RAFM-2020
E-Abstract Book

05-06th November 2020

Online

National Conference On
Recent Advances in Functional Materials
(RAFM-2020)

Organized by

Department of Physics

IQAC and STAR College Scheme (GOI)

Atma Ram Sanatan Dharma College

(University of Delhi)

Dhaula Kuan, New Delhi-110021

Patrons

Prof. Pradeep Burma
(Chairman, ARSD College)

Prof. Prem Lal Uniyal
(Treasurer, ARSD College)

Chairman

Dr. Gyantosh Kumar Jha
(Principal, ARSD College)

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Dr. Vinita Tuli

Co-convener

Dr. Manish Kumar

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Address for Correspondence

Dr. Vinita Tuli, Dr. Manish Kumar, Dr. Arvind Kumar
Mob.: 9811125949, 9555977892, 8826668810
Email: rafm2020.arsd@gmail.com

Principal's Message

Dear Colleagues,

I would like to congratulate the Physics Department for organizing two days online National Conference on "*Recent Advances in Functional Materials (RAFM-2020)*" under the IQAC & Star College Scheme (DBT, GoI). Physics Department has been at the forefront of research activities in College and this new endeavour only serves to highlight their commitment to the same. I wish them all the best.

Atma Ram Sanatan Dharma College has become synonymous with Equity and Excellence in last few years. Established in 1959, the College underwent upheaval and transformation in the post-Independence years. Yet, the ability to adapt while holding onto one's cultural identity, built into its foundations early on, has held ARSD in good stead.

A NAAC-accredited A-grade institution and holding NIRF All India Rank of 13, the College stands testament to this community's dedication towards creating an educational ecosystem that is holistic and all-embracing. In the last five years alone, the College has gone from strength to strength, developing existing facilities to maximize their potential and keep pace with rapid shifts in the global economy. The College now has a Wi-Fi-enabled campus, an almost fully digitalized library, and is on its way to implementing more learner-centric pedagogic processes. ARSD is evolving into an excellent centre for research. Presently, apart from several major and minor projects funded by various government agencies, the College has 11 Innovation projects and 7 projects under Star Innovation projects funded by the University of Delhi, involving close to 200 undergraduate students. Students are given the opportunity to develop their higher thinking, reasoning, and writing abilities in a highly competitive and academic environment as well as publish their findings in reputed journals. Furthermore, the departments of Physics, Chemistry, Biology and Mathematics are funded by the Department of Biotechnology, GOI, under the Star College Scheme, attesting to the high quality of work being undertaken on campus. The establishment of the DBT Science Centre in addition to the Centre for Innovation and Entrepreneurial Leadership (CIEL) in collaboration with M/o MSME, a first for any University of Delhi college, showcases ARSD's commitment to research and innovation. The College has been the recipients of several prestigious grants and is fast emerging as a hub of undergraduate research. Along with imparting a sound education in line with the demands of the international job market, students are endowed with the professional and vocational skills necessary to succeed in life. Apart from offering placement and internship opportunities via the Placement Cell, vocational training and short-term add on courses are also provided through our Skill Development and Entrepreneurial Cell. The changes in progress are indicative of a larger desire to join a global community of progressive institutions. During this pandemic the IQAC cell of the college has successfully conducted more than 90 national/international webinars, online FDPs and other cultural and academic events and continually committed to impart best teaching, learning and research practices for the holistic development of the students and stockholders.

The aim of ARSD College is, therefore, to produce bright young minds in synergy with their ecosystem and maximizing their potential in an ethically sound manner. I wish this institution the very best and hope it continues to light the way towards the creation of a knowledge society.

I am extending the best wishes to the organising committee for planning this online national conference.

Dr. Gyantosh Kumar Jha

(Principal, ARSD College, DU)

Convener's Message

It's my pleasure to convey you all that Department of Physics, Atma Ram Sanatan Dharma College, University of Delhi is organising a online National Conference on Recent Advances in Functional Materials RAFM-2020, between 5-6 th Nov. 2020.

