ST JOSEPH'S UNIVERSITY

#36, Lalbagh Road, Bengaluru-560027, Karnataka, India

National Conference
on
Next-Generation and Emerging Materials

NCNGEM-2025

Book of Abstracts

27 - 28 February 2025

Organized by

Department of Physics,
School of Physical Sciences
St Joseph's University
Bengaluru-560027, Karnataka.

ISBN: 9789348505019

National Conference

on

Next-Generation and Emerging Materials – Abstract book

Convenor

Dr. Parul Goel

Co-Convenor

Dr. Mohan A

Organied by
Department of Physics
School of Physical Sciences
St Joseph's University, Bengaluru
Karnataka, India

27-28 February 2025

Published by

Royal Book Publishing
Ward No 10, Old No 118/07,
New No 52-1,
Ayothiyapattinam,
Salem.
Tamil Nadu-636103, India.
Email: contact@royalbookpublishing.com
Website: www.royalbookpublishing.com

Published in India.

International Standard Book Number (ISBN) : 9789348505019

From the Vice-Chancellor's Desk

St Joseph's University, Bengaluru

I am delighted to acknowledge that the 1st National Conference on Next Generation and Emerging Materials (NCNGEM-2025) is being hosted by the Department of Physics, St Joseph's University (SJU), Bengaluru, on February 27th and 28th, 2025. This conference serves as a crucial forum for researchers, academicians, industry leaders, and policymakers to share knowledge, discuss emerging trends, and explore cutting-edge advancements in advanced materials.

It is inspiring to see the rapid growth of research and development in this field and the increasing capacity of the scientific community to address real-world challenges through material innovation. Strengthening the ecosystem for material design, synthesis, and application is imperative to drive progress and meet global needs. NCNGEM-2025 has attracted distinguished researchers, academicians, industry professionals, and young scholars, fostering meaningful discussions, collaborations, and new opportunities for future breakthroughs.

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I extend my heartfelt congratulations to the organizing committee of NCNGEM-2025 for their efforts in curating this significant event. I am confident that this conference will serve as a catalyst for pioneering research, fostering interdisciplinary collaborations, and shaping the future of next-generation materials.

Rev. Dr Victor Lobo, SJ
Vice-Chancellor,
St Joseph's University, Bengaluru.

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Pro-Vice Chancellor's Note

St Joseph's University, Bengaluru

I am pleased to announce that the 1st National Conference on Next Generation and Emerging Materials (NCNGEM-2025) will be hosted by the Department of Physics at St Joseph's University (SJU) in Bengaluru on February 27 and 28, 2025. This conference represents a vital platform for researchers, academics, industry experts, and policymakers to engage in thought-provoking discussions and collaborative exploration of cutting-edge materials science.

It is encouraging to witness the remarkable progress in research and the expanding capabilities of our scientific community in this area. Establishing a robust ecosystem for designing, synthesizing, and applying novel materials is crucial for tackling global challenges and advancing technological advancements. Interdisciplinary research and cross-sector collaborations are essential to unlocking new frontiers in materials science, ensuring that discoveries translate into real-world applications with profound societal impact. I am thrilled that NCNGEM-2025 has garnered participation from esteemed researchers, academics,

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industry professionals, and emerging scholars, ensuring rich discussions and fruitful collaborations.

Exploring and developing next-generation materials is at the forefront of contemporary science and technology, playing a crucial role in shaping sustainable, high-performance, and environmentally friendly applications. This field offers immense potential for academic research, industrial advancement, and societal benefits, ranging from quantum materials and bio-inspired nanostructures to energy-efficient materials and smart polymers. These innovations promise both immediate and long-term impacts, including the potential to transform sectors such as healthcare, energy, electronics, and manufacturing.

I commend the Department of Physics and the organizing committee of NCNGEM-2025 for their dedication to curating this significant academic event. With the participation of leading researchers and emerging scholars, I am confident that this conference will foster insightful exchanges, catalyze pioneering discoveries, and pave the way for new scientific collaborations.

I extend my best wishes for the success of NCNGEM-2025 and wish all attendees a stimulating and productive conference experience.

Dr Ronald J. Mascarenhas

Pro-Vice Chancellor,

St Joseph's University, Bengaluru.

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Message from Pro-Vice Chancellor

"Next-Generation and Emerging Materials". This conference brings together some of the brightest minds in the field of materials science to share their latest research, innovations, and breakthroughs.

The rapid advancement of technology has created a pressing need for novel materials that can meet the demands of emerging applications. From energy storage and generation to healthcare and biotechnology, the next generation of materials will play a crucial role in shaping our future.

One such advancement has helped in development of topological qubits a new phase of matter that exists neither as a solid, liquid, nor gas, which has the potential to revolutionize the field of quantum computing, enabling the creation of powerful machines that can solve complex problems in fields such as chemistry, materials science, and cryptography.

As we embark on this journey of discovery and innovation, I would like to quote from the great materials scientist, Dr. Richard Feynman: "I think I can safely say that nobody understands quantum mechanics."

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As we delve into the world of next-generation and emerging materials, we are reminded that there is still so much to be discovered, and that the journey ahead will be filled with challenges and opportunities. I am excited to see what the future holds, and I am confident that this conference will be a catalyst for innovation and progress.

Thank you and let us begin our journey into the world of next-generation and emerging materials!

Dr Regina Mathias
Pro-Vice Chancellor
St Joseph's University, Bengaluru.

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ST JOSEPH'S UNIVERSITY

Message from the Registrar

It is with great pleasure that I extend my warmest greetings to all participants, speakers, and organizers of the 1st National Conference on Next Generation and Emerging Materials (NCNGEM-2025), hosted by the Department of Physics, St Joseph's University (SJU) in collaboration with esteemed scientific societies and institutions on February 27-28, 2025. This conference marks a significant milestone in fostering innovation, collaboration, and knowledge exchange in the rapidly evolving field of advanced materials.

The abstracts compiled in this book represent cutting-edge research and novel insights that reflect the remarkable progress made in material science and technology. From quantum materials and nanostructures to energy-efficient solutions and smart polymers, these contributions highlight the transformative potential of next-generation materials

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across industries such as healthcare, energy, electronics, and sustainable manufacturing.

At St Joseph's University, we are committed to supporting scientific research and academic excellence. The participation of distinguished scholars, researchers, and industry professionals in NCNGEM-2025 is a testament to the growing interest and significance of this field. I am confident that the discussions and collaborations facilitated by this conference will lead to new breakthroughs and long-term partnerships.

I sincerely appreciate the dedication of the organizing committee, contributors, and reviewers for their efforts in making this event a success. I hope this abstract book is a valuable resource for researchers and inspires future innovations in next-generation materials.

Best wishes for a productive and insightful conference!

Dr. Melwin Colaco
Registrar
St Joseph's University

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Message from the Dean,
School of Physical Sciences

St Joseph's University, Bengaluru

I am pleased to note that the 1st National Conference on Next Generation and Emerging Materials (NCNGEM-2025) is being organized on February 27-28, 2025 by the Department of Physics, School of Physical Sciences, St Joseph's University (SJU), Bengaluru, in collaboration with leading scientific societies and institutions. This conference provides an invaluable platform for researchers, academicians, industry experts, and policymakers to engage in insightful discussions and explore ground breaking advancements in advanced materials.

The evolution of next-generation materials is at the heart of modern scientific and technological innovation, offering transformative solutions for a sustainable and high-performance future. Covering a broad spectrum of topics, including quantum materials, bio-inspired nanostructures, energy-efficient materials, and smart polymers. This field presents remarkable opportunities for academic research, industrial applications, and societal progress. The profound impact of these materials can be seen in diverse sectors such as healthcare, renewable energy, electronics, and sustainable

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manufacturing, underscoring their significance in shaping the future.

It is truly encouraging to witness the substantial strides made in research and development and the expanding capabilities of scientists working in this domain. Building a strong foundation for material design, synthesis, and application is essential for addressing contemporary challenges and advancing scientific frontiers. The enthusiastic participation of renowned researchers, academicians, industry professionals, and young scholars at NCNGEM-2025 ensures that this event will foster collaboration, spark new ideas, and drive innovation forward.

I sincerely commend the organizing committee of NCNGEM-2025 for their dedication in bringing together a distinguished community of experts for this important conference. I am confident that the discussions and insights emerging from this event will lead to meaningful discoveries and impactful interdisciplinary partnerships.

Dr Rabbi Akkiba Angiras

Associate Professor

Dean, School of Physical Sciences,

St Joseph's University, Bengaluru.

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Message from the Director of Research

St Joseph's University, Bengaluru

It is with great enthusiasm that I welcome you to the National Conference on Next-Generation and Emerging Materials (NCNGEM 2025), hosted by the Department of Physics, St Joseph's University, Bengaluru. This conference brings together researchers, academicians, and industry professionals to explore the latest advancements in materials science and its transformative impact on technology and innovation.

The ever-evolving field of material science plays a crucial role in shaping the future of sustainable technologies, quantum advancements, and novel functional materials. NCNGEM 2025 aims to provide a collaborative space for scientists and scholars to discuss key developments in nanotechnology, quantum materials, multifunctional materials, energy storage solutions, and AI-driven material research. Through insightful keynote talks, technical sessions, and research presentations, this conference aspires to highlight emerging trends and foster cross-disciplinary collaborations.

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A special appreciation goes to the distinguished speakers, researchers, and contributors whose participation enhances the depth and scope of this event. I also extend my gratitude to the organizing team for their dedicated efforts in making this conference a success.

I look forward to engaging discussions, inspiring presentations, and fruitful interactions that will drive innovation and research excellence. Wishing all participants a stimulating and rewarding experience at NCNGEM 2025.

Fr. Dr Roshan Castelino, S.J.
Director of Research,
Assistant Professor, Department of Physics,
St Joseph's University, Bengaluru.

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About the Department of Physics

The Department of Physics at St Joseph's University (SJU), established in 1923, has a rich legacy of fostering scientific inquiry and excellence in education. With a dedicated team of 11 faculty members, we currently mentor approximately 500 undergraduate and 60 postgraduate students. Our mission is to cultivate a deep commitment to the pursuit of knowledge in the physical sciences, encouraging innovation and adaptability through quality teaching, learning, and research. In collaboration with ISRO, we have been offering the "Space and Rocket Dynamics" certificate course since 2000, providing students with the opportunity to engage with eminent scientists and gain insights into India's space exploration achievements. Our facilities include an 8-inch Schmidt-Cassegrain optical telescope at the PG block, sponsored by ISRO, and a 12-inch RC telescope in the UG block, enabling students to explore the wonders of the night sky.

Our curriculum is designed to integrate theoretical knowledge with practical application. Courses such as

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numerical techniques include hands-on laboratory sessions utilizing Python programming. We also offer open electives in Astrophysics and Material Science at the post-graduation level. To bridge the gap between undergraduate and postgraduate studies, we have initiated bridge courses that provide continuity and support for students from diverse academic backgrounds.

Recognized as a Research Centre under SJU, our department emphasizes collaborative projects with premier research institutes like ISRO, IISc, RRI, and IIA, especially during the final semester. Our active Physics Students Association (PSA) and the postgraduate association, φψξ (Physeeksee), organize events such as the intercollegiate fest "Tek-Olma", special lectures, and various intra-collegiate activities, fostering a vibrant academic community.

We are committed to preparing our students for higher educational and career challenges by nurturing scientific temper and human values, ensuring they are well-equipped to contribute meaningfully to society.

Dr Lora Rita Goveas

Head, Department of Physics,

St Joseph's University, Bengaluru.

