hydroxyapatite has significant antibacterial properties to *S.aureus*, *E.coli*, *B. subtilis*, *Listeria monocytogenes*.

**Keywords:** nano-hydroxyapatite synthesis, Cockleshell waste, Antibacterial activity, biocompatibility

PP-FM-496

## Highly Efficient Base-Catalyzed Synthesis of Piperidine-4-imine Lead Molecules for SARS-CoV-2 Mutant Spike Protease via in Silico method

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### ABSTRACT

For the discovery of drugs to SARS-CoV-2 pandemics, we have developed a new series of piperidine-4-imines as the central core owing to significant pharmaceutical demands on it. The synthesis of piperidine-4-imines involves a two-step base-catalyzed reaction, namely (i) condensations followed by cyclization with aromatic aldehyde, aliphatic ketone, and ammonia to yield piperidine-4-ketone core, and (ii) a simple Schiff base/piperidine-4-imines formation between piperidine-4-ketone and various aromatic primary amines. All the synthesized intermediate and target piperidine-4-imines molecular structures were well characterized by NMR, FT-IR, and mass spectral studies. Further, the ground state geometry of synthesized molecules was optimized using DFT with basis set of b3lyp 6-31g (d,p) in Gaussian 09 program. Using this molecular geometry, we docked against SARS-CoV-2 mutant spike protease of delta, delta plus, and omicron, shows an effective binding ability. In addition, Lipinski's rule, preADME and toxicity studies also reveal drug-likeness properties.

**Keywords:** Piperidine-4-imine, Base-catalyzed, SARS-Cov-2, DFT, and Docking.

# **6. SENSORS**

## **PAPER PRESENTATIONS**

OP-SS-048

## Sensing of Metal Ions by Green Synthesized Silver Nanoparticles by Final Fluorescent Emission

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### ABSTRACT

In this work, we report the green synthesis of metal nanoparticle (MNP) for sensing metal ions by optical methods. Highly stable silver nanoparticle (AgNPs) has been synthesized via green synthesis using diluted gum obtained from *Aegle marmelos*, commonly known as bael gum (BG). The green route is chosen, since it is more economically viable, simpler and eco-friendly method. The MNP formed on heating the mixture of silver nitrate ( $\text{AgNO}_3$ ) solution and BG for 30 minutes. The added BG assist in both the reducing the metal ion and stabilizing the NPs formed. Formation of AgNPs was visually evident by the change of colour from yellow to dark brown. Further the formation of AgNPs was confirmed by the 400nm peak in the UV-visible spectrum, which is due to surface plasmon resonance of the NPs formed. Metal nanoparticles prepared are characterized by IR spectrometer, Powder XRD and Cyclic voltammetry measurements. The metal ion sensing property of AgNPs is assessed using transition metal ions ( $\text{Ag}^+$ ,  $\text{Cu}^{2+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Mn}^{3+}$ ,  $\text{Mo}^{3+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Th}^{2+}$ ) and main group metal ions ( $\text{Al}^{3+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Bi}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Li}^+$ ,  $\text{Na}^+$ ). Prime importance of these biosynthesized nanoparticles was the efficient sensing activity towards inorganic metal ions and the green synthesized Ag nanoparticles instantly detected the presence of metal ion in micromolar concentrations. Therefore, the green synthesized Ag NPs are potential candidate for optical sensing.

**Keywords:** Green synthesis, Nanoparticles, Optical sensing, Fluorescence, Metal ions.

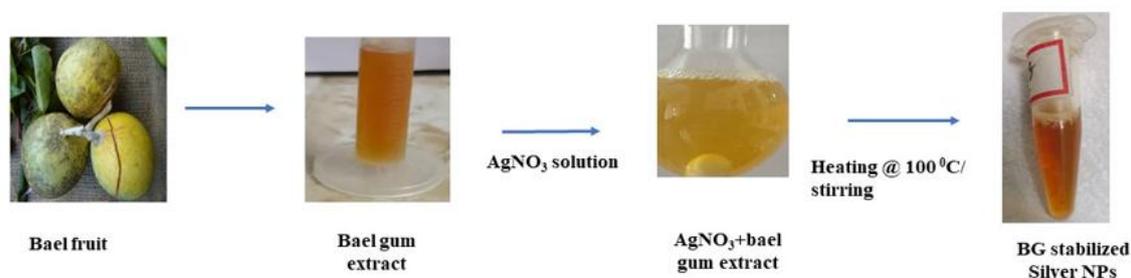


Fig. 1: Schematic Representation of Green Synthesis of BG stabilized AgNPs.

OP-SS-057

## Non-Enzymatic Electrochemical Sensor for the Real-Time Detection of Glutamic Acid using Stroke Induced Human Neural Cells

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### ABSTRACT

The significance of neurotransmitter detection in diagnosing and treating many physiological and behavioural illnesses is inalienable.<sup>1</sup> Hence, developing electrochemical sensors for economic diagnostics that offer a timely output on demand is a significant concern in the present biomedical research.<sup>2</sup> The development of such a sensor requires immense knowledge, from synthesizing sensor material to its real-time sensing ability. Glutamic acid (Glu) sensors have always piqued the interest of the scientific community, owing to the numerous roles of Glu in pathophysiology and psychopharmacology.<sup>3</sup> The past decade has witnessed its paradigm shift from first-generation enzymatic sensors to third-generation non-enzymatic ones. Hence, various efforts are being taken to develop sensitive and selective real-time detection of Glu.

Here, we report a low-cost easily synthesized nickel hydroxide/ multiwalled carbon nanotube modified non-enzymatic sensor for the detection of Glu with an LOD of 0.72  $\mu$ M. The sensor exhibited high sensitivity, selectivity, and stability. The detection of Glu was performed using the human serum of different individuals. The real-time monitoring of Glu was also performed by sub-culturing human neural cells SH-SY5Y and detecting the Glu released by these cells. As a specific application to stroke-affected patients, the sensor was analyzed to detect Glu released from an in vitro stroke model. The sensor successfully detected Glu released during the oxygen-glucose deprivation process, which is destined to become an important breakthrough in the medicinal field in the coming decade.

**Keywords:** Nickel hydroxide, Multi-walled carbon nanotube, Glutamic acid, SH-SY5Y neural cells, Oxygen glucose deprivation.