Theme of the conference is very relevant in the present day of technology. Researcher from each and every corner of the globe are working very efficiently in the advancement of the technology for the benefit of the common people.

In this present pandemic situation, this online conference may be a platform for the reseacher and young scientist from the different organisation of the nation to share their work and views. They could get the opportunity to interact with the academicians and scientific personals who are expert in their fields of research. They may share their knowledge, new findings and challenges for the coming era of technology with the young minds of the nation.

I extend my warm greetings to all the delegates and wish the RAFM-2020 a grand success.

V. Tuli

Dr. Vinita Tuli
(Convener, RAFM-2020)
Dept. of Physics, ARSD College. DU

Co-ordinator's Message

On behalf of the Department of Physics, A.R.S.D. College, I welcome to all the participants and delegate who will join this two day online national conference on "Recent Advances in Functional Materials (RAFM-2020)". Our department is devoted with many young and dynamic faculty members those are constantly involved in the innovative research work. We are trying to do our best to contribute significantly for our college and society. We have planned to organize this national conference via online mode in this Pandemic situation for the enrichment and benefit of the materials research society of the nation.

Materials are the backbone of the technological developments. The search of new materials and therein innovative properties was keen interest of the materials scientist and physicist since many decades. The applications of materials science used to be key role in the various scientific and technological developments for society and civilization. Thus, this conference may provide a platform to our researchers and scientists to discuss the challenges of the society and try to find out the possible solutions for them.

The conference will cover a wide range of topics: multifunctional materials, biomaterials, DFT and solar simulation of materials, perovskite and double perovskite materials, luminescent materials, smart materials, materials for energy conversion and storage, smart materials, advanced functional materials, materials in agriculture, polymeric materials, composites, liquid crystals, materials for sustainable development, nanomaterials and thin films, smart devices and quantum dots synthesis technique and characterization tools with application in smart devices.

I am sure that the conference will promote the awareness of the state of art of the materials science and will prove to be an excellent forum for starting interdisciplinary collaborative research work in materials science across the country.

I wish for every success of this two days national conference.

Dr. Manish Kumar
(Co-convener, RAFM-2020)
Co-ordinator
Dept. of Physics, ARSD College, DU

Program Schedule

Online National Conference on

Recent Advances in Functional Materials (RAFM-2020)

05-06th November, 2020

Day 1 (RAFM-2020) November 05, 2020			
Timing (Indian Standard Time)		**Event**	**Total time**
09:20 - 10:00 AM		Inaugural Function	40 minutes
09:30 - 09:40 AM		Welcome Address: Dr. Gyantosh Kr. Jha, Principal, ARSD College	10 minutes
09:40 - 09:50 AM		Inaugural Address: Prof. Prem Lal Uniyal, Treasurer, ARSD College	10 minutes
09:50 - 10:00 AM		Inaugural Address: Prof. Pradeep Burma, Chairman, ARSD College	10 minutes
10:00 - 10:30 AM		***Keynote Lecture:*** Prof. Vinay Gupta *Department of Physics and Astrophysics, University of Delhi*	30 minutes
Session 1 (Invited Talks) (Session Chair: Dr. Manish Kumar and Dr. Arvind Kumar)			
10:30 - 11:00 AM	**IT-1**	Prof. U. P. Singh *School of Electronics Engineering, KIIT University, Bhubaneswar, India*	30 minutes
11:00 - 11:30 AM	**IT-2**	Dr. Ravi S S *Ultrafast Photophysics and Photonics Laboratory, Department of Physics, Indian Institute of Technology Hyderabad, Kandi 502285, Telangana, India*	30 minutes
11:30 - 12:00 NOON	**IT-3**	Dr. Subhash Sharma *Conacyt-Universidad Nacional Autónoma de México, Centro de Nanociencias y Nanotecnología, Km. 107 Carretera Tijuana-Ensenada. Apartado Postal 14, C. P. 22800, Ensenada, B. C. México*	30 minutes
12:00 - 12:30 PM	**IT-4**	Dr. Avneesh Anshul *CSIR-National Environmental Engineering Research Institute (NEERI), Nagpur-440020, India*	30 minutes
12:30 - 01:00 PM	**IT-5**	Dr. Ajeet Kumar *School of Materials Science and Engineering, Yeungnam University, Gyeongsan, South Korea-38541*	30 minutes
Lunch Break 01:00 PM – 02:00 PM			
Session 2 (Oral Presentations)			
Timings	**Session 2(a)** (Session Chair: Dr. Avanish P. Singh and Dr. Raghvendra)	**Session 2(b)** (Session Chair: Dr. Anjali Sharma and Dr. Yogesh Kumar)	**Total time**
02:00 - 02:10 PM	**OT-1**	**OT-19**	10 minutes
02:10 - 02:20 PM	**OT-2**	**OT-20**	10 minutes
02:20 - 02:30 PM	**OT-3**	**OT-21**	10 minutes
02:30 - 02:40 PM	**OT-4**	**OT-22**	10 minutes
02:40 - 02:50 PM	**OT-5**	**OT-23**	10 minutes
02:50 - 03:00 PM	**OT-6**	**OT-24**	10 minutes
03:00 - 03:10 PM	**OT-7**	**OT-25**	10 minutes