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Message from the Convenor

It gives me immense pleasure to welcome you to the National Conference on Next-Generation and Emerging Materials (NCNGEM 2025), organized by the Department of Physics, St Joseph's University, Bengaluru. This conference serves as a vital platform for scientists, academicians, and researchers to engage in meaningful discussions on recent developments and innovations in material science.

NCNGEM 2025 aims to foster interdisciplinary collaborations and exchange of ideas in the field of advanced materials, addressing challenges in their synthesis, characterization, and applications. The conference features keynote and invited talks by eminent experts, along with oral and poster presentations from researchers across diverse fields.

The scientific sessions will cover a broad spectrum of topics, including but not limited to nanomaterials, quantum materials, topological materials, multifunctional materials, thermoelectric materials, AI and ML in material science, and novel photovoltaic, energy and sensor materials. Through these talks and discussions, we hope to encourage cutting-

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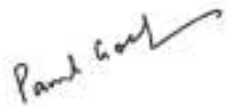
edge research and explore pathways for future technological advancements.

We are honoured to host distinguished speakers from premier research institutions whose insights and expertise will undoubtedly enrich our understanding of emerging materials and their impact on various scientific and industrial domains.

I extend my sincere gratitude to all speakers, participants, and contributors for making this conference a dynamic and intellectually stimulating experience. May NCNGEM 2025 inspire new collaborations and innovative breakthroughs in material science.



Dr. Parul Goel
Convenor, NCNGEM 2025
Associate Dean, School of Physical Sciences,
Department of Physics,
St Joseph's University, Bengaluru.

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Message from the Co-Convenor

It is with immense gratitude that I take this opportunity to extend my heartfelt thanks to everyone who contributed to the success of the National Conference on Next-Generation and Emerging Materials (NCNGEM 2025). This conference has been a truly enriching experience, bringing together the scientific community to engage in insightful discussions and exchange ground breaking ideas in the field of material science.

I would like to express my sincere appreciation to our distinguished keynote and invited speakers for sharing their invaluable expertise and research, which has undoubtedly inspired new perspectives among all participants. Your contributions have played a pivotal role in shaping the scientific discourse of this conference. I extend my deep gratitude to all researchers and participants for presenting their work, engaging in thought-provoking discussions, and making this conference a vibrant platform for knowledge exchange. Your dedication and enthusiasm towards advancing materials science are truly commendable.

A special thanks to the Organizing Committee, namely, Dr. E Bruno Martin (Associate Professor, Physics), Dr. Arun Varma Thampan (Assistant Professor, Physics), Fr. Dr Roshan Castelino S (Assistant Professor, Physics), Dr. G Vignesh

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(Assistant Professor, Physics), Mr. Ricky Wilfred (Assistant Professor, Physics), Dr Madhu Kashyap J (Assistant Professor, Physics), Dr Litty Thomas Manamel (Assistant Professor, Physics) and Dr Allen Lobo (Assistant Professor, Physics), whose relentless efforts made this event a grand success. Your dedication, from planning and logistics to ensuring smooth execution, has been instrumental in making this conference a seamless and rewarding experience.

I also extend my appreciation to our sponsors, collaborators, and institutional partners for their generous support, which has enabled us to provide a conducive environment for academic and scientific engagement. I would like to thank our host institution, St Joseph's University, the Vice-Chancellor, Registrar, Pro-Vice-Chancellors, Dean of the School of Physical Sciences, Head of the Physics Department, and the members of the University staff for providing us with the platform and resources to bring this conference to fruition. As we conclude NCNGEM 2025, I hope that the ideas and collaborations initiated here will continue to grow and lead to impactful advancements in material science. Wishing you all the best in your research endeavours, and I look forward to meeting you again in future editions of this conference.

Dr. Mohan A.
Co-Convenor, NCNGEM-2025,
Assistant Professor, Department of Physics
St. Joseph's University, Bengaluru.

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List of Keynote and Invited Speakers

Prof. P.S. Anil Kumar

A prominent figure at the Indian Institute of Science (IISc) in Bengaluru, Prof. Kumar specializes in condensed matter physics. His research encompasses spintronics and thin-film magnetism, contributing to the development of advanced materials for technological applications.

Prof. Tanusri Saha Dasgupta

As the Director of the S.N. Bose National Centre for Basic Sciences in West Bengal, Prof. Dasgupta's research delves into the magnetic, optical, and electronic properties of complex materials at the nanoscale. Her work has significantly advanced the understanding of material behaviors at the quantum level.

Prof. Bivas Saha

As a professor at the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) in Bengaluru, Prof. Saha focuses on the synthesis and characterization of advanced materials. His contributions have been instrumental in understanding the properties of materials under extreme conditions.

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Prof. Anshu Pandey

Based at IISc Bengaluru, Prof. Pandey's research interests include nanomaterials and quantum dots. His innovative work has implications for the development of new materials with applications in optoelectronics and quantum computing.

Prof. N. Gopalakrishnan

Serving as a professor at the National Institute of Technology (NIT) in Trichy, Prof. Gopalakrishnan's expertise lies in optoelectronics and spintronics. His work focuses on the development and characterization of thin films, which are crucial for various electronic and photonic devices.

Prof. M.M. Shaijumon

At the Indian Institute of Science Education and Research (IISER) in Thiruvananthapuram, Prof. Shaijumon leads research in energy materials. His studies on nanostructured materials have paved the way for advancements in energy storage and conversion technologies.

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Detailed Program Schedule of NCNGEM-2025

Session	**Day 1** **(Thursday, 27th February)**		
08.00 - 09.00 AM	Registration		
09.00 - 10.00 AM	Inauguration		
10.00 - 10.30 AM	High Tea		
	Event	**Title of Talk**	**Session Chair**
10.30 - 11.30 AM	Keynote Address By Prof. P. S. Anil Kumar, IISc, Bengaluru	Quantum Materials and Heterostructures	Prof. T.G. Ramesh, Retd. Scientist, NAL
11.45 - 12.45 PM	Keynote Address By Prof. Tanusri Saha Dasgupta, S N Bose Centre for Basic Science, West Bengal	Quantum Materials by Computation: Challenges and Opportunities	Prof. Bivas Saha, JNCASR, Bengaluru
12.45 - 01.30 PM	Lunch break		
01.45 - 02.45 PM	Special Lecture by Prof. Bivas Saha, JNCASR, Bengaluru	Polaritons for Near-UV-to-Far-Infrared Nanophotonics	Fr. Roshan Castelino, Research Director, SJU, Bangalore
02.45 - 04.30 PM	Oral Presentations (2 Parallel Sessions)		
04.30 PM onwards	High Tea		

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Session	**Day 2 (Friday, 28th February)**		
	Event	**Title of Talk**	**Session Chair**
09.00 - 10.00 AM	Special Lecture by Prof. Anshu Pandey, IISc, Bengaluru	Quantum Science with Quantum Dots	Prof. M. M. Shaijumon, IISER, Thiruvanantha puram
10.00- 10.30 AM	Tea Break		
10.30 - 11.30 AM	Special Lecture by Prof. N. Gopalakrishnan , National Institute of Technology, Trichy	β-Ga_2O_3, Future Generation Materials; Fabrication and Application for Gas Sensing	Prof. Lora Rita Goveas, HOD, Physics, SJU, Bangalore
11.45 - 12.45 PM	Special Lecture by Prof. M. M. Shaijumon, IISER, Thiruvanantha puram	Emerging Materials for Energy Storage and Conversion	Prof. N. Gopalakrishnan, NIT, Trichy
12.45 - 01.30 PM	Lunch Break		
01.30 - 03.30 PM	Poster Presentations		
03.30 PM - 04.30 PM	Valedictory		
04.30 PM onwards	High Tea		

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KEYNOTE ABSTRACTS

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KY -01

Quantum Materials and Heterostructures

P S Anil Kumar*

Department of Physics

Indian Institute of Science, Bangalore 560012, India.

Abstract:

Quantum materials display novel electronic phenomena arising from reduced dimensionality, quantum confinement, topology of wave functions, and other factors. These materials, such as graphene, topological insulators (TIs), Weyl semimetals, spin-liquids, and others, have attracted extensive research interest from condensed matter physicists and materials scientists in recent decades as they offer promising prospects for the next generation of electronic devices due to their superior properties. The emergence of TIs and semimetals has opened up a new realm of low-energy electronic devices that enable dissipationless transport through their highly spin-orbit coupled conducting channels. Dual TIs possess two different topological surface states protected by different symmetries. Scanning Tunneling Microscopy and Spectroscopy have identified topological surface states and one-dimensional conducting channels in these materials. Introducing superconductivity to TIs can result in topological

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superconductivity, potentially hosting Majorana fermions for quantum computing. In a BiTe/$NbSe_2$ heterojunction, evidence of p-wave superconductivity was found through electrical transport measurements, revealing anisotropic p-wave and s-wave superconducting gaps.

*In collaboration with Gagan Rastogi, Abhinab Mohapatra, Ambili KK and R Ganesan

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KY -02

Quantum Materials by Computation: Challenges & Opportunities

Tanusri Saha-Dasgupta

Department of Condensed Matter Physics & Materials Science,

Thematic Unit of Computational Materials Science, S. N. Bose

National Centre for Basic Sciences, Kolkata, India

Email: t.sahadasgupta@gmail.com

Abstract:

In recent time, there has been a world-wide surge of activity on Quantum materials. These are materials, whose properties are dominated by quantum fluctuations, quantum entanglement, quantum coherence, topology etc. In this talk, I will discuss the contribution of computation in understanding and predicting these materials. In particular, I will discuss its application in three categories of problems. First category will deal with understanding the structure-property relation. Examples will be drawn from high Tc cuprates and low dimensional quantum spin systems. In the second category, the power of computation will be demonstrated in prediction of new functionalities in known materials, focusing on the spin crossover phenomena. In the third category, application of machine learning in materials informatics will be discussed.

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INVITED TALK ABSTRACTS

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IV -01

Polaritons for Near-UV-to-Far-Infrared Nanophotonics

Bivas Saha

Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, Karnataka 560064, India.

Abstract:

Polaritons, the hybrid quasiparticles of photons and electric or magnetic dipoles (plasmons, polar phonon modes, excitons, etc.), have attracted significant interest in numerous nano-photonic applications. Due to their sub-diffraction mode confinement and field enhancement, plasmon- and phonon-polaritons are researched extensively to overcome the fundamental resistance-capacitance delay in electronics and the diffraction limit in photonic devices. However, applications of polaritons in practical devices are limited primarily due to the significant optical losses arising from the scattering of the free electrons and optical phonon modes. Therefore, materials exhibiting low-loss and high-quality plasmon and phonon-polaritons in the ultraviolet (UV)-visible and infrared (IR) spectral range are in great demand. Titanium nitride, an archetypal refractory transition metal nitride, has been studied extensively as an alternative plasmonic material to gold for visible spectral

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range applications. However, as the epsilon-near-zero wavelength of TiN cannot be varied readily, there is a pressing demand to develop new polaritonic materials that lead to strong light-matter interactions in near-UV to far-IR spectral range.

In this talk, we will present low-loss and high-quality plasmon and phonon-polariton resonances in epitaxial transition metal nitrides and group III-nitride semiconductors spanning from the near-UV to far-IR spectral ranges. Epitaxial HfN heterostructures are developed as an alternative plasmonic material to silver for near-UV applications, such as solar mirrors. Similarly, with tuneable carrier concentration, polar semiconducting ScN thin films are designed to exhibit IR plasmon-polaritons with low optical loss and high propagation lengths. Polar phonon modes of ScN and GaN are further utilized to achieve surface phonon-polaritons and Reststrahlen band nanophotonics. Additionally, the optical properties of the nitride heterostructures are tuned by accessing their transdimensional regime, designing hyperbolic metamaterials, Ferrell-Berreman mode engineering, and activating surface-polaritons with nanostructure formation. Our recent findings also show an electron confinement-induced plasmonic breakdown in epitaxial ultrathin nitride metals that originate due to the strong Coulomb interaction

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among electrons. Our work elucidates that nitride thin films and heterostructures are excellent hosts for polaritonic resonances for a wide array of near-UV to far-IR spectral range applications.