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OP-SS-082

## Analysis of the Optical, Chemical, Surface, and Humidity Sensing Characteristics of Nanostructured Bi<sub>2</sub>O<sub>3</sub>-doped MoO<sub>3</sub> Materials

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### ABSTRACT

In the present investigation, we report characterization and humidity sensing studies of pure molybdenum trioxide and Bi<sub>2</sub>O<sub>3</sub>-doped MoO<sub>3</sub> nanomaterials prepared by a solid-state reaction method. Pellet samples of MoO<sub>3</sub>-Bi<sub>2</sub>O<sub>3</sub> nanocrystalline powders with 0, 10, 20, and 50 wt.% of Bi<sub>2</sub>O<sub>3</sub> in MoO<sub>3</sub> were prepared. The prepared powder was given a pellet shape by applying pressure of 150 MPa. The X-ray diffraction studies showed the peak of orthorhombic molybdenite and monoclinic bismite present in the sample. The crystallite size was calculated using the Scherrer formula and found to be in the range of 37-72 nm. The grain size of samples was also measured by FE-SEM micrographs. FE-SEM micrographs suggest that small crystallites agglomerate to form large grains. The FT-IR results confirm the chemical bonding of molybdenum and bismuth with oxygen. FT-IR spectroscopy was used to investigate the molecular vibration and functional groups of synthesized nanomaterials. The optical band gap was determined by UV spectroscopy and found in the range of 4.08 to 4.13 eV. The surface topography was studied by AFM, which showed an average roughness of 35.52nm, 23.87nm, 16.07nm, and 23.40nm, respectively. The synthesised samples were exposed to humidity in the range of 10-90% RH. It was discovered that an increase in the weight percentage of Bi<sub>2</sub>O<sub>3</sub> in MoO<sub>3</sub> causes the sensor's sensitivity to rise. The sample with 50 wt.% exhibits the highest sensitivity, 24.8 MΩ/%RH. The hysteresis slightly decreases with increasing wt.% of Bi<sub>2</sub>O<sub>3</sub> in MoO<sub>3</sub> and exhibits 1.62% for a sample with 50 wt.%.

**Keywords:** Humidity, Powder, Micrographs, Grains, Hysteresis.

OP-SS-089

## Structural and Photosensitivity studies of $\text{Bi}_{1-x}\text{La}_x\text{FeO}_3$ Thin Film Heterostructures

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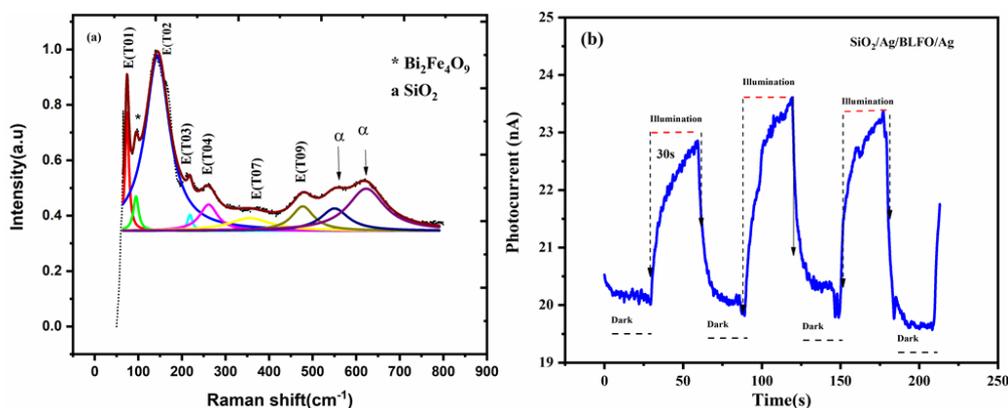
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### ABSTRACT

Being a room temperature multiferroic material bismuth ferrite ( $\text{BiFeO}_3$ ) has been widely investigated for its applicability to memory elements, photovoltaic devices, sensors etc (1). In the present study light induced switching of resistive states of  $\text{BiFeO}_3$  have been investigated. Thin films of lanthanum doped bismuth ferrite ( $\text{Bi}_{0.8}\text{La}_{0.2}\text{FeO}_3$ ) have been deposited using RF magnetron sputtering. The thin film was fabricated in an architecture  $\text{SiO}_2/\text{Ag}/\text{BLFO}/\text{Ag}$ . The structure of the prepared film was identified to be rhombohedral with small amount of secondary phase  $\text{Bi}_2\text{Fe}_4\text{O}_9$ . The Raman analysis also supports the XRD observation. FESEM micrograph shows spherical morphology and uniform distribution of grains. Film possesses a strong absorption band in the UV region with absorption maximum centred at 303nm. The Photosensitivity studies show the primary indication of switching of resistive states upon visible light illumination with a photoresponsivity value 4.02nA/W.

**Keywords:**  $\text{BiFeO}_3$ , Photosensitivity, RF sputtering, Raman spectra.



**Fig. 1:** a) Raman spectra of  $\text{SiO}_2/\text{Bi}_{0.8}\text{La}_{0.2}\text{FeO}_3$ . b) Photosensitivity response of BLFO film upon an illumination using halogen lamp of incident power  $1.1\text{mW}/\text{cm}^2$

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OP-SS-099

## Comparative Study on Zinc and Tin Oxide for Gas Sensing Application

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### ABSTRACT

The gas sensor market is changing dramatically with increasing demand for monitoring various types of gases present in the environment. Currently, besides various gas sensor materials, metal oxide semiconductor materials are being widely used in gas sensors within the world due to their high sensitivity and low cost. Hence, in this present study, Zinc oxide (ZnO) and Tin oxide (SnO<sub>2</sub>) are synthesized by a low-cost hydrothermal method, and their physical and chemical properties were thoroughly characterized. XRD data of Zinc oxide shows the diffraction peaks observed are hexagonal wurtzite ZnO, calculated from Fullprof software, space group- P63mc with space group no. 186, the volume of cell-  $47.61 \times 10^6 \text{pm}^3$  and crystallite size were found in the range of 30-65 nm. XRD data of Tin oxide shows the diffraction peaks observed are tetragonal wurtzite SnO<sub>2</sub>, calculated from Fullprof software, space group- P42/ncm with space group no. 138, the volume of cell-  $70.62 \times 10^6 \text{pm}^3$ . The crystallite size was determined by Scherrer's formula and modified Scherrer's method. The surface morphologies of synthesized nanomaterials are investigated using a field emission scanning electron microscope (FE-SEM) and elemental composition analysis is carried out using Energy-dispersive X-ray spectroscopy (EDS). The FT-IR results confirm the chemical bonding of Zinc with oxygen and Tin with oxygen. FTIR also use for material composition, Further UV Visible spectroscopy is used to study the optical and electrical properties of ZnO and SnO<sub>2</sub> material. The data for rutile ZnO suggest that its surfaces host deeply trapped electrons at large densities, allowing good sensitivities and, more notably, a relatively unsaturated response at large concentrations. This comparative study compared Zinc oxide and Tin oxide and concluded on their sensing applications the dependency on characterization results.