03:10 - 03:20 PM	**OT-8**	**OT-26**	10 minutes
03:20 - 03:30 PM	**OT-9**	**OT-27**	10 minutes
03:30 - 03:40 PM	**OT-10**	**OT-28**	10 minutes
03:40 - 03:50 PM	**OT-11**	**OT-29**	10 minutes
03:50 - 04:00 PM	**OT-12**	**OT-30**	10 minutes
04:00 - 04:10 PM	**OT-13**	**OT-31**	10 minutes
04:10 - 04:20 PM	**OT-14**	**OT-32**	10 minutes
04:20 - 04:30 PM	**OT-15**	**OT-33**	10 minutes
04:30 - 04:40 PM	**OT-16**	**OT-34**	10 minutes
04:40 - 04:50 PM	**OT-17**	**OT-35**	10 minutes
04:50 - 05:00 PM	**OT-18**	**OT-36**	10 minutes

Day 2 (RAFM-2020) November 06, 2020

Timing (Indian Standard Time)	**Event**		**Total time**
Session 3 **(Session Chair: Dr. Arvind Kumar and Dr. Manish Kumar)**			
09:30 - 10:00 AM	***Keynote Lecture*:** Prof. Sevi Murugavel *Department of Physics and Astrophysics, University of Delhi*		30 minutes
10:00 - 10:30 AM	***Keynote Lecture*:** Prof. Amita Chandra *Department of Physics and Astrophysics, University of Delhi*		30 minutes
(Invited Talks)			
10:30 - 11:00 AM	**IT-6**	Dr. Rajesh Kumar *Discipline of Physics, Indian Institute of Technology Indore, Simrol, 453552 India*	30 minutes
11:00 - 11:30 AM	**IT-7**	Prof. P. K. Singh *Department of Physics, Sharda University, Greater Noida 201310, Uttar Pradesh, India*	30 minutes
11:30 - 12:00 NOON	**IT-8**	Dr. Pallav Gupta *Department of Mechanical Engineering, Amity School of Engineering and Technology, Amity University Uttar Pradesh, Noida-201313 (INDIA)*	30 minutes
12:00 - 12:30 PM	**IT-9**	Dr. Shiv Kumar *Hiroshima University, Japan*	30 minutes
12:30 - 01:00 PM	**IT-10**	Dr. P. K. Jha *Department of Physics, DDU College, University of Delhi, New Delhi, India*	30 minutes
Lunch Break 01:00 PM – 02:00 PM **(Poster Session)** **ALL POSTERS** (Session Chair: Dr. Manisha, Dr. Sadiq and Dr. Amit Kr. Vishwakarma)			Each Participant will get 3 min to share his/her poster
Session 4 **(Oral Presentations)**			
Timings	**Session 4(a)** (Session Chair: Dr. S. Shankar and Dr. Abid Hussain)	**Session 4(b)** (Session Chair: Dr. Ashutosh V. Bandhu, Dr. Anjani Kr. Singh and Dr. Amit Kr. Vishwakarma)	**Total time**
02:00 - 02:10 PM	**OT-37**	**OT-55**	10 minutes
02:10 - 02:20 PM	**OT-38**	**OT-56**	10 minutes
02:20 - 02:30 PM	**OT-39**	**OT-57**	10 minutes
02:30 - 02:40 PM	**OT-40**	**OT-58**	10 minutes
02:40 - 02:50 PM	**OT-41**	**OT-59**	10 minutes
02:50 - 03:00 PM	**OT-42**	**OT-60**	10 minutes