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3. K. C. Maurya, D. Rao, S. Acharya, P. Rao, A. I. K. Pillai, S. K. Selvaraja, M. Garbrecht and B. Saha, "Polar Semiconducting Scandium Nitride as an Infrared Plasmon and Phonon-Polaritonic Material" ***Nano Letters, 22, 13, 5182-5190 (2022).***

4. K. C. Maurya, A. Chatterjee, S. M. Shivaprasad and B. Saha, "Morphology-Controlled Reststrahlen Band and Infrared Plasmon Polariton in GaN Nanostructures" ***Nano Letters, 22, 23, 9606–9613 (2022).***

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IV -02

Quantum Science with Quantum Dots

Anshu Pandey

Solid State and Structural Chemistry Unit,

Indian Institute of Science, Bangalore 560012

Abstract:

Solution grown quantum dots have been around for over three decades. Recent progress in quantum information science has spurred the deeper investigation of these materials. Much interest has particularly arisen due to attempts to integrate quantum emission from these materials into devices.

This presentation will provide an overview of the progress made as well as challenges to be overcome for the usage of quantum dots to advance quantum information science. We will focus on electronic structure of these materials as well as the methods to prepare these. Techniques to engineer their electronic states of these materials to boost certain desirable properties will be discussed. We will particularly focus on our recent work regarding control over near field energy flow using proximal plasmonic centers.

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(1) *Plasmon Mediated Single Photon Emission from a Nanocrystal Ensemble* Mondal, P.; Saha, S. K.; Roy, P.; Vasudeva, N.; Anshu, A.; Rajasekar, G. P.; Pandey, A. **J. Phys. Chem. Lett. 2024** https://doi.org/10.1021/acs.jpclett.4c00540

(2) *Solution grown quantum dots for quantum science* Roy, P.; Gogoi, P.; Pandey, A. **Journal of Physics: Condensed Matter. 2024**, https://doi.org/10.1088/1361-648X/ad9da5

(3) *Engineering Quantum Dots for Improved Single Photon Emission Statistics*. Roy, P.; Pandey, A. **J. Chem. Phys. 2024**, https://doi.org/10.1063/5.0205113.

(4) *Enhanced Multiexciton Emission Quantum Yields in Nonblinking Interlinked Nanocrystals* Roy, P.; Pandey, A **J. Phys. Chem. C 2024,** https://doi.org/10.1021/acs.jpcc.3c07631

ISBN: 9789348505019

IV -03

β-Ga_2O_3, Future Generation Materials; Synthesis and Application for Gas Sensing

N.Gopalakrishnan*

Thin Film Laboratory, Department of Physics, National Institute of Technology, Tiruchirappalli-620015, India.

Email: ngk@nitt.edu

Abstract:

β-Ga_2O_3 (~ 4.9 eV) is next generation semiconductor owing to its superior properties over Si, SiC and GaN in terms of band gap, break down voltage and Baliga figure of merit. This ensures better performance with limited power consumption [1]. This talk covers the enhancement of gas sensing performance of hydrothermally synthesized β-Ga_2O_3 at room temperature by introducing Sn and Cr into β-Ga_2O_3 lattice.

First, a facile, surfactant-free hydrothermal synthesis route has been employed to synthesize GaOOH at pH = 7. This, pre-product, has been thermally converted into β-Ga_2O_3 upon calcination between 900-1000 ℃. They were made into a thick film on top of the pre-printed silver inter digitated electrode (IDE) pattern on glass substrate by drop coating technique. Thus prepared IDE β-Ga_2O_3 sensors have been exposed to reducing vapours of ammonia, ethanol, methanol & acetone and oxidizing gas of CO_2. It has been found that β-Ga_2O_3 showed higher sensing responses and

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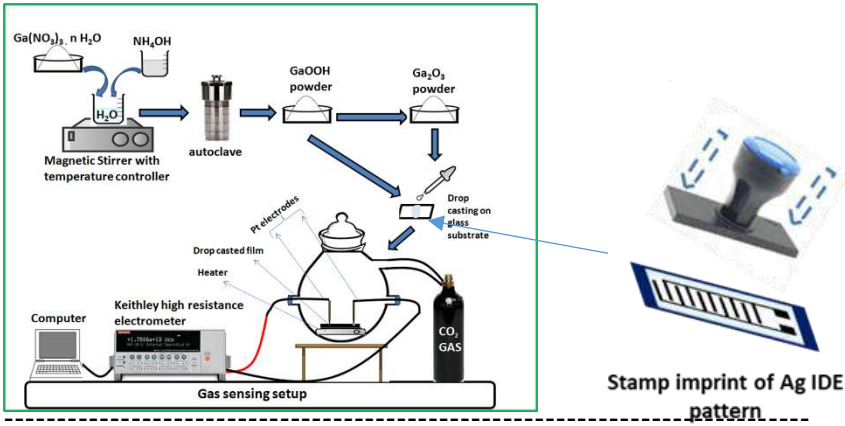
sensitivities towards reducing vapours than oxidising gas which can be ascribed to its *n*-type conductivity.

An attempt has been made to incorporate Sn into β-Ga_2O_3 at 2 mol% and 4 mol% to enhance the gas sensing performance. It has been found that 2 mol% Sn incorporated β-Ga_2O_3 IDE sensors showed enhanced sensing responses, sensitivities and faster response-recovery processes compared to pure and 4 mol% Sn doped sensor owing to higher BET surface area (12.49 m^2/g), smaller crystallite sizes (26.36 nm) and lower bandgap (4.67 eV) [2]. Similarly, Cr has been also introduced into β-Ga_2O_3 lattice and found that enhanced performance than that of pure β-Ga_2O_3. The important features have been discussed in detail.



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ISBN: 9789348505019

IV -04

Emerging Materials for Energy Storage and Conversion

M. M. Shaijumon

School of Physics, Indian Institute of Science Education and Research Thiruvananthapuram, Maruthamala PO, Vithura, Thiruvananthapuram, Kerala, India 695 551

E-mail: shaiju@iisertvm.ac.in

Abstract:

Driven by technology advancements, the global demand for sustainable and efficient energy storage and conversion systems continues to grow. This talk will explore the cutting-edge developments in battery technology including all-solid-state and anode-less batteries, addressing the key materials, design challenges, and the benefits over state-of-the-art systems. Atomically thin two-dimensional (2D) materials, such as graphene, transition metal dichalcogenides, and MXenes, have emerged as transformative platforms for electrocatalysis. The talk will further explore recent advancements in electrocatalytic hydrogen generation, from single-atom catalysts to multi-functional composites, and their implications for scalable, sustainable energy conversion technologies. Further, some of our recent efforts on tuning the electrocatalytic properties of atomically thin electrocatalysts based on defect engineering and surface modification will be discussed.

ISBN: 9789348505019

ORAL PRESENTATION ABSTRACTS

ISBN: 9789348505019

OL - 1

Fabrication and Electromagnetic Shielding Study of Multilayer Polymer Hybrids with MWCNTs, GNPs, Fe_3O_4-Cu_2O, and rGO for Stealth Applications

Amal Tom Prakash[1], Sujatha B. Reddy [2], Bharath. V [3,*]

[1]Department of Physics, St. Joseph's College, 36, Lalbagh Road, Bangalore 560027, India

[2]Department of Electronics and Communication Engineering, M. S. Ramaiah Institute of Technology, Bangalore 560054, India.

[3]Department of Artificial Intelligence and Machine Learning, HKBK College of Engineering, Bangalore 560045, India.

**Corresponding Author*

E-mail: bharathv.work@gmail.com (Bharath. V[3,])*

Abstract:

In this study, we investigate the EMW SE (Electromagnetic waves shielding effectiveness) of novel multilayered polymer hybrids (MLPHs) in the X-band frequencies. GNPs were synthesized using solution combustion method, Cu_2O NPs were fabricated using the chemical reduction method, Fe_3O_4 NPs were synthesized via thermal decomposition followed by hydrothermal treatment, and Fe_3O_4-Cu_2O composite was prepared using a hydrothermal treatment process. The synthesized GNPs and Fe_3O_4-Cu_2O composite were utilized in the fabrication of three MLPHs via optimized solution casting method. The

ISBN: 9789348505019

first layer in MLPHs consist of CNTs, GNPs, and Fe_3O_4-Cu_2O with varying ratio uniformly dispered in PVA matrix, the second layer consists of MWCNTs and rGO with varying ratios uniformly dispered in PVA matrix. XRD was employed to verify the synthesized GNPs, Fe_3O_4-Cu_2O composite, and MLPHs. Shielding analysis were performed on the fabricated MLPHs which represents a novel exploration of their performance in X-band frequency range. Among the fabricated MLPHs, the $MLPH_3$ (Layer 1: Fe_3O_4-$Cu_2O_{5\%}$, $MWCNT_{5\%}$, $GNP_{40\%}$, $PVA_{50\%}$; Layer 2: $MWCNT_{15\%}$, $rGO_{35\%}$, $PVA_{50\%}$) achieved the highest EM SE of 62.6573 dB suppressing 99.999945 % of incoming EMW at 11.96 GHz. The fabricated MLPHs demonstrates a significant potential for advanced RADAR-absorbing stealth applications through absorption-dominant EMW shielding, addressing the need for materials that enhance stealth technology in military.

Keywords: Multilayered polymer hybrids (MLPHs); EMW shielding; X-band frequencies; Absorption-dominant EMW shielding.

ISBN: 9789348505019

OL - 2

Measurement of Optical Non-Linearities of ZnPc Thin Films Using Open Aperture Z-Scan

***Anitta Augustine*[1*]**

Department of Light and Matter Physics, Raman Research Institute, Bengaluru, India

**Author E-mail: anittaaugustine6@gmail.com*

Abstract:

The thesis investigates the nonlinear optical properties of zinc phthalocyanine (ZnPc) thin films fabricated using the drop-casting method. The primary objective of this study is to observe the non-linear response of the ZnPc thin films in response to a laser source and explore its potential for optical limiting and other various applications such as optical switching, telecommunications, chemical sensing, and biomedical diagnostics.

ZnPc thin films were deposited on glass substrates using the drop-casting technique. The absorption properties of the sample were studied using UV-Vis-IR spectroscopy. From various trial and error Z-Scan analyses of the thin film, the concentration of the sample is decided, so that it shows significant non-linear behaviour.

The nonlinear optical properties of the ZnPc thin films were investigated using the open-aperture Z-scan technique. This method allows for the determination of the nonlinear absorption coefficient by measuring the transmitted intensity. The Z-scan measurements were

ISBN: 9789348505019

performed using a Q-switched, frequency-doubled Nd: YAG pulsed laser source, and the resulting transmittance curves were analysed using B-spline interpolation to obtain the nonlinear optical parameters.

The open-aperture Z-scan curves of the ZnPc thin films exhibited a characteristic valley shape, indicating the presence of reverse saturable absorption (RSA). The nonlinear optical properties are attributed to the efficient excited-state absorption.

The observed RSA behaviour in the ZnPc thin films is used to analyse the optical limiting behaviour, where the transmitted intensity is plotted against the sample position. The B-spline interpolation of the Z-scan curves provided a smooth and accurate representation of the nonlinear optical response, enabling a detailed analysis of the material's performance.