**Keywords:** Metal oxide, Gas sensing, Hydrothermal, Characterization, Zinc oxide, Tin oxide.

**OP-SS-143**

## A Novel Naphthol Diazenyl Scaffold based Schiff Base as Potential Chemosensor Properties with Various Metal Ions

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### ABSTRACT

A novel naphthol diazenyl scaffold-based Schiff base was well synthesized by condensation of 2-naphthol azo dye with aromatic amine. A study on their electrochemical and fluorescence have also been performed. The binding have been characterized on account of metal estimation studies, conductance behaviour, IR, UV-Visible and thermal analysis. The electrochemical properties of the binding Schiff base have been studied by cyclic Voltammetry. The Schiff base exhibits a strong fluorescence emission; in contrast to this partial fluorescence quenching phenomena is observed.

**Keywords:** Schiff base, IR, UV-Visible, Photoluminescence, Cyclic Voltammetry.

**OP-SS-144**

## Microwave Band Pass Filter with Super Substrate for Detection of Dielectric Constant in C<sub>2</sub>H<sub>6</sub>O/H<sub>2</sub>O Aqueous Solutions

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### ABSTRACT

In this study, an assessment of dielectric properties was evaluated using a microwave band pass filter with super substrate for detection of dielectric constant C<sub>2</sub>H<sub>6</sub>O/H<sub>2</sub>O aqueous solutions is explained. The prototype consists of microwave band pass filter with symmetric structure on a dielectric substrate and rectangular slot joining the microstrip lines. A super substrate (Rogers RT/ duroid 6010LM (tm)) is placed above the rectangular slot. In parallel to the process, a microfluidic channel is created through the super substrate and rectangular slot in the prototype to fill the aqueous solution samples each capitulate unique impedance parameter in the transmission poles and transmission zeros. The dimensional framework of the proposed band pass design structure have FR4 epoxy ( $\epsilon_r = 4.4$  and  $\tan \delta = 0.02$ ) substrate with 1.6 mm thickness. The detection technique is based on odd-even mode method with the change in resonance characteristics when variation in dielectric properties of the test samples in the microfluidic channel and the presence of super substrate when comes in contact. When compared to commercial and ideal permittivity values, the detector prototype required a 2.5  $\mu$ L volume of liquid sample each time, but still provided an overall accuracy of better than 99.06 %, with an average error measurement of 0.45 %. At 3 GHz, there was good agreement between simulated and measured results over a wide frequency range of 1 to 6 GHz.

**Keywords:** Odd-Even mode method, Bandwidths shifts, Transmission poles, Dielectric detection.

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### OP-SS-145

## A High-Performance Quad-Port Defected Ground Structured Multiple-Input Multiple-Output Antenna System for 5G Sub-6GHz RF Devices

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### ABSTRACT

The design of a miniaturized Four-element MIMO antenna system for sub-6 GHz fifth generation (5G) RF device applications generating different bands and high port isolation properties is presented in this work. The suggested antenna system features a single-band module comprised of four 9-shaped elements positioned perpendicularly; each antenna element in this feature covers the C-band, providing uniqueness as well as good isolation. The total dimension of the main antenna is  $38 \times 38 \times 1.6$  mm<sup>3</sup>. A single antenna is made up of four radiating elements that are fed via a 50-ohm microstrip feeding line built on the main board. According to the results, the developed MIMO antenna radiates at multiple frequency ranges inside the assigned 5G spectrums, namely 5.0-5.2 GHz, based on impedance bandwidth criterion. It is also revealed that the antenna elements can produce pattern diversity in both frequency ranges. Furthermore, isolation of greater than 18 dB is seen between any two radiating elements. Several MIMO essential performance metrics, including as diversity gain, envelope correlation coefficient, and channel capacity are evaluated. A pattern is created, observed, and the measured and simulated results are found to agree well. Based on its performance characteristics and highest peak gain of 4.8 dBi, the proposed MIMO system can be used in 5G communication networks.

**Keywords:** MIMO Antenna, 5G RF Devices, ECC, Spatial diversity, Peak gain, SAR Analysis.

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**OP-SS-211****Exploration and Study on the Influence of Zinc Substituted Barium Stannate (BaSnO<sub>3</sub>) Nano Powders for Ammonia Sensing Applications**

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**ABSTRACT**

In the present work, we report the ammonia (NH<sub>3</sub>) gas sensing performance of a ternary Barium Stannate (BaSnO<sub>3</sub>) semiconducting oxide material doped with zinc at the Barium site (Ba<sub>1-x</sub>Zn<sub>x</sub>SnO<sub>3</sub>, where x = 0.0; 0.2; 0.4; 0.6; 0.8 & 1.0). Simple hydrothermal technique was adopted for the synthesis of all the samples. The samples were characterized using XRD, FESEM, EDAX, UV-DRS and PL for their structural and optical properties. Among various test gases, all the interdigitated electrode materials exhibited a fast response to NH<sub>3</sub> except 2Zn<sub>x</sub>B<sub>1-x</sub>SnO<sub>3</sub>. Amidst these electrode materials (ZnBSO (0-10 wt.%)), the 8ZnBSO exhibited good sensitivity to NH<sub>3</sub> at 5 ppm at the room temperature. The similar response and recovery time (40s), and a good cyclic repeatability of the 8ZnBSO electrode material clarifies that this would be the most favourable electrode material for NH<sub>3</sub> gas sensing.

OP-SS-427

## Electrostatic Self Assembly of Synergistically Enhanced Hexagonal Boron Nitride Encapsulated Protonated Graphitic Carbon Nitride Nanocomposite Towards Electrochemical Detection of Sulfamethazine with High Selectivity

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### ABSTRACT

The development of a nonenzymatic sensing platform for the highly sensitive and selective detection of particular biomolecules is challenging for the scientific community. Antimicrobial Resistance (AMR) in adults can result from an overdose of the antibacterial drug sulfamethazine (SMZ), which prevents microorganisms. Therefore, the need for a quick and accurate sensor that can detect SMZ in milk and meat residuals. This study seeks to protonate g-C<sub>3</sub>N<sub>4</sub> (PCN) and electrostatically assemble it to create a unique 2D/2D (h-BN/PCN) nanohybrid that may be used as an electrocatalyst for SMZ sensing. The structural and morphological characteristics of the as-produced material were investigated using XRD, FT-IR, RAMAN, XPS, HR-SEM, and HR-TEM techniques, and the electrochemical properties were tuned using CV, EIS, DPV, and i-t curve techniques. According to the electrochemical experiment, the synergistic effect and active surface sites are what caused the considerable increase in conductivity h-BNs after PCN assembly. With a quick response time, high sensitivity, a low detection limit, a wide detection range, and long cycle life, the electrocatalyst-modified GCE that is described here demonstrates superior non-enzymatic sulfamethazine sensing performance. Based on electrochemical investigations, it is claimed that the suggested sensor has improved operating stability, rapid response, fair repeatability, and reproducibility. Most significantly, our produced sensor showed exceptional selectivity over a variety of potential interferents. The capability of the h-BN/PCN modified sensor to identify SMZ in a sample of cow milk, which is frequently consumed by people, was also examined.