03:00 - 03:10 PM	**OT-43**	**OT-61**	10 minutes
03:10 - 03:20 PM	**OT-44**	**OT-62**	10 minutes
03:20 - 03:30 PM	**OT-45**	**OT-63**	10 minutes
03:30 - 03:40 PM	**OT-46**	**OT-64**	10 minutes
03:40 - 03:50 PM	**OT-47**	**OT-65**	10 minutes
03:50 - 04:00 PM	**OT-48**	**OT-66**	10 minutes
04:00 - 04:10 PM	**OT-49**	**OT-67**	10 minutes
04:10 - 04:20 PM	**OT-50**	**OT-68**	10 minutes
04:20 - 04:30 PM	**OT-51**	**OT-69**	10 minutes
04:30 - 04:40 PM	**OT-52**	**OT-70**	10 minutes
04:40 - 04:50 PM	**OT-53**	**OT-71**	10 minutes
04:50 - 05:00 PM	**OT-54**	**OT-72**	10 minutes
05:00 - 05:30 PM	**VALEDICTORY FUNCTION** **(Dr. Vinita Tuli and Dr. Manish Kumar)**		30 minutes

Invited Lectures

Name	Affiliation	Code	Title of Talk
Prof. Vinay Gupta	Department of Physics and Astrophysics, University of Delhi, Delhi 110007	**Keynote Lecture**	Study of GaN and InGaN heterostructures and quantum wells by Laser MBE technique for short wavelength photonic devices
Prof. Udai P. Singh	School of Electronics Engineering, KIIT University, Campus-3, Patia, Bhubaneswar-751024, India	**IT1**	Recent developments in thin film photovoltaic
Dr. Raavi Sai Santosh Kumar	Ultrafast Photophysics and Photonics Laboratory, Department of Physics, Indian Institute of Technology Hyderabad, Kandi 502285, Telangana, India.	**IT2**	Rare-Earth Doped Photoanodes for Organic Molecule based Solar Energy Conversion Devices
Dr. Subhash Sharma	Conacyt-Universidad Nacional Autónoma de México, Centro de Nanociencias y Nanotecnología, Km. 107 Carretera Tijuana-Ensenada. Apartado Postal 14, C. P. 22800, Ensenada, B. C. México	**IT3**	The search for a practical multiferroic material: The BFO-BST case
Dr. Avneesh Anshul	CSIR-National Environmental Engineering Research Institute (NEERI), Nagpur-440020, India	**IT4**	Investigation of piezoelectric, magnetic and structural properties in BFO-BST nanoparticles
Dr. Ajeet Kumar	School of Materials Science and Engineering, Yeungnam University, Gyeongsan, South Korea-38541	**IT5**	Aerosol Deposited Thick Films with highly Stable Energy Efficiency for Energy-Storage Applications
Prof. Sevi Murugavel	Department of Physics and Astrophysics, University of Delhi, Delhi 110007	**Keynote Lecture**	Size Induced Structural Changes and Charge Transport Mechanism: An In-Depth Study by Experimental and Simulations
Prof. Amita Chandra	Department of Physics and Astrophysics, University of Delhi, Delhi 110007	**Keynote Lecture**	How known physical observations were converted to 20th century technology
Dr. Rajesh Kumar	Discipline of Physics, Indian Institute of Technology Indore, Simrol, 453552 India	**IT6**	Physics at Nanoscale: Raman scattering, spectroscopy and beyond
Prof. Pramod Kumar Singh	Department of Physics, Sharda University, Greater Noida 201310, Uttar Pradesh, India	**IT7**	Polymer –ionic liquid solid electrolyte for energy applications
Dr. Pallav Gupta	Department of Mechanical Engineering, Amity School of Engineering and Technology, Amity University Uttar Pradesh, Noida-201313 (INDIA)	**IT8**	Recent Developments and Future Directions of Metal Matrix Composites/Nanocomposites
Dr. Shiv Kumar	Hiroshima University, Japan	**IT9**	ARPES study of magnetic topological insulators
Dr. Pradip K. Jha	Department of Physics, DDU College, University of Delhi, New Delhi, India	**IT10**	Inevitable Carbon in multiferroic BFO – First principle studies and Experimental investigations