This study contributes to the understanding of the nonlinear optical properties of ZnPc thin films and their potential for practical applications in photonics and optoelectronics. The findings can also be further explored to optimise the fabrication and performance of ZnPc-based devices for various light-management and optical protection applications.

Keywords: Thin films; Nonlinearity; Energy-efficient Materials for industrial application; Nonlinear optical properties.

ISBN: 9789348505019

OL - 3

A Simplified Approach for the Measurement of Emissivity of Metals and Non-Metals

Dr. Ajay Kumar Saxena[1], Amit Kumar Jindal[2], Shruti Sarawagi[3]

[1]Senior Scientist, IIA, Koramangala, Bengaluru, Karnataka 560034, India

[2,3]UG Student, St Joseph's University, Bengaluru, Karnataka 560027, India

Email: 2amitkumarjindal95@gmail.com

Abstract:

In the vacuum environment of outer space where convection is no longer available, the only heat dissipation is through the radiation, which is mostly governed by Stefan-Boltzmann Law. The total emissivity of absorbing surfaces is a critical parameter in space structure design and its thermal management system, especially for the non-terrestrial requirements of scientific and exploratory missions in outer space.

Most of the apparatus for the measurement of the emissivity value of thermal surfaces available on the market are based on identical twin arrangements for the black body and the test surface, in comparison mode, in the same enclosure. Practically, it is quite a cumbersome process.

ISBN: 9789348505019

In this paper, a simplified approach using a single-slot enclosure is presented. Data for a black body and sample surface were collected separately, and conveniently without the interference of any non-radiative process. The values obtained are in fair agreement with the expected value.

The complete procedure for the measurement of the emissivity using the new single-slot enclosure is presented here. Data for aluminium (Al) as a metal sample, and Carbon Fiber-Reinforced Plastic (CFRP) as a non-metal has been obtained. CFRP has been specifically chosen due to its properties that are useful in the field of space science.

Keywords: Emissivity; Black body; Metal; Non-Metal.

ISBN: 9789348505019

OL – 4

Luminescent Properties of Eu^{3+} and Er^{3+} Co-Doped Tungstate Phosphors

Kiran R[1], Sudha D Kamath[1],*

[1]Department of Physics, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal, Karnataka – 576104, India.

*Corresponding Author E-mail: sudhakamath6@gmail.com

Abstract:

In this paper, novel Ca_2MgWO_6 phosphors co-doped with 2 mol% Er^{3+} and varying concentrations of Eu^{3+} were synthesized via the solid-state reaction method. The synthesis process involved an initial grinding of the precursor materials (CaO, MgO, WO_3, Eu_2O_3, and Er_2O_3) for 1 hour, followed by a heat treatment at 600 °C for 5 hours. After cooling to ambient temperature, the mixture was reground to enhance homogeneity and subjected to subsequent calcination at 1200 °C for 5 hours. The successful formation of the desired crystalline phase was verified through XRD analysis. The photoluminescent (PL) emission spectra were employed to optimize the phosphor, enabling the determination of the optimal Eu^{3+} doping concentration. An in-depth investigation of the concentration quenching mechanism revealed the underlying processes governing the concentration

ISBN: 9789348505019

quenching. Furthermore, temperature-dependent PL spectral analysis highlighted the remarkable thermal stability of the phosphor's optical properties. Given its exceptional luminescent performance, thermal robustness, and tunable emission properties, the synthesized phosphor demonstrates significant potential for diverse applications across multiple domains, including light-emitting devices, colour tunability, temperature sensing, and radiation dosimetry.

Keywords: Tungstate; Optical properties; Red Phosphor; LED

ISBN: 9789348505019

OL - 5

Synthesis of BN-SiC Composite for Hall Thruster Discharge Channels

Tejas Raghv[1,*] A. T. Sriram[2], Priyanka K. P[1], Vikas Shelar[1]

[1]Department of Physics, M. S. Ramaiah University of Applied Sciences, 470-P, Peenya Industrial Area 4th Phase, Peenya, Bangalore -560058, India.

[2]Department of Aerospace and Automotive Engineering, M. S. Ramaiah University of Applied Sciences, 470-P, Peenya Industrial Area 4th Phase, Peenya, Bangalore -560058, India

**Corresponding Author E-mail: tejas.toolshed@gmail.com*

Abstract:

Hall Thrusters are propulsion systems deployed onboard satellites to generate thrust. It invokes plasma physics in its working principle during electric discharge. The discharge channel confines the plasma interactions, while housing a floating ionization region. Therefore, the materials that comprise the channel wall must possess a wide array of properties such as high thermal conductivity, chemical neutrality and strong affinity towards sputtering. A recent study proved successful in improving the channel's performance by designing multilayer walls. However, this work aims to investigate performance improvements through the development of nanocomposities. Discharge channel materials such as Boron Nitride and Silicon Carbide

ISBN: 9789348505019

are used to synthesis composite materials. The synthesized composites are characterized using X Ray Diffraction and Fourier Transform Infrared Spectroscopy. Scanning Electron Microscopy is used to study the surface morphology, while thermal studies are performed to understand its applicability in Hall Thrusters.

Keywords: Boron Nitride; Composite; Discharge Channel; Silicon Carbide

ISBN: 9789348505019

OL - 6

Structural and Electrical Properties Correlation in the Polymer Devices Using Current-Voltage, Raman and Impedance Spectroscopy Tools.

Usha S K[1], P. Anjaneyulu[2]

Department of Physics, REVA University, Bengaluru, India 56006

**Corresponding Author E-mail: ushask@reva.edu.in*

Abstract:

Correlation studies between structural and electrical properties in polymer devices is an important area to explore, since such correlation studies are less. In our studies we used Raman spectroscopy as a tool to study the structural disorder of polymer thin films by varying the growth temperature. Thin films of Polypyrrole and Poly (3-methyl Thiophene) are synthesized at different temperature by electrochemical method. I-V and Impedance measurements are carried out on SS/polymer/Ag geometry. In the present study, Current-Voltage (I-V), impedance and Raman spectroscopy are used to probe the extent of disorder, to correlate with transport properties of doped Polypyrrole and Poly (3-methylthiophene) thin film-based devices. In our studies we observed the interoperability in the conduction mechanism by observing the corresponding change in the relaxation mechanism of the polymer devices.

Keywords: Electrochemical method, Transport property

ISBN: 9789348505019

OL - 7

Effect of Sputtering Pressure on DC Sputtered Copper Nitride Thin Films for Thermoelectric Applications.

Madhu S[1], Ashok rao[2], Nagaraja Kodihalli K[1]*

[1]Alternative Energy Materials Lab, Department of Physics, Manipal academy of higher education, Manipal, India.

[2]Functional Materials Research Lab, Department of Physics, Manipal academy of higher education, Manipal, India.

**Corresponding Author E-mail; nagaraja.kk@manipal.edu*

ABSTRACT

Sustainable development of goal 7 guarantees the access of reliable, affordable, and clean energy for everyone. According to recent reports only 17% of SDG's target has been achieved, but half of that indicates moderate progress. The achievement of universal access to electrical energy by 2030 needs improvement in the production of renewable energy and enhancements in energy efficiency. Thermoelectricity is one of the renewable sources of energy being used to provide green energy and therefore needs enhancement in the aspect of efficiency when applied. In this work we investigate on effect of deposition pressure on structural and electrical properties of Cu_3N films on glass substrate. All the sputtering parameters are kept constant only deposition pressure varied from 1Pa to 5 Pa. Cu_3N is semiconducting material which shows interesting electrical

ISBN: 9789348505019

properties. Structural phase analysis is characterized through XRD and Raman spectroscopy, as deposition pressure increases [100] plane of orientation changes to [111] with conforms anti-ReO_3 crystal structural. Raman peaks show 635 cm^{-1} of raman shift conforms in stoichiometry of Cu_3N and shows peaks of Cu_2O due to surface oxidation. Scanning electron microscopy conforms uniformity and Grains growth of Cu_3N films. Optimized electrical properties like resistivity, carrier concentration and mobility which makes Cu_3N suitable for thermoelectric applications.

Keywords: Copper nitride; Deposition Pressure; Surface oxidation; electrical properties.

ISBN: 9789348505019

OL - 8

Photocatalytic Degradation of Dye Using Pristine and Aluminium Doped Zinc Oxide

S. Pramodini*, C. Shalini

Department of Physics, REVA University, Kattigenahalli, Yelahanka, Bengaluru 560 064, India.

**Corresponding Author E-mail: somynraj@gmail.com*

Abstract:

In the present work, photocatalytic degradation of dye using pristine zinc oxide (ZnO) and aluminium doped zinc oxide (AZO) powders was carried out under mercury lamp (UV-light source). The samples, ZnO and AZO (3 wt.%) are synthesized using sol-gel method. The physical, chemical, and optical properties of the synthesized samples are analysed using different characterization techniques. X-ray diffraction analysis confirmed the hexagonal-wurtzite structure of ZnO and AZO nanoparticles. The optical bandgap decreased from 3.16 eV to 3.13 eV with increase in aluminium doping percentage. The Fourier transform infrared analysis displayed the peaks of Zn-O and Al-O bonds and successful incorporation of Al into ZnO. High resolution scanning electron microscopy (HRSEM) revealed the hexagonal and cauliflower like nanostructures and the particle size in the range of 85 nm to 37 nm of the photocatalyst. Thermogravimetric (TGA) analysis reveals

ISBN: 9789348505019

the thermal stability of ZnO with minimal weight loss when subjected to high temperature compared to AZO samples. The photocatalytic degradation on the dye is investigated under different conditions like variation in catalyst dosage and dye concentrations. AZO emerged to be a good catalyst there by degrading the dye of higher concentrations (200 μM) up to 97 % good stability during recyclability test.

Keywords: Zinc oxide; Aluminium doped zinc oxide; photocatalytic degradation; Mercury (UV light).

ISBN: 9789348505019

OL - 9

Investigation of Structural and Optical Properties of Metal-Sandwiched Zn-PC Thin Films

Ricky Wilfred

Department of Physics, St Joseph's University, Bengaluru

email: ricky@sju.edu.in

Abstract:

ZnPC, an organic semiconductor known for its excellent thermal and chemical stability, has been explored much in the scientific literature over the past years. Here, we report the preparation and characterization of ZnPC thin films with different metal sandwich layers. The absorption spectra of various films recorded show a similar spectrum for the transition metals titanium, copper and chromium deposited as sandwich layers. Thin films with aluminium, a post-transition metal deposited as a sandwich, showed a broadening in the absorption peak both in the Q and B bands. Unlike other metal sandwich films that were deposited, the PL data for the aluminium sandwich film reveal a stronger emission without showing any significant red shift in both bands. The energy bandgap for the deposited films was calculated using Tauc plot and ranged from 2.5 eV to 2.9 eV. The XRD peak for all the sandwich films reveals a strong signature peak of ZnPc 6.83°. Thin films deposited with copper as the sandwich layer hint at the possibility of a composite structure with a short shoulder split peak at 6.65°, again a signature of CuPC.

ISBN: 9789348505019

OL - 10

Dynamic Shock Wave Driven Simultaneous Crystallographic, Molecular and Magnetic Switching Between α-Fe_2O_3 and Fe_3O_4 Nanoparticles – a New Findings

Dr. A. Rita

Asst. Professor, Department of Physics, St. Anne's Degree College for Women, Halasuru, Bengaluru, Karnataka.