**Keywords:** 2D/2D heterojunction, Sulfamethazine, h-BN/PCN, Milk sample, DPV.

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OP-SS-430

## LPG Sensing and MB Dye Degradation by RF-Sputtered TiO<sub>2</sub> Thin Films

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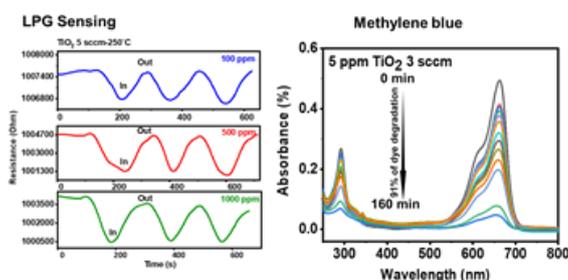
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### ABSTRACT

Growing fast industrialization has led to environmental-related issues. Some of the major environmental pollutants are organic dyes in food, textiles, leather industries and hazardous, gases emitted from industries. [1]. Metal-oxide nanomaterials have attracted great attention due to their versatile properties. Herein we report the synthesis, LPG gas sensing, and photocatalytic activity of TiO<sub>2</sub> thin films prepared by RF sputtering technique. X-ray diffraction, Raman spectroscopy, field emission scanning electron microscopy, UV-visible spectroscopy, Fourier transform infrared spectroscopy were used to characterize the structural properties, optical properties, and elemental composition of TiO<sub>2</sub> thin films. The structural studies reveal that the TiO<sub>2</sub> thin films grown using low concentration of O<sub>2</sub> contain anatase phase and the films grown using high O<sub>2</sub> concentration contain rutile phase [2]. The crystallite size of the TiO<sub>2</sub> thin films range from 7.7 nm to 8.9 nm. FESEM analysis confirmed the presence of quasi-spherical nanoparticles. From UV–vis spectroscopy, the bandgap energy was determined as 3.48 eV–3.25 eV. LPG sensitivity of rutile TiO<sub>2</sub> thin films can reach up to 7.3% for the concentration of 100 ppm at an operating temperature 250°C. The response and recovery time of the thin films were 8.1 s and 70 s, respectively. Photocatalytic activity results of anatase TiO<sub>2</sub> thin films demonstrated methylene dye degradation (91%) in 160 min under UV light irradiation. Structurally dependent-TiO<sub>2</sub> thin films can significantly improve gas sensing and photocatalytic properties and thus have the potential for practical applications in future nanotechnology.

**Keywords:** TiO<sub>2</sub>, Thin films, RF sputtering, Gas sensing, Photocatalysis.



**Fig.1:** LPG Sensing and Methylene blue dye degradation

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OP-SS-431

## Synthesis of Conducting polymer/2D Nanocomposite modified Electrochemical Transducers for the Detection of 5-Fluorouracil with High Selectivity

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### ABSTRACT

One of the most significant chemotherapy drugs, 5-fluorouracil (5-Fu), is used to treat various types of cancers such as colon, esophageal, stomach, pancreatic, breast, and cervical cancer. Recognizing the safe and effective dosage of drugs for chemotherapy remains a critical concern in the management of cancer diseases. Herein we reported the efficient electrochemical detection of 5-Fu by a modified GC containing conducting polymer encapsulated with 2D material. The efficiency is attributed due to the high electrical conductance with a large surface area consisting of numerous active sites. Furthermore, the successful synthesis of nanocomposite was confirmed by the HR-TEM, HR-SEM, XRD, and FT-IR. The electrochemical properties and sensing performance of nanocomposite modified GCE towards 5-Fu were tested using electrochemical impedance spectroscopy (EIS) and the cyclic voltammetry (CV) respectively. The electrochemical experiments further confirmed the enhanced sensing performance of modified GCE. The analytical performance of our proposed catalyst was tested using electrochemical techniques such as differential pulse voltammetry (DPV), and the amperometry (i-t curve), and the nanohybrid showed enhanced sensing performances with quick response time, wide linear range, the lowest limit of detection, high sensitivity, selectivity in the presence of various interferents, and prolonged cycle stability over 30 days. Finally, the practical applicability of the proposed sensor was tested with real-world samples with very good recovery percentages.

**Keywords:** Sensors, Sensitivity, Conducting polymer, Interface, Electrocatalyst, Environmental sample.

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OP-SS-432

## Simple Triphenylamine-Based High Performance Electroluminescent Materials: From Molecular Design to Device Fabrication Studies

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### ABSTRACT

A series of new D-A-D type small fluorophores with triphenylamine (TPA) as a fixed donor and different acceptor core were investigated. The photophysical, thermal and electrochemical properties of these fluorophores were systematically studied. All the fluorophores showed high fluorescent quantum yields in the solid film state. The fluorophores displayed high thermal stability with decomposition temperatures above 350°C. The electrochemical properties reveal that they possess appropriate HOMO and LUMO energy levels for effective charge injection. Finally these new synthesized luminogens were employed in the fabrication of new OLED device as sole emitters and dopants with CBP host materials. Interestingly, the host-guest devices doped with CBP host emitters show a remarkable improvement in the overall device performance. Synthesized triphenylamine based doped device has achieved a maximum current efficiency ( $\eta_c$ ), high power efficiency ( $\eta_p$ ), and good external quantum efficiency ( $\eta_{EQE}$ ) of 10.72 cd/A, 7.87 lm/W, and 5.32%, respectively.

**Keywords:** Triphenylamine, Donor-acceptor (D-A-D), Yellow, Organic light-emitting diodes.

PP-SS-199

## A Cost Effective Way to Determine Transistor Characteristics Using Arduino

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### ABSTRACT

Transistor, the semiconductor device, which consist of two p-n junctions are widely used in electronic industries like amplifiers, switches etc. Hence analyzing characterization of a transistor is a prime requirement in semiconducting research. The semiconducting parameter analyzers available in the market are not affordable for many laboratories. In order to make a cost effective transistor characterization set up, we use Arduino microcontroller, which is cost effective, programmable and can be interfaced with computer. Arduino is basically an open-source electronic prototyping platform which help us to build automatic electronic objects. Using Arduino we can directly measure the voltage across any terminals and get the data as spreadsheet. For measuring current, we measure voltage across suitable resistor and calculate current. In this work we analyzed BC547C NPN transistor characteristics. A digital potentiometer MCP41010 was used to sweep the potential in the input and output. The input

and output characteristics are matched with the device specification. This cost effective device can be used for primary analyzes of transistors in semiconducting research.