E-mail: arulrita193@gmail.com

Abstract:

Molecular as well as crystallographic switchable dielectric, optical and magnetic materials are in high demand for the electronic industries because of their outstanding functional properties and the minimum operational complexity of the devices which are widely used in high-pressure experiments. In recent years, impressive progress on dynamic shock waves produced by Reddy tube triggered crystallographic phase transitions of technologically important materials has been well documented in both bulk and nano form and several interesting results have been found. The next generation of applications may use materials that enabled to undergo a rapid phase change between two phases so that switching can be fast and repetitive, but such materials are highly scarce in current era. Hence, there is a great demand for

ISBN: 9789348505019

identifying the externally stimulated solid-state switchable phase transition materials for several industrial applications. In this paper, we present the experimentally observed solid-state molecular level switchable phase transitions of nanocrystalline iron oxide materials: {α-Fe_2O_3 (R-3c) to Fe_3O_4 (Fd-3m) and Fe_3O_4 (Fd-3m) to α-Fe_2O_3 (R-3c)} under dynamic shock wave loaded conditions and the results were evaluated by diffraction, vibrational and optical spectroscopic techniques. This report which demonstrates the induced switchability of the iron oxide systems not only provides the convenience for research of the growth mechanism but could also contribute to a lot of commercial applications such as environmental monitoring sensors, pressure transmitters, molecular switches, resistive memory sensors.

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ISBN: 9789348505019

OL - 11

Design & Fabrication of Polymer Composites Filled with Tungsten for Gamma Ray Shielding Applications

Atheena Kurian A[1], Jovitta Rose Vazhappilly[1], Haridev M[1], Parul Goel[1], Mohan A[1], Sherry Shajan Kuttukaran[2], Ambika MR[2*], Nagaiah N[3]

[1]Department of Physics, St. Joseph's University, 36, Lalbagh Road, Bengaluru 560027, India

[2]Department of Physics, M S Ramaiah Institute of Technology, Bengaluru-560054, India

[3]Department of Physics, Bangalore University, Jnana Bharathi Campus, Bengaluru-560056, India

**Corresponding author email: ambikamr@msrit.edu*

Abstract:

Gamma rays are the most penetrative type of radiation and tend to be hazardous to the society and environment. Conventionally, high density materials such as lead and concrete were used for shielding of gamma rays. Unfortunately, lead is hazardous and quite heavy. Therefore, polymer composites are on high demand for shielding these radiations due to their low density, cost effectiveness and non- toxicity. In this study, Liquid Silicone Rubber (LSR) is used as the matrix and is reinforced with tungsten. Tungsten is added in varying concentration (10, 30, 50, 70 and 90 phr) into LSR. Hand mixing is done for

ISBN: 9789348505019

homogenous distribution of filler particles throughout the rubber matrix and open mould cast technique is used for making the sample. Gamma ray attenuation study is carried out using Gamma ray spectrometer for the photon energies, 80, 356 and 662 keV from sources, Ba-133 and Cs-137 respectively. The experimental results show that at 662 keV, the Linear Attenuation Coefficient (LAC) values increase with increase in filler concentration, due to increase in the density of the polymer composite upon addition of tungsten, but for 90 phr, there is a decline in LAC value and this may be attributed to the agglomeration of tungsten particles which is confirmed using SEM analysis. Mass Attenuation Coefficient (MAC) values are also found to increase with increase in filler concentration. The slight variations seen for the polymer composite containing 30 and 90 phr of filler may be due to the non-uniform dispersion of the fillers into the matrix. The shielding is more effective upon increase of filler concentration witnessed by the shielding parameters. The Half Value Layer (HVL) and Tenth Value Layer (TVL) thickness decreases with increase in filler concentration and is least for LSR + 70phr W at 662 keV i.e. 3.246 cm and 10.785 cm respectively. Relaxation length (λ) is also found to decrease with increase in filler concentration. The later has lowest value for LSR + 70phr W which is found to be

ISBN: 9789348505019

4.68 cm. As λ decreases, the gamma shielding property increases.

The same trend is observed for all the shielding parameters at 80 and 356 keV as well. The polymer composite LSR + 70phr W has the best results. For MAC it is found to be 3.473 and 0.413 cm^2/g and for HVL it is 0.111 and 1.024 cm for 80 and 356 keV respectively. Simultaneously with increase in photon energy the values were found to decrease due to the interaction processes that takes place at different energy range.

Thus from the gamma attenuation studies of the liquid silicone rubber reinforced with tungsten filler particles, it is found that the attenuation coefficient increases with increase in filler concentration. Other shielding parameters like HVL, TVL and λ tends to decrease with increase in filler concentration. Thus from the present study, it is evident that the prepared polymer composite is efficient compared to other conventional shielding materials. And is a better alternative to make radiation shielding garments as the material is lightweight, flexible and cost effective.

Keywords: Polymer composite, Dispersion, Lightweight, Gamma shielding.

ISBN: 9789348505019

OL – 12

Synthesis and Characterization of CuO-ZrO_2 Nanocomposite for Antibacterial Activity

Pooja Badiger, Saathvika Lakshmanan, Shivani TS and N.Gopalakrishnan*

Thin film Laboratory, Department of Physics, National Institute of Technology, Tiruchirappalli-620 015, India

**Corresponding Author: ngk@nitt.edu*

Abstract:

In this study, we present an investigation on CuO-ZrO_2 nanocomposite for antibacterial activity. The CuO, ZrO_2 and CuO-ZrO_2 composite nanostructures have been synthesized using a facile hydrothermal technique. The relevant properties of the as-synthesised nanoparticles and nanocomposite have been investigated by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR) and Field emission scanning electron microscopy (FESEM). The XRD and FTIR confirmed the phase, crystallinity and functional groups present in the synthesized samples and the interaction between the CuO and ZrO_2. Both the materials shown monoclinic phase with crystal size of 19 nm for CuO and 123 nm for ZrO_2. Morphology of the synthesized nanomaterials have been determined from FESEM analysis. Both the materials shown flake-like morphology with the flakes having an approximate area of

ISBN: 9789348505019

156 nm^2 and 170 nm^2 for CuO and ZrO_2, respectively. The as-prepared CuO, ZrO_2 and CuO-ZrO_2 (different composition) have been subjected to antibacterial activity against E. coli and S. aureus. It has been inferred that chosen materials are promised application for water filtration upon embedded into PSF/PVP matrix.

Keywords: CuO-ZrO_2 composite, Hydrothermal method, Antibacterial activity, Water filtration.

ISBN: 9789348505019

OL – 13

Facile Fabrication of NiAl LDH/g-C_3N_4 Electrode for High Performance Supercapacitors

A. Vinnarasi, R. Ramesh, J. Kalyana Sundar, P. M. Anbarasan*

Nano and Hybrid Materials Laboratory, Department of Physics, Periyar University, Salem-11

Email: anbarasanpm@gmail.com, anbarasanpm@periyaruniversity.ac.in

Abstract:

Energy storage is crucial for addressing the challenges of fluctuating energy demand. Supercapacitors, with their exceptional performance, high energy and power density, rapid charge/discharge cycles, long lifespan, and superior safety are rapidly emerging as a promising power source. Developing high-performance electrode materials is essential to advance energy storage systems. In this work, a NiAl LDH/g-C_3N_4 nanocomposite was synthesized via a simple one-step ultrasonication method. The as-prepared electrode was characterized using X-Ray Diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM), and X-Ray Photoelectron Spectroscopy (XPS) to determine its physico-chemical properties. XRD patterns confirmed the rhombohedral phase of the NiAl LDH/g-C_3N_4. XPS analysis confirmed the presence of Ni, Al, N, C, and O in their respective chemical valence states within the as-prepared

ISBN: 9789348505019

NiAl LDH/g-C_3N_4 electrode. Electrochemical performance was evaluated using cyclic voltammetry, galvanostatic charge-discharge and electrochemical impedance spectroscopy techniques. The as-prepared nanostructured electrode exhibited outstanding electrochemical results in terms of specific capacitance, long-term cycling stability, and coulombic efficiency. This promising material has the potential for widespread application in wearable electronics.

Keywords: Supercapacitor, NiAl LDH/g-C_3N_4, Electrode material, Ultrasonication method

ISBN: 9789348505019

OL – 14

Comprehensive study on Ga-Doped PbS Thin Films for Optoelectronic Applications

Tabassum Sulthana T[1], Prathik Rajaram kharat[2], Dr Gajanan V Honnavar[3*]

[1]Department science and Humanities, PES University, Bengaluru, India

[2]Department science and Humanities, PES University, Bengaluru, India

[3]Department science and Humanities, PES University, Bengaluru, India*

**Corresponding Author E-mail: Gajanan.honnavar@pes.edu*

Abstract:

PbS and Ga doped PbS quantum dots of controlled sizes have been fabricated by a simple sol-gel method. The composition, structure, morphology and optical Properties of the products are Characterized through X-ray diffraction, FESEM, EDS, UV/VIS/IR techniques. The obtained Quantum dots exhibits high crystallinity, Uniformity and have various ranges of size. A significant blue shift is observed in UV/VIS/IR absorption spectrum due to the quantum confinement effect. Hall effect measurement is carried out to check the mobility, carrier type, carrier concentration. Important optical properties including the band gap, absorption coefficient, dielectric constant, index of

ISBN: 9789348505019

refraction and coefficient, responsivity, noise equivalent power, signal to noise ratio, detectivity of the films are systematically reported. Optical study of the films revealed a variation of the band gap with increasing Ga doping level. The 5% Ga doped PbS films showed better photosensitivity compared with other films based on Current-Voltage measurements.

Keywords: Quantum Dots; Thin films; Photosensitivity studies; Hall effect measurement.

ISBN: 9789348505019

OL – 15

Green Synthesis of SnO_2 Nanoparticles and its Characterization

Roshni Kumari

Department of Physics, Babasaheb Bhimrao Ambedkar University, Vidya Vihar Raebareli Road, Lucknow, 226025, India

**rkroshni.2705@gmail.com*

Abstract:

Tin dioxide (SnO_2) has emerged as a promising material for various energy applications due to its unique characteristics such as wide band-gap, high surface area, chemical stability and optical properties. This study reports an eco-friendly approach for synthesis of tin dioxide nanoparticles. Synthesized nanoparticles were characterized by X-Ray Diffraction (XRD), scanning electron microscopy (SEM) Fourier Transform Infrared Spectroscopy (FTIR) and UV-visible spectroscopy.

Keywords: Tin oxide, Green synthesis, Plant extract.

ISBN: 9789348505019

OL – 16

Synthesis and Performance Study of Electromagnetic Shielding of Hybrid Thin Films with GNPs, CB NPs, and Carbon Derived from Waste Coconut Shells and Fibers

K. Sreeranjani [1], V. Bharath [2*], B. Sujatha Reddy [1]

[1]Department of Electronics and Communication Engineering, M. S. Ramaiah Institute of Technology, Bangalore 560054, India

[2]Department of Artificial Intelligence and Machine Learning, HKBK College of Engineering, Bangalore 560045, India.

**Corresponding author*

E-mail: bharathv.work@gmail.com (Bharath. V 2)*

Abstract:

In this study, we investigate the electromagnetic wave shielding effectiveness (EMW SE) of novel thin films (TFs) in the X-band frequency range. Graphene nanoplatelets (GNPs) were synthesized using solution combustion method, waste coconut shells and fibers were ground into a fine powder using ball milling technique, then subjected to pyrolysis to produce carbonized coconut powder (CC) and were further treated via a hydrothermal method. The synthesized GNPs, CC, and carbon black nanoparticles (CB NPs) were uniformly dispersed in a polyvinyl alcohol (PVA) matrix. Three TFs of varying ratios of GNPs, CB NPs, and CC were fabricated via solution casting method. X-Ray Diffraction (XRD) analysis confirmed the structural characteristics of the GNPs, CC, and the fabricated TFs. Shielding analysis were performed on the fabricated TFs which

ISBN: 9789348505019

represents a novel exploration of their performance in X-band frequency range. Among the fabricated TFs, the TF_2 composed of PVA50%, CB5%, GNP35%, and CC10% achieved the highest EMW SE of 15.1064 dB suppressing 96.9142 % of incoming EMW at 12 GHz. Notably, 95.4062% of the incoming EMW were absorbed by the TF_2 demonstrating a significant potential for advanced RADAR-absorbing stealth applications through absorption-dominant EMW shielding, addressing the need for materials that enhance stealth technology in military.

Keywords: Electromagnetic wave shielding effectiveness (EMWSE), Graphene nanoplatelets (GNPs), Waste coconut shells and fibers, Thin films (TFs), X-band frequency.

ISBN: 9789348505019

POSTER PRESENTATION ABSTRACTS

ISBN: 9789348505019

PT-1

Microwave-Assisted Synthesis of $Cu_{1-x}Zn_xO$ Nanocomposites: Tailoring Structural, Optical, and Photocatalytic Properties via Zn Doping

S.J. Helen[1], Mohan A*[1]

[1]Department of Physics, Dr. Zakir Husain College, Ilayangudi - 630 702, Sivagangai , Tamilnadu, India

[2]Department of Physics, St. Joseph's University, Bangalore, Karnataka, India

**Corresponding Author E-mail: mohan@sju.edu.in*

Abstract:

In recent years, there has been a growing demand for facile and eco-friendly methods to synthesize metal oxide-based nanostructures. Addressing this need, $Cu_{1-x}Zn_xO$ (x = 0.25, 0.50, and 0.75) nanocomposites (NCs) were successfully synthesized using a microwave-assisted chemical precipitation method. The structural, optical, morphological, and photocatalytic properties of the NCs were systematically tailored as a function of Zn content. X-ray diffraction (XRD) and Laser-Raman spectroscopy confirmed the formation of CuO-ZnO nanocomposites. A blue shift in the optical spectra and variations in average grain size were observed, indicating a quantum confinement effect due to the incorporation of higher Zn concentrations. Optical analysis further revealed the formation of CuO-ZnO

ISBN: 9789348505019

heterostructures in all nanocomposites. Among the various nanostructures, nanoflakes and hexagonal nanoplates exhibited significantly enhanced photocatalytic performance. Additionally, the Zn content was found to play a critical role in determining the surface morphology of the NCs. Photocatalytic degradation of Methylene Blue (MB) demonstrated an impressive efficiency of 93% for nanocomposites featuring a mixture of nanoplates and nanoflakes, underscoring their potential for environmental remediation applications.

Keywords: $Cu_{1-x}Zn_xO$ nanocomposites, Microwave-assisted synthesis, Chemical precipitation method, Zn doping, Quantum confinement effect.

ISBN: 9789348505019

PT-2

Structural and Optical Properties of Dy^{3+}-Doped $CaYF_5$ Phosphor for Solid-State Lighting Applications

Vinod Patil

Manipal Academy of Higher Education, Manipal, Karnataka

Email: vinodfiziks@gmail.com

ABSTRACT

Fluoride-based phosphors exhibit excellent chemical and thermal stability, along with superior emission intensity due to their low phonon energy. These characteristics make them ideal hosts for rare-earth dopants, which can easily occupy lattice sites, rendering them an excellent choice for host materials. Therefore, we synthesized the $Ca_{(1-x)}$ YF_5: x Dy^{3+} (x = 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 mol%) phosphor via the co-precipitation method. X-ray diffraction confirmed the cubic structure with an Fm-3m space group, which was further validated by Rietveld refinement. Scanning Electron Microscopy (SEM) revealed that the phosphors consisted of non-uniform, flaky particles with significant agglomeration. Fourier-Transform Infrared Spectroscopy (FTIR) identified various bonds and their associated vibrational modes. The average band gap of the phosphors was calculated to be 6.35 eV. Photoluminescence emission spectra exhibited three peaks at 481 nm (blue), 579 nm (yellow), and 673 nm (red), corresponding to Dy^{3+} ion transitions $^4F_9/_2 \rightarrow {}^6H_j$

ISBN: 9789348505019

(J = 15/2, 13/2, 11/2) under 353 nm excitation. Optimal dopant concentrations were determined based on these spectra. The distinct properties, such as CIE coordinates, correlated colour temperature (CCT), and colour purity, were measured as (0.44227, 0.43473), 2948 K, and 71.7%, respectively. These results show the suitability of this phosphor for solid-state lighting applications.

ISBN: 9789348505019

PT-3

Optimizing ZnPc/Al Hybrid Structures for Improved Photovoltaic Performance: Fabrication, Characterization, and Efficient Solar Spectrum Harvesting

Souvik Datta, Ricky Wilfred, Mohan A*

Department of Physics, St. Joseph's University, Bangalore, Karnataka, India

**Corresponding Author E-mail: mohan@sju.edu.in*

Abstract:

This study underscores significant advancements in the understanding and developing zinc phthalocyanine (ZnPc) based photovoltaic (PV) devices through a meticulous and systematic investigation. We employed a layer-by-layer deposition technique via thermal evaporation to fabricate ZnPc/Al/ZnPc hybrid structures and maintain a constant ZnPc thickness of 100 nm while varying the Aluminium (Al) thickness at 10, 50, and 100 nm. The evaporation rate was precisely controlled between 1-3 Å/sec, and the vacuum pressure was maintained within the range of approximately 10^{-5} to 10^{-6} mbar. Our fabrication yielded high-quality ZnPc thin films characterized by uniform morphology and excellent optical properties, as confirmed through comprehensive characterization using UV-Visible Spectroscopy, Raman Spectroscopy, Scanning Electron

ISBN: 9789348505019

Microscopy (SEM), and X-Ray Diffraction (XRD). These films exhibit promising attributes as absorber layers in solar cells, including robust light absorption across the visible to infrared spectrum and optimal energy levels conducive to efficient charge generation. The structural analysis revealed a decrease in grain size from 14 nm for pure ZnPc samples to 9 nm for the ZAZ-100 hybrid structure. Additionally, the energy band gap exhibited a notable variation: a decrease from 1.37 eV to 1.27 eV for the first band gap and an increase from 2.26 eV to 2.50 eV for the second band gap with increasing Al layer thickness, aligning well within the desired range for photovoltaic applications. Raman spectroscopy confirmed the presence of ZnPc peaks corresponding to different vibrational modes and indicated shifts associated with increasing Al layer width. SEM images revealed plate-like structures suggestive of crystalline domains alongside smaller granular particles indicative of amorphous or nanocrystalline regions. Future research should focus on optimizing device architecture, interface engineering, and material properties to enhance further the performance and commercial viability of ZnPc/Al thin film solar cells.

Keywords: Zinc Phthalocyanine (ZnPc), Photovoltaic Devices, Thermal Evaporation, Thin Film Solar Cells.

ISBN: 9789348505019

PT-4

Impact of Ar and O2 Gases on the Sb_2O_3 Nanobelt's Phase and Form, as Well as an Examination of its Optical Characteristics

Shivamurthy[1], C.G Renuka[1*], N. Pradeep[2]

1Department of Physics, Bangalore University, Bengaluru 560056, India

2Department of Nanoscience and Technology, Mount Carmel College, Bengaluru 560052, India

**Corresponding author:* renubub@gmail.com.

Abstract:

A chemical vapor deposition reaction with constant argon gas and variable oxygen gas over a consistent period of time produced an antimony oxide nanobelt. The creation of structure, morphology, and optical properties was examined in relation to the reaction temperatures and nanobelt time. XRD, SEM, EDAX, elemental mapping, UV-Visible spectrometry, and photoluminescence (PL) are used to analyze the structure, surface morphology and optical characteristics of Sb_2O_3 nanobelts. According to the Debye-Scherrer equation, the Sb_2O_3 nanoparticles size fell between 52 and 54 nm. The nanobelts, which range in thickness from nanometers to micrometers and display a variety of morphological patterns in a single frame, are confirmed by Scanning Electron Microscopy (SEM). The

ISBN: 9789348505019

result shows that many morphologies have been observed as a consequence. The Sb and O peaks were validated by energy dispersive X-Ray Analysis (EDAX) experiments. At about 240 nm, a characteristic band for orthorhombic pure Sb_2O_3 was seen in a broad UV-Vis absorption spectrum. The PL emission indicates that the band gap of Sb_2O_3 is 3.07 eV to 3.38 eV to the corresponding excitation wavelength from 350 to 475 nm. The produced Sb_2O_3 nano belt are expected to be unique functional materials and are used in the manufacturing of advanced optoelectronic nanodevices.

Keywords: Antimony trioxide, nano belt, CVD method, optical properties

ISBN: 9789348505019

PT-5

Green Synthesis of Zirconium Oxide Nanoparticles Using Solanum Trilobatum and Evaluation of Photodegradation Activity

S. Arumugam[1], A. Shafreen Banu[1], P. Ramesh[2]

[1]PG and Research Department of Chemistry, Nehru Memorial College (Autonomous) Puthanampatti, Affiliated to Bharathidasan University, Tiruchirappalli, Tamil Nadu 621007, India

[2]PG and Research Department of Physics, Nehru Memorial College (Autonomous) Puthanampatti, Affiliated to Bharathidasan University, Tiruchirappalli, Tamil Nadu 621007, India

Abstract:

In this study, we employed an eco-friendly technique to create ZrO nanoparticles using Solanum Trilobatum plant extract. FTIR, UV, Scanning Electron Microscopy, and X-ray diffraction were among the methods used to analyze the ZrO NPs in basic media and at pH 12. The hazardous free synthesis procedure has drawn attention to the green synthesis of nanoparticles using plant extract. Numerous metal oxide nanoparticles have been identified to have environmental engineering uses. A root extract from the Solanum Trilobatum plant was used in this study to create zirconium oxide nanoparticles (ZrO-Nps) utilizing a straight forward green-synthetic approach that involved reducing 0.5M Zirconium oxychloride. A light brown structure with a

ISBN: 9789348505019

surface plasmon band absorbed near to 383nm revealed ZrO-Nps synthesis. FT-IR spectrum analysis revealed the function of the group stages during ZrO-Nps synthesis. Zirconium oxide's nanoparticle origin was confirmed by agglomerations of nanoparticles that were absorbed during FE-SEM investigation. Based on dynamic light scattering, the average ZrO-Nps particle size was 606.8 nm; according to FE-SEM analysis, the particles were spherical in shape. Under solar radiation, the synthesized ZrO-Nps demonstrated a 50% reduction in methylene blue, reactive red 120, and methylene orange, demonstrating a good photodegradation efficacy. A facial synthesis technique for ZrO-Nps with good photodegradation efficiency is presented in this research.

Keywords: ZrO nanoparticles, Solanum Trilobatum, FE-SEM, XRD

ISBN: 9789348505019

PT-6

Green Synthesis of Titanium Dioxide Nanoparticles Using Plant Extracts of Enicostemma Littorale and Evaluation of Photocatalytic Activity

R. Santhoshkumar[1], and P. Ramesh[*1]

[1] PG and Research Department of Physics, Nehru Memorial College (Autonomous) Puthunamapatti, (Affiliated to Bharathidasan University, Tiruchirappalli), Tiruchirappalli, India.

**Corresponding Author E-mail: p.ramesh704@gmail.com*

Abstract:

In the present study, we report on the green synthesis of titanium dioxide (TiO_2) nanoparticles using Enicostemma littorale by single-step straightforward co-precipitation method. The preparation of TiO2 nanoparticles is a fully green and environmentally beneficial process. XRD analysis confirmed the crystalline structure of green-synthesized TiO_2 NPs. Energy Dispersive X-Ray analysis was used to test the chemical purity of the nanoparticles, and surface morphology was inspected by scanning Electron Microscopy. Fourier Transform Infrared spectroscopy was also used to test the presence of different functional groups in the nanoparticles and to establish their purity. The photocatalytic activity of the bio-synthesized TiO_2 NPs was established by the degradation of methylene blue, rhodamine B, and eosin yellow dyes. The TiO_2NPs showed a

ISBN: 9789348505019

more expanded absorbing band and higher surface area, which led to higher photocatalytic activity under sun light illumination.