**Keywords:** transistors, Arduino, Transistor characterization.

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### PP-SS-203

## Automated simple pendulum measurement using Arduino

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### ABSTRACT

Measuring the acceleration due to gravity using simple pendulum is of fundamental importance and is indispensable part of most of the mechanics courses. It describes the movement of a bob hanged from a fixed end under the influence of gravity. For tracking the movement of a bob, a suitable sensor and suitable interface to take data with time is needed. Here we used the Arduino UNO microcontroller with suitable sensors for the experiment for the automated measurement of simple pendulum. Arduino UNO, which is an easy programmable board is based on ATmega328P microcontroller. For our experiment we used an ultrasonic sensor and a light detecting diode to detect the movement of the oscillator. A large ball was used as a bob in order collect the reflected signals using the sensor. We performed the experiment first with ultrasonic sensor and then with light detecting resistor. The program was uploaded in Arduino from the computer. The sensors convert the distance measurement to proportional voltages. From the sinusoidal data collected we can are able to trace the movement of the ball and calculate the time period. The acceleration due to gravity was calculated from the time period extracted from the data. We also discuss the comparison of the two sensors used for the better collection of the data.

**Keywords:** Simple pendulum, Arduino; sensor, Acceleration due to gravity.



**Fig.1:** Experimental set up.

PP-SS-205

## Implementing characterization of RC circuit using Arduino

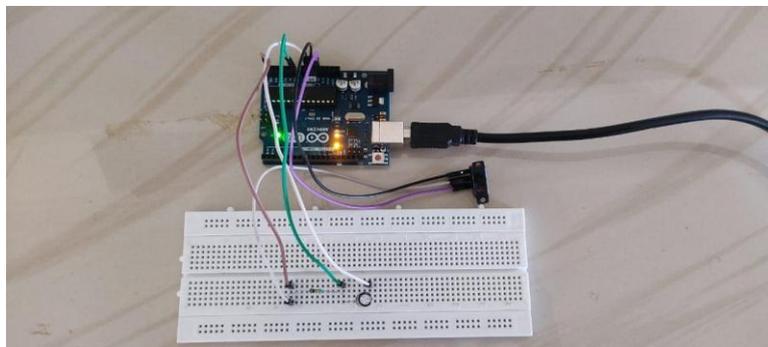
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### ABSTRACT

Investigating charge discharge characterization of an RC circuit is of high interest in fundamental understanding as well as for the modern research like super-capacitor research. Most of the experimental instruments to measure the automated characterization of RC circuits like potentiostat are not affordable to many laboratories. Here we demonstrate a cost effective and efficient method to characteristics of different capacitors using Arduino Microcontroller. Arduino is a microcontroller and easily programmable and can be interface with the computer. The capacitor is connected in series with resistor and powered from Arduino. The voltage can measured across capacitor and current can be calculated from the voltage drop across the resistor. The Arduino supplies 5 V constant voltage and a SPDT switch was used to switch on and off the circuit. The transient characteristics of the capacitors were measured using Arduino interface. In this study we demonstrate the characterization using common capacitors with values (220microF, 100microF and 47microF). This measurement system can be used for the preliminary study of the characteristics of supercapacitor materials at low cost.

**Keywords:** RC circuit, Arduino, Supercapacitor.



**Fig.1:** RC Circuit Using characterization set up.

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**PP-SS-215**

## Demonstration of Damped Harmonic Oscillator Using Arduino

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### ABSTRACT

A damped harmonic oscillator is one of the central problems in mechanics and has a fundamental importance in physics. It describes the movement of an oscillator under the influence of the restoring force and friction. For tracking the movement of an oscillator suitable sensor and suitable interface to take data with time are needed. Here we use the Arduino UNO microcontroller with suitable sensors for the experiment. Arduino is an open-source electronics platform based on easy-to-use hardware and software. For our experiment, we use an ultrasonic sensor and a light-detecting diode was used to detect the movement of the oscillator. The steel scale is placed parallel to the ultrasonic sensor and vibrated manually. We performed the experiment first with an ultrasonic sensor and then with light detecting diode. The program was uploaded to Arduino using the computer. The sensors convert the distance measurement to proportional voltages. From the data collected, we can are able to trace the movement of the oscillator and further analysis of the damped harmonic oscillator was done. We also discuss the comparison of the two sensors used for the better collection of the data.

**Keywords:** Damped oscillation, Arduino, Ultrasonic sensor, Obstacle, Vibration.

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**PP-SS-216**

## Low-cost diode characterization set up using Arduino

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### ABSTRACT

Diodes, the semiconductor devices which allow the flow of current in one direction can be used in the electronic industry for many applications like switches, rectifiers, voltage regulators, etc. Diodes are widely used in electronic circuits and the diode characteristic defines its operating properties. Studying diode characteristics has primary importance in semiconductor research. Here we demonstrate a cost-effective and efficient method for characteristics of different diodes and LEDs using an Arduino Microcontroller. Arduino is a microcontroller and easily programmable and can be interface with the computer. The diode is connected in series with a resistor and variable DC voltage. The voltage can be measured across diodes and current can be calculated from the voltage drop across the resistor. The Arduino supplies 5 V constant voltage and a digital potentiometer (MCP41010) can be used

to tune the potential across the diode. In this study, we demonstrate the diode characterization using a common 1N4007 diode. This measurement system can be used to study the diode characteristics in material research in a cost-effective and automated way.

**Keywords:** Diode, Arduino, Diode characterization.

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#### PP-SS-256

### Gold- Silver Alloy Embedded PEDOT Nanohybrids for the non-enzymatic Electrochemical Detection of Histamine.

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#### ABSTRACT

Recently, poly(3,4-ethylenedioxythiophene) (PEDOT) has become one of the most described conducting polymers (CPs) due to its remarkable performance in various fields. The synergistic effect between CPs and metal nanoparticles appears with great perspective for new assemblies and applications. Properties of monometallic nanoparticles are enhanced, when alloys are formed in the nanoregime. It is difficult to controllably synthesize Au-Ag alloy nanostructures without using hazardous or expensive chemical agents. Liquid/liquid interface-assisted polymerization offers a scalable methodology to fabricate hybrid materials, in contrast to the conventional and ubiquitous routes. We introduce this versatile approach toward the fabrication of well-tailored Au-Ag alloy nanostructures in a CP matrix, PEDOT. Without using any external reducing agents, in-situ polymerization at the hexane/water interface has produced Au-Ag alloy embedded PEDOT nanostructures. By varying the molar ratio of Au<sup>3+</sup>/Ag<sup>+</sup> in the mixture solution, efficient nanostructure tuning has been achieved. The as-synthesized composite was further adapted to detect histamine (HA), a crucial biomolecule known for its regulatory functions in the human body and occurs naturally in foods and drinks. The consumption of abnormal doses of HA can lead to allergic reactions and neuropsychiatric disorders. The sensor displayed high sensitivity towards HA with a limit of detection (LOD) of 1.5 nM, even in the presence of various interfering analogs. The proposed sensor's ability to detect HA generated by sub-cultured human neural cells SH-SY5Y and canned tuna fish demonstrated its practical viability. Therefore, PEDOT/Au-Ag alloy nanohybrids can serve as an ideal non-enzymatic sensor for the sensitive and selective detection of HA.