Keywords: Green Synthesis, TiO_2 nanoparticles, XRD, FE-SEM, Photocatalyst activity

ISBN: 9789348505019

PT-7

Exploring Structural, Morphological and Luminescence of $Ca_2Al_2O_5:Dy^{3+}$ Phosphors

Vidya Saraswathi. A, Tejas, Dr. Sudha. D. Kamath

Department of Physics, Manipal Institute of Technology, Manipal Academy of Higher Education (MAHE), Manipal 576104, Karnataka, India.

Abstract:

$Ca_2Al_2O_5:Dy^{3+}$ (CAO: Dy^{3+}) phosphors were synthesized utilizing the solid-state reaction method. X-ray Diffraction analysis was conducted to examine phase and structural parameters. Scanning Electron Microscopy (SEM) revealed highly irregular morphological features of CAO-Dy samples. The XRD patterns corresponded well with the reference data, and the crystal phase remained unaltered following Dy^{3+} ion doping. Fourier Transform Infrared Spectroscopy (FTIR) was employed to identify the functional groups present in the samples. The influence of doping concentration on the luminescence properties of CAO: Dy^{3+} phosphors was investigated. The Photoluminescence spectrum exhibited three emission peaks at 483 nm (blue), 575 nm (yellow), and 665 nm (red) upon excitation at 350 nm. The correlated color temperature (CCT) value ranged from 5400 K to 6400 K, which is classified as cool white light emission. Consequently, CAO: Dy^{3+} phosphors

ISBN: 9789348505019

demonstrate significant potential as candidates for white LEDs. Temperature dependent luminescence properties of CAO- Dy^{3+} samples are studied to find the thermal stability of phosphors at elevated temperatures. The prepared samples exhibit high thermal stability; hence they can be used as optoelectronic devices.

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ISBN: 9789348505019

PT-8

Energy Enhancement of a Nickel–Cobalt-Mixed Metallic Metal–Organic Framework Electrode and a Potassium Iodide Redox Mediator Bound with an Aqueous Electrolyte for High-Performance Redox-Aided Asymmetric Supercapacitors

Ganesan Shanmugam*

Energy Conversion and Energy Storage Laboratory, Department of Chemistry, SRM Institute of Science and Technology, SRM Nagar, Kattankulathur, Chengalpattu District, Tamil Nadu - 603 203, India.

Corresponding author e-mail: sakthi_ganesan@rediffmail.com, ganesans2@srmist.edu.in

Abstract:

In recent years, increasing energy demands in industry and human science call for efficient, clean energy conversion and storage devices. Therefore, improved energy storage technologies are urgently required. Batteries and supercapacitors have emerged as promising possibilities, and they have seen a lot of use in electronic vehicles and electronic gadgets. Compared with batteries, supercapacitors exhibit a fast charge and discharge capability, high power density, and high cycle stability [1] Generally, Various materials such as metal oxides, metal organic frameworks (MOFs), covalent organic frameworks

ISBN: 9789348505019

(COFs), conducting polymers (CPs), metal chalcogenides, etc., exhibits pseudocapacitance. Contemporarily, researchers have increasingly focused on Metal–organic framework (MOF) materials with redox active metal ions have improved the pore structure and have been continually exploited for energy storage because of their unique Pseudocapacitive nature. [2] By using KI redox mediator electrolyte, pseudocapacitance can increase the power density, and cycle stability is observed in the electrode material for supercapacitors.

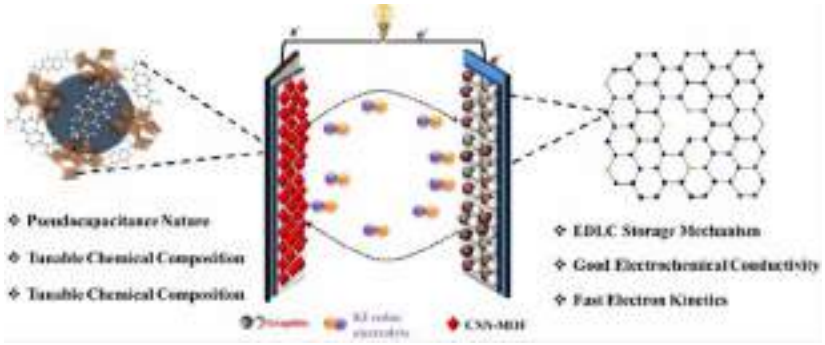

Figure 1. Graphical abstract of the fabricated RAASC device.

Enhancing the energy density of supercapacitors requires the development of novel electrode and electrolyte materials that can endure high voltages and exhibit fast electrochemical kinetics. Pseudo-capacitance, high energy density, and specific capacitance can be achieved through electrodes and redox mediator electrolytes used in redox-aided asymmetric supercapacitors (RAASC), which are vital

ISBN: 9789348505019

for their practical application. In this study, a rod and microsphere structure of Ni/Co-mixed metal-organic framework (MOF) was synthesized using a hydrothermal method for the positive electrode material. The rod and microsphere structure provides numerous active sites and smooth ionic channels, making Ni/Co-MOF a suitable material with three different organic linkers. The CNN-MOF material, which has a rod-like structure, demonstrated good capacitance. To further improve its capacitance, a KI redox mediator combined with a KOH electrolyte was introduced, achieving a specific capacitance of up to 612 F g^{-1} in a three-electrode system. Additionally, in the assembled RAASC, a graphite anode with CNN-MOF as the cathode and a KI redox mediator bound with a KOH gel polymer electrolyte exhibited electrical double-layer capacitor behavior. The RAASC device achieved an energy density of 84.2 W h kg^{-1} and a power density of 532 W kg^{-1}. It also displayed excellent cyclic stability, retaining 97.4% of its initial capacitance after 11,200 charge/discharge cycles. This work highlights the efficient fabrication of high-performance MOF electrodes and introduces the KI redox electrolyte-constructed RAASC device as a promising approach for advanced energy storage systems.

ISBN: 9789348505019

Keywords: metal organic frameworks (MOFs), asymmetric supercapacitors, KI

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ISBN: 9789348505019

PT-9

Design & Fabrication of Polymer Composites Filled with Tungsten for Gamma Ray Shielding Applications

Atheena Kurian A[1], Jovitta Rose Vazhappilly[1], Haridev M[1], Parul Goel[1], Mohan A[1], Sherry Shajan Kuttukaran[2], Ambika M R[2*], Nagaiah N[3]

[1]Department of Physics, St. Joseph's University, 36, Lalbagh Road, Bengaluru 560027, India

[2]Department of Physics, M S Ramaiah Institute of Technology, Bengaluru-560054, India

[3]Department of Physics, Bangalore University, Jnana Bharathi Campus, Bengaluru-560056, India

**Corresponding author email: ambikamr@msrit.edu*

Abstract:

Gamma rays are the most penetrative type of radiation and tend to be hazardous to the society and environment. Conventionally, high density materials such as lead and concrete were used for shielding of gamma rays. Unfortunately, lead is hazardous and quite heavy. Therefore, polymer composites are on high demand for shielding these radiations due to their low density, cost effectiveness and non- toxicity. In this study, Liquid Silicone Rubber (LSR) is used as the matrix and is reinforced with tungsten. Tungsten is added in varying concentration (10, 30, 50, 70 and 90 phr) into LSR. Hand mixing is done

ISBN: 9789348505019

for homogenous distribution of filler particles throughout the rubber matrix and open mould cast technique is used for making the sample. Gamma ray attenuation study is carried out using Gamma ray spectrometer for the photon energies, 80, 356 and 662 keV from sources, Ba-133 and Cs-137 respectively. The experimental results show that at 662 keV, the Linear Attenuation Coefficient (LAC) values increase with increase in filler concentration, due to increase in the density of the polymer composite upon addition of tungsten, but for 90 phr, there is a decline in LAC value and this may be attributed to the agglomeration of tungsten particles which is confirmed using SEM analysis. Mass Attenuation Coefficient (MAC) values are also found to increase with increase in filler concentration. The slight variations seen for the polymer composite containing 30 and 90 phr of filler may be due to the non-uniform dispersion of the fillers into the matrix. The shielding is more effective upon increase of filler concentration witnessed by the shielding parameters. The Half Value Layer (HVL) and Tenth Value Layer (TVL) thickness decreases with increase in filler concentration and is least for LSR + 70phr W at 662 keV i.e. 3.246 cm and 10.785 cm respectively. Relaxation length (λ) is also found to decrease with increase in filler concentration. The later has lowest

ISBN: 9789348505019

value for LSR + 70phr W which is found to be 4.68 cm. As λ decreases, the gamma shielding property increases.

The same trend is observed for all the shielding parameters at 80 and 356 keV as well. The polymer composite LSR + 70phr W has the best results. For MAC it is found to be 3.473 and 0.413 cm^2/g and for HVL it is 0.111 and 1.024 cm for 80 and 356 keV respectively. Simultaneously with increase in photon energy the values were found to decrease due to the interaction processes that takes place at different energy range.

Thus from the gamma attenuation studies of the liquid silicone rubber reinforced with tungsten filler particles, it is found that the attenuation coefficient increases with increase in filler concentration. Other shielding parameters like HVL, TVL and λ tends to decrease with increase in filler concentration. Thus from the present study, it is evident that the prepared polymer composite is efficient compared to other conventional shielding materials. And is a better alternative to make radiation shielding garments as the material is lightweight, flexible and cost effective.

Keywords: Polymer composite, Gamma shielding, Dispersion, Lightweight.

ISBN: 9789348505019

PT-10

CuS & CuZnS Nano-Composite Studies

Anitha Clarin, Mohan A

Department. of Physics, St Joseph's University, Bengaluru

Email: anitha.clarin@sju.edu.in

Abstract:

In this work we are focusing on synthesis of CuS and CuZnS nanoparticles for effective solar spectrum utilisation. These nanoparticles are prepared by microwave and hydrothermal treatment using copper chloride ($CuCl_2$) and sodium sulphide (Na_2S). The XRD showed the CuS nanostructure had hexagonal covellite structure and UV analysis showed the optical energy band ranging from 2.11–2.92 eV. Raman analysis confirmed the molecular structure, vibrational modes and phase composition CuS for its various application in optoelectronic, catalysis and photovoltaics.

ISBN: 9789348505019

PT-11

Photocatalytic Degradation of Organic Dyes Using Green Synthesis of Cadmium Oxide Nanoparticles

S. Arumugam[1], E. Nithya Sree[1] and P. Ramesh[*2]

[1,2]PG and Research Department of Chemistry, Nehru Memorial College (Autonomous) Puthanampatti, (Affiliated to Bharathidasan University, Tiruchirappalli), Tiruchirappalli, India.

[2]PG and Research Department of Physics, Nehru Memorial College (Autonomous) Puthunamapatti, (Affiliated to Bharathidasan University, Tiruchirappalli), Tiruchirappalli, India.