**Keywords:** PEDOT/Gold- Silver alloy, Interfacial polymerization, Histamine, Electrochemical sensor.

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## PP-SS-258

### Enhanced Output Performances of Triboelectric Nanogenerator Based on ZIF-67/PVDF Film for Harvesting the Mechanical Energy

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#### ABSTRACT

Mechanical energy harvesting based on the triboelectric effect has been demonstrated to be a simple, cost-effective, and reliable technique of generating power. However, TENG's output performance remains low and requires further improvement in order to accelerate commercial application. The performance and application of TENG are significantly influenced by the material used in fabrication. In this work, a TENG based on Zeolite imidazole family ZIF-67 a subclass of metal-organic frameworks (MOFs) is reported. The ZIF-67 incorporated PVDF and PMMA are used as active materials for the TENG device. When hand tapped, the developed TENG generated maximum output voltage and current of  $\square 186.4$  V and  $\square 55.3\mu\text{A}$  respectively. The maximum output power density obtained from the TENG is  $\sim 86.3\mu\text{W}/\text{cm}^2$  and can directly power up to 136 LEDs. Further, the TENG response was tested over 500 cycles confirming its stability. Hence the reported TENG has a potential application in portable electronic devices and sensors.

**Keywords:** Triboelectric nanogenerator, Metal-organic frameworks, Energy harvesting, Electronic devices.

PP-SS-263

## Effect Thermal Annealing on the Morphology of ZnO Films: Transformation of Micro-Flowers to Nanoparticles

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### ABSTRACT

ZnO/Si (111) films deposited using radio frequency (RF) sputtering exhibit various morphologies from flower-like microstructure to spherical nanoparticles. We have reported the transformation of ZnO micro-flowers into nanoparticles using thermal annealing in the temperature range 400-700°C. AFM images reveal the formation of ZnO micro-flowers in as-deposited films which transformed into nanoparticles after annealing at 400°C. With further annealing up to 700°C, the size of these nanoparticles increases. The power spectral density (PSD) approach is performed for quantifying the underlying mechanism governing the evolution of surface morphology with annealing temperature. The variation in the intensity of the PSD curve with annealing is in coherence with the RMS roughness measurements. ZnO films can be employed for multiple applications such as anti-microbial activity and gas sensing depending on their surface morphology.

**Keywords:** ZnO films, Micro-flowers, Nanoparticles, PSD.

PP-SS-292

## A Structural and Optical Study of Sol-Gel Auto Combustion Derived Facile Potassium Doped Magnesium Ferrite Nanostructures

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### ABSTRACT

Potassium doped magnesium ( $Mg_{0.7}K_{0.3}Fe_2O_4$ ) nanoferrite was synthesized via conventional sol-gel auto combustion method using oxalic acid as a chelating agent. The morphology and structure of obtained product was examined using scanning electron microscope (SEM) and X-ray diffraction (XRD) techniques. The analysis of XRD pattern revealed the formation of single-phase cubic spinel structure. The size distribution of small particles in suspension or polymers in solution was determined by using the DLS (Dynamic Light Scattering) technique. It gives the hydrodynamic radius of particles suspended in a prepared dispersion. The UV-

Vis spectroscopy measurement gives the absorption spectra near 370 nm as well as the optical energy band gap value around 3.23 eV using Tauc plot. The desired nanostructures find their extensive applications in microwave absorption, gas sensing, photo catalysis and magnetic recording devices.

**Keywords:** Potassium, Nanoferrites, XRD, SEM.

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**PP-SS-304**

## Microwave Absorption Performance of MWCNTs Derived from Plant Based Oil

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### ABSTRACT

The synthesis of carbon nano structures from biomass has become one of the newest themes in the field of microwave absorption due to its economical, immense availability and sustainability. Plant based oil derived multiwall carbon nanotubes (MWCNTs) were synthesized by Chemical Deposition method (CVD), the structure and properties of the synthesized MWCNTs is scientifically explored. The hollow tubular structures of MWCNTs have excellent dielectric properties and hence shows better microwave absorbing performance. The economically obtained MWCNTs are efficient microwave absorbing materials (MAMs) and demonstrate a big potential in industrial and defense application. Chemical Vapour deposition (CVD) is most utilized method to synthesize Multiwall Carbon Nano Tubes (MWCNTs) because of simple, economical, easy to control experiment condition, controllable diameters and better yield compare to others methods. Plant-based precursors i.e., Olive oil was used as source of carbon to obtained MWCNTs over Ni-Co catalyst in inert atmosphere of Argon gas. The effect of synthesis parameters on yield and morphology of MWCNTs were evaluated using Taguchi optimization method. Acid treated MWCNTs were characterized using FT-IR, FEG-SEM, EDS, TEM. The average diameter and length of MWCNTs are 48 nm and 736 nm, respectively. MWCNTs/Acrylic composite having 9 wt. % and 3.8 mm thickness, an optimal value of -44.0 dB was observed at 10.9 GHz. the effective absorption ( $R_L \leq -20$  dB) has a bandwidth of 10.14-11.59 GHz.

**Keywords:** Chemical vapour deposition, Olive oil, Plant-based precursors, FT-IR, FEG-SEM, EDS, TEM.

PP-SS-331

## Electric Field (EF) Enhancement Factor of SERS Phenomena: Error in Estimating the EF Values Affect the Sensitivity of Sensor

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### ABSTRACT

Surface-enhanced Raman scattering (SERS) is the only spectroscopic technique which provide quantitative and qualitative information on a small number of analytes (down to single molecules), and it can be miniaturized to perform field missions without loss of performance<sup>1,2</sup>. Plasmonic nanomaterials combined with Surface Enhanced Raman Spectroscopy (SERS) meet all of the criteria for an effective platform for pollutant trace detection<sup>3</sup>. These materials can be designed in a variety of shapes/structures to enclose a variety of nanoscopic structures that allow extreme field confinement to subwavelength dimensions, resulting in highly localized electric fields or region of concentrated electric field<sup>4</sup>.

In general, the enhancement factor (EF) of a SERS substrate determines how sensitively it can detect a specific analyte. The EF is roughly proportional to the fourth power of the enhancement of the local electromagnetic field  $E_{local}(|E/E_0|)^4$ , where E and E<sub>0</sub> are the intensities of the local electromagnetic field in the presence and absence of substrates. The experimental determination of EFs necessitates measurements of the SERS intensity for adsorbed molecules on the substrate relative to the normal Raman intensity of the same molecule using the equation below<sup>3</sup>:

$EF = I_{SERS} N_{RS} / I_{RS} N_{SERS}$ , Where, I<sub>SERS</sub> is the total SERS intensity, I<sub>RS</sub> is the normal Raman Intensity of the probe molecules. N<sub>SERS</sub> and N<sub>RS</sub> are the number of molecules contributing under SERS and normal Raman conditions, respectively. At a given excitation wavelength, this equation is evaluated for a specific Raman-active vibrational mode. During these calculations, various assumptions, such as the surface coverage of the molecular probe, estimated Raman cross-sections, concentration of analyte molecules, area of the substrate and analyte density can be made, resulting in discrepancies in the values reported in the literature. *The lack of clear protocol makes comparing electromagnetic enhancement factors between laboratories difficult. Therefore, understanding SERS EFs is critical for properly evaluating work in this field and designing any sensor characteristic.*

**Keywords:** SERS; Plasmonic materials; Electric field enhancement factor; Sensors.

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PP-SS-333

## Monitoring and Predictive Maintenance of Copper Pipeline Using AMG8833 Thermal Sensor

Srinivas Palaniraj

### ABSTRACT

In today's world pipelines are widely used to transport fluid or gas medium from one place to another. Especially in the chemical, petroleum, and gas industries pipelines are needed to be well maintained and monitored to avoid catastrophe. Pipeline and Hazardous Materials Safety Administration states an economic loss of \$228 million in the year 2019 with a total of 657 incidents causing 11 fatalities and 36 injuries. So, to avoid such a disastrous event there is a need to find a better solution to this problem. This paper mainly focuses on copper pipelines. After conducting a proper study on copper pipes we are proposing a method using thermography, where a thermal sensor is used to monitor the copper pipelines continuously and the output will be displayed on the screen. The paper describes the sensor and the methods used for the detection of any anomaly in the copper pipeline.

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PP-SS-337

## Review on Temperature Monitoring System for Welding Application – A Case Study on Thermocouple Array

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### ABSTRACT

Process Monitoring System is implemented in machining process to get the quality products, increase the precision, reduce defects, reduce machining time. The process monitoring system, involves in monitoring many parameters such as temperature, force, pressure, voltage, vibration etc., these parameters are implemented in machining process like lathe operation, milling operation, drilling operation, boring, welding etc. On a traditional way a of monitoring these parameters there are two techniques namely **sensor-based techniques** and **image processing technique**. In **sensor-based techniques** different types of sensors has been

used for monitoring such as thermocouple, thermistor, RTD, pressure sensor, accelerometer, vibration sensor, load cell, strain gauge etc., these sensors have been calibrated with a microcontroller for data analysis. **Image Processing technique** involves in capturing the radiation of the machined/machining product by using Infrared camera, ultraviolet camera, photoelectric thermoscope, optical thermoscope, thermal image camera, continuous circuit television etc., the data captured by using the image sensing devices has been processed and analysed by using machine learning algorithm. We are going to develop a processing monitoring system for monitoring temperature of a weld metal welded by using MIG/TIG welding. The weld monitoring system, monitors the rise in temperature of a welded metal during welding process like GTAW, GMAW, Laser Welding etc. It can be achieved by using Sensor-based technique. A K-Type thermocouple is fixed with a titanium alloy. This kit is placed under the welded metal and the heat distribution of the metal is studied and analysed.

**Keywords:** Welding, Thermocouple, Temperature monitoring, FSW, Machining.

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**PP-SS-342**

## Stochastic Diffusion Hunt Optimization for Potential Load Balancing In Wireless Sensor Networks

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### ABSTRACT

Stochastic diffusion hunt optimization (SDH) is an efficient technique to enhance the flexibility and longevity of a wireless sensor network. This paper applies an SDH algorithm for enhancing the energy efficiency of the network and balancing the load. In SDH optimization, its diffusing method selects the optimal cluster heads (CHs) and efficient routing paths. The method converges quickly thanks to SDH operators defined as a particular robustness function that considers minimal power usage and load balancing, as well as new resolution criteria. Furthermore, an adaptive round period believing power and load balancing is offered to keep the clusters running smoothly and cut energy usage even more. The evaluation results indicate that SDH optimization is better than Clustering Routing Protocol for Wireless Sensor Networks (CRCA), Low-energy adaptive clustering hierarchy (LEACH), Genetic algorithm for energy efficient clustering and routing (GECR), Optimal Multi-hop Path Finding Mechanism (OMPFM) and genetic algorithm based distance-aware routing protocol Low-energy adaptive clustering hierarchy (GADA-LEACH) in terms of many clusters formed, the average delay for transmission, mean packet loss, node alive in percentage.

**Keywords:** WSN, Clustering, Load balancing, Multi-hop, Stunt diffusion hunt, Machine learning.

**PP-SS-364**

## IR Sensor Enabled Realtime Location System for Controlling Overcrowding in Outpatient Clinics

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### ABSTRACT

The global positioning system (GPS) is a real-time locating solution, but it falls short in indoors. The issues with indoor location detection have led to the development of several indoor real-time location systems [1]. There are numerous applications for indoor location tracking, and choosing the best technology for the task at hand is the key to the success of a real-time location system. The issue of patient overcrowding in outpatient clinics is examined in the current study. Due to the increased demand and constrained availability of healthcare services, patient congestion in outpatient clinics is a pertinent issue nowadays. Overcrowding of patients causes lengthy wait times, lowers the standard of service given, and makes patients unhappy. The real-time location system, is used to gather information on patient's real-time location. The real time location data helps to make better visualization using simulation tools for the improvement of wait time and the efficiency of the outpatient clinic.