**Corresponding Author E-mail: p.ramesh704@gmail.com*

Abstract:

One major problem in developing nations is the absence of access to clean water and sanitary conditions. An eco-friendly catalyst based on bio-synthesised nanoparticles could be a viable option for treating wastewater. In order to create Cadmium oxide nanoparticles (CdO-NPs), a green and environmentally friendly reducing and capping agent, leaf extract from Abutilon Indcium is utilized. CdO-NPs' optical, structural, and morphological properties are investigated by the use of FTIR, UV visible analysis, SEM and Photodegradation. The SEM picture was utilized to examine the NPs' surface shape, the purity of the produced samples and the different functional groups present in the NPs were examined using Fourier-transform infrared

ISBN: 9789348505019

(FTIR) spectroscopy. And the UV visible analysis CdO absorption wavelength at about 300 nm-700 nm. The photocatalyst reactions carried out in methylene blue dye 120min were decolorized by the bio-synthesis CdO NPs. Superior photocatalytic activity under solar radiation was caused by CdO nanoparticles wider absorption intensity at 650 nm.

Key Words: Green Synthesis, CdO nanoparticles, FTIR, FE-SEM, Photocatalyst activity

ISBN: 9789348505019

PT-12

Combustion Synthesis and Characterization of Surface oxidized Iron Nanoparticles

R Sudarshana[a, b *], R Sambasivam[b], M Prakash [b], Ramdas Balan[a]

[a]*Department of Physics, CMR Institute of Technology, Bengaluru - 560037, India.*

[b]*PG & Research Department of Physics, Urumu Dhanalakshmi College (Affiliated to Bharathidasan University, Tiruchirapalli-620024), Tiruchirappalli - 620019, India.*

Email id: sudarshana.r@cmrit.ac.in

Abstract:

Combustion synthesis is a versatile method for producing metals and metal oxides. In this study, we report the synthesis of surface-oxidized iron nanoparticles (FeNPs) through a simple auto-combustion reaction between sodium borohydride ($NaBH_4$) and α-Fe_2O_3. The optimal ratio of the combustion agent, NaBH4, was determined to be 1:2. The resulting compound was characterized using powder X-Ray Diffraction (PXRD), Fourier Transform Infrared Spectroscopy (FT-IR), and High-Resolution Transmission Electron Microscopy (HR-TEM) to investigate its structural, morphological, and elemental properties. The characterization results indicated

ISBN: 9789348505019

that amorphous, surface-oxidized iron nanoparticles were formed, exhibiting a core-shell structure. Furthermore, it was observed that the oxidized surface inhibits complete oxidation, thereby enhancing the stability of the iron nanoparticles.

Keywords: Iron nanoparticle; Combustion synthesis; Surface oxidized Iron

ISBN: 9789348505019

PT-13

Isovalent Y Doping on n-Type $Bi_{1.8}Sb_{0.2}Te_3$ Thermoelectric Alloys: an Effort Towards Modulating the Thermoelectric Transport

Poojitha G[1], Poornesh P[1], K Gurukrishna[1,2], Ashok Rao[1*]

[1]Department of Physics, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal, 576104, India.

[2]Department of Materials science and Engineering, Indian Institute of Technology Kanpur, Kanpur, Uttar Pradesh, 208016, India

**Corresponding Author E-mail: a.rao@manipal.edu (Ashok Rao)*

Abstract:

Isovalent Y-doped $Bi_{1.8}Sb_{0.2}Te_3$ to the Bi site with three different doping concentrations (x = 0.04, 0.08, 0.12) were synthesized using the solid-state reaction method. X-ray diffraction data confirms the Rhombohedral crystal structure with $R\bar{3}m$ space group. The electrical resistivity of the samples increases with temperature exhibiting degenerate semiconducting behavior in the temperature range of 30-310 K. The Seebeck coefficient and Hall effect measurements reveal that electrons are majority charge carriers and the Seebeck coefficient increases monotonously with temperature without any major variations with the addition of the doping concentrations, this may be due to the equivalent density of states and fermi energy. The highest power factor of 197 $\mu W/mK_2$ at

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310 K was obtained for the pristine sample. The excess of Y concentration in the doped sample notably reduced thermal conductivity, which is attributed to point defects responsible for phonon scattering and increased ZT for x = 0.12 sample of 0.17 at 310 K, which is 35% higher than the pristine sample. These findings emphasize the potential of rare earth doping in enhancing the performance of materials, particularly for low and near-room temperature thermoelectric devices, offering valuable insights for further optimization and application in the TE field.

Keywords: Isovalent doping; Rare earth; Thermoelectric; Thermal conductivity.

ISBN: 9789348505019

PT-14

Structural and Optical Characterization of Dy3+-Doped Silicate Phosphors for Solid-State Lighting Applications

Tejas[1], Sudha D Kamath[1*]

[1]Department of Physics, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal, Karnataka, India

**Corresponding Author E-mail: sudhakamath6@gmail.com*

Abstract:

Recently, there has been a growing interest in luminescence materials triggered with rare-earth ions for application in solid state lighting. However, due to their competing demands for thermal responsiveness, it is difficult to accomplish the aforementioned numerous functions in a single material. The luminescent materials are of great significance in the fields of biological imaging, anti-counterfeiting, solid state lighting applications. Using the solid-state reaction technique, single phase cool light emitting silicate phosphors are effectively synthesized. Using different chemical precursor, grinded well and calcinated to get final product. X-Ray Diffraction, Scanning Electron Microscopy, Optical analysis and thermal dependent photoluminescence studies have been done to become familiar with the prepared phosphors thermal, optical, morphological, and structural characteristics. XRD

ISBN: 9789348505019

confirms the pure monoclinic structure. SEM observations reveal the agglomerated and irregular shape of prepared phosphors. Diffused reflectance spectra were utilized to calculate the material's band gap. Under 351 nm excitation, the as-prepared phosphors show different emissions which correspond to the Dy^{3+} ion transitions such as, 4F9/2 → 6H13/2 and 4F9/2 → 6H15/2. Thermal dependent PL revealed optical thermal stability of prepared phosphor at elevated temperature. Thermogravimetry analysis confirms the thermal stability of structure of phosphor at higher temperature. All of these results show that phosphor prepared using the high temperature solid state reaction method shows excellent efficiency and stability to be used in LED applications. The optical thermal stability shows that the phosphors can also be used for optical thermometry applications on further investigation.

Keywords: Luminescence, Phosphors, Optical, Solid-state lighting, XRD

ISBN: 9789348505019

PT-15

Performance Analysis of a MoSSe-Based Heterojunction Thin Film Solar Cells Using SCAPS-1D

Chongdeikim Thangeo and Vignesh

Ganesan School of Physical Sciences, Department of Physics, St Joseph's University, Bengaluru, Karnataka

Abstract:

A theoretical study has been conducted using MoSSe, a Janus transition metal dichalcogenide (JTMDC), as an active layer in tri-layer thin film Solar Cells (SC). MoSSe is leveraged to enhance the present model's light absorption and charge carrier generation capacity. Using SCAPS- 1D Simulation, the performance of TiO2/MoSSe/$MoSe_2$ heterostructure stacking is evaluated. This device includes ETL (electron transport layer), absorber layer, HTL (hole transport layer), and FTO at an operating temperature of 300k under standard test conditions (AM1.5G illumination at 300K). The thickness parameters of HTL, ETL, and Active layer are optimized as 700nm, 2000nm, and 725nm, respectively, to get a suitable configuration. Despite this simplification, the simulation achieved power conversion efficiency (PCE) of 12.63% under standard test conditions. The optimized model executed open-circuit voltage (VOC) as 0.1 V, 18.42mA/cm^2 as short circuit current density (Jsc), which results in the fill factor (FF) of 82.17%. The Photoconversion efficiency (PCE) of the present configuration is 12.635%. The solar cell performance of the above model is analyzed, and results are discussed.

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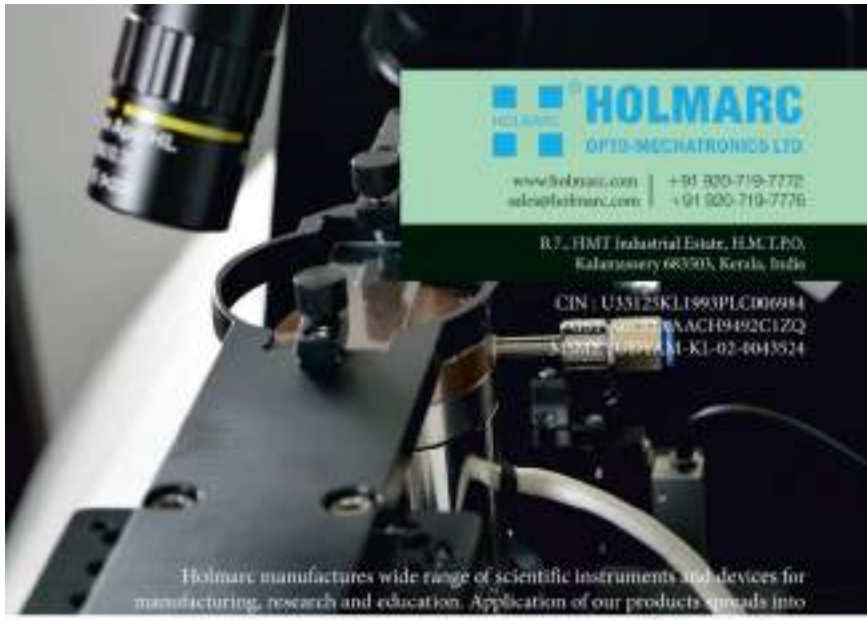

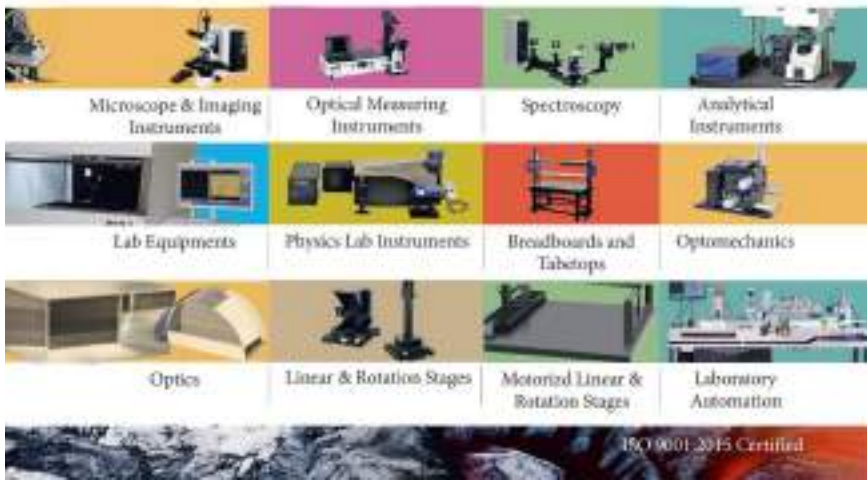

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RESEARCH FACILITIES FOR MATERIAL SCIENCE AT ST JOSEPH'S RESEARCH INSTITUTE (SJRI), SJU

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About St Joseph's University, Bengaluru

St Joseph's University is a Jesuit university at the heart of Bengaluru, the silicon city of India. Established in 1882 by Paris Foreign Mission Fathers, the management of the college was handed over to the Jesuit order (Society of Jesus) in 1937. The college was first affiliated with the University of Madras and later with the Mysore and Bangalore universities. In 1986, St Joseph's College became the first affiliated college in Karnataka to offer postgraduate programmes. In 1988, it became the first college in Karnataka to get a Research Centre, and in 2005, it was one of five colleges in Karnataka that was awarded academic autonomy. In February 2021, St Joseph's University Bill was presented in the Karnataka Legislative Assembly and was subsequently passed by the Legislative Assembly and Karnataka Legislative Councill. The college received its university status on 2nd July 2022 and was inaugurated as India's first Public-Private-Partnership University by the Honourable President of India, Smt. Droupadi Murmu on 27th September 2022.

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