The current study uses an IR sensor based RTLS to find out the location of patients in the hospital [2,3]. The RTLS mainly uses fixed receivers in each hospital room to pick up signals from the patients' tiny wearable IR tags in order to pinpoint their exact location within the facility or another enclosed outdoor space. The patient to whom the tag is affixed is recorded along with their ID. Using a tiny battery, infrared tags transmit signals into the room, that are modified with their individual ID. Infrared receivers fixed in the rooms pick up the signal from the tag and its individual ID before sending the information to a host computer through Wi-Fi. The use of IR sensors has the benefits of great room level accuracy and low cost whereas the short range of IR sensors is a drawback [4]. The location software communicates with the tags and location sensors to find the location of patients in an RTLS. The location engine provides this data to the middleware and application software that visualize the patient density in the outpatient clinic. The middleware in the IR sensor RTLS serves as a channel between the location engine software and the Hospital Simulation and Visualization Software which visualizes the real-time location of patients [5]. The current research solves the problem of accurate collection of patient location data which will help to visualize and simulate analytical models to control overcrowding in the outpatient clinic. The study will also assist both new and seasoned researchers in the field to clarify and characterize workable technologies to develop cutting-edge location identification systems and applications.

**Keywords:** Real Time location systems, Hospital management, Infrared sensor, Outpatient clinic.

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**PP-SS-406**

## Synthesis of Graphene Quantum Dots from Natural Source and its Application Towards Nitro-explosive Sensing

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### ABSTRACT

Rapid and selective detection of nitro explosives is one of the most promising issues concerning global security. Intensive research has already been carried out, however, the selectivity is still lacking. The recent years have seen an increase in efforts to develop a simple and less complex method of converting waste materials into graphene nanomaterials. Herein, we present the valorisation of bio-waste for the green synthesis of graphene quantum dots (GQDs) using hydrothermal technique. These dots were characterized by different analytical techniques such as IR, Raman, UV-vis, and photoluminescence spectroscopy. The morphological analyses, which were conducted using TEM showed that the particles of the samples were uniform in size and circular in shape. The as-prepared GQDs have good fluorescence properties. The as-prepared GQDs are highly sensitive and selective toward ammonium nitrate, as observed using a fluorescence quenching technique.

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PP-SS-487

## Silver Nanoparticles Interfaced with Hematene Nanosheets for the Enhanced Electrochemical Sensing of Hydrogen Peroxide

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### ABSTRACT

Here, we report an electrochemical biosensor for hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) by merging 3-dimensional silver nanoparticles (Ag-NPs) with a 2-dimensional hematene (HMT) nanosheets. The two-dimensional material, HMT was exfoliated from natural iron ore hematite ( $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>) and characterized by Raman spectroscopy. The morphology of the Ag nanoparticles and HMT was imaged by scanning electron microscope. The carrying out of the AgNPs/HMT/GCE electrode was Electrochemical characterization was performed by cyclic voltammetry (CV) and impedance spectroscopy (EIS) and the results showed enhanced sensing properties of AgNP/HMT/GCE towards H<sub>2</sub>O<sub>2</sub>. The fabricated sensor showed a wide linear range from 0.99  $\mu$ M to 953 $\mu$ M and a low detection limit of 0.16  $\mu$ M in a physiological buffer conditions. Further, the sensor successfully applied for the electrochemical sensing of hydrogen peroxide using chronoamperometry (CA) from 58 $\mu$ M to 953 $\mu$ M. These consequences suggested that AgNPs-HMT could be a good campaigner for H<sub>2</sub>O<sub>2</sub> sensing in complex biological illustration.

**Keywords:** Hydrogen peroxide sensing, silver nanoparticles, hematene, 2-dimensional nanomaterials, Chronoamperometry.

PP-SS-499

## S Artificial Intelligence: Predicting the Droughts in Western Coastal India

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### ABSTRACT

Drought is a natural and gradual threat with many devastating consequences for all aspects of human life. Accurate drought forecasting is a promising step to help decision-makers develop strategies to manage drought risks. To achieve this goal, choosing a suitable model is vital in forecasting. Various artificial neural network (ANN) models are used to predict short-term and long-term droughts on different time scales using the Standardized Precipitation Index (SPI), including 3, 6, 12, 24, and 48 months in Rajasthan and Gujarat. Due to the frequent danger of drought, people face environmental challenges today in the country, community,

and industry. Some of the adverse effects of the drought threat persist in Pakistan, including other threats. However, early measurement and identification of drought can guide water resources management to use drought-resistant strategies. This article uses Perceptron Neural Network (MLPNN) algorithm to predict drought. 1Seventeenweather stations in Daman and Diu.

**Keywords:** Artificial intelligence, predicting the droughts, SIP & SDAT, Perceptron Neural Network, Drought occurrence.

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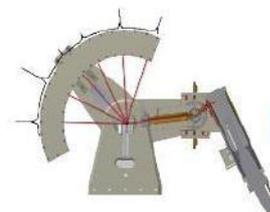
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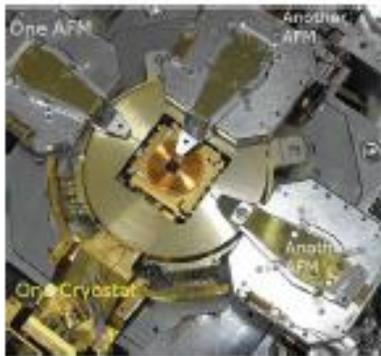
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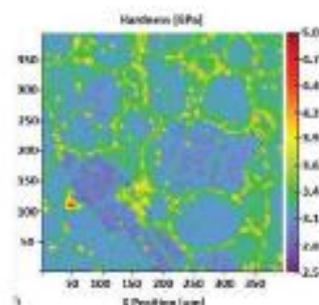
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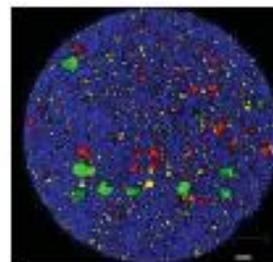
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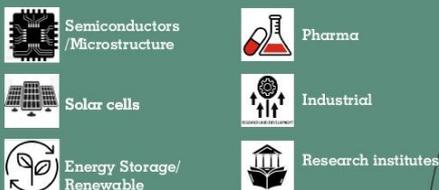
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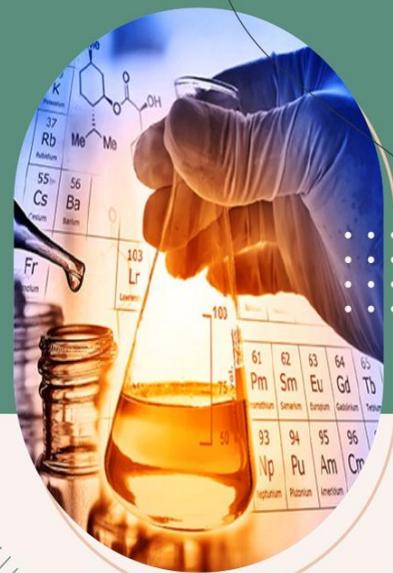
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