Oral Presentation

Name	Affiliation	Code	Type of Presentation	Title of Abstract
Abhishek Raj	CSIR-National Environmental Engineering Research Institute (NEERI)	**OT1**	Oral Presentation	A computational approach to enhance the device efficiency of lead-free CsGeI3 based perovskite solar cell
Ajay Kumar Saw	Maharaja Institute of Technology Mysore (Aff.. To VTU Belagavi)	**OT2**	Oral Presentation	Automated Low temperature Resistivity Measurement Set-Up: Design and Fabrication
Amardeep Singh	Chaudhary Charan Singh University, Meerut	**OT3**	Oral Presentation	Evaluation of Mycogenic Silver Nanoparticles as Potential Control Agent Against Late Blight of Potato (Phytophthora Infestans)
Anusmita Chakravorty	IUAC, New Delhi	**OT4**	Oral Presentation	300 keV Ar ion induced effects in GaAs and 4H-SiC
Joginder Singh	Vikrant Institute of Technology and Management, Gwalior (MP), India-474011	**OT5**	Oral Presentation	Effect of Annealing on Growth and Properties of Electrodeposited InSb Thin Films
Gyanika Shukla	Chaudhary Charan Singh University, Meerut	**OT6**	Oral Presentation	Comparative evaluation of Aspergillus niger and Fusarium pallidoroseum for their mycogenic silver nanoparticles producing efficacy
Himani Tiwari	M. B. Govt. P. G. College Haldwani	**OT7**	Oral Presentation	Physical and optical analysis of Sm3+ doped zinc phosphate glass
Josny Rose	University of Calicut	**OT8**	Oral Presentation	Synthesis of Carbon Dots from medicinal plant for Bioimaging and Drug delivery
Kanwalpreet Sahni	Guru Nanak Dev Engineering College, Ludhiana	**OT9**	Oral Presentation	Role of thermal spray and hard facing techniques on Slurry Erosion and Wear Behaviour: A Review
Karan Surana	Material Research Laboratory, Sharda University	**OT10**	Oral Presentation	Reduced graphene oxide and sequentially deposited quantum dots for efficient quantum dot sensitized solar cell
Kashmiri Baruah	Tezpur University	**OT11**	Oral Presentation	Visible light active Au@g-C3N4 core-shell plasmonic photocatalyst
Mansi Sharma	Jaypee Institute of Information Technology	**OT12**	Oral Presentation	Biomaterials for Transdermal Delivery: Preparation and Characterization
Milan Singh	IIT Roorkee	**OT13**	Oral Presentation	Towards the Origin of Magnetic Field Dependent Storage Properties: A Case Study on Super-capacitive Performance of FeCo2O4 Nanofibers
Mohit Kumar	Delhi Technological University, Delhi	**OT14**	Oral Presentation	Er3+ ions doped borosilicate glasses for photonic applications
Onome Ejeromedoghene	Southeast University, Nanjing, China	**OT15**	Oral Presentation	Acid-catalyzed transesterification of palm kernel oil (PKO) to biodiesel
Paramveer	Delhi Institute of Tool Engineering	**OT16**	Oral Presentation	Effect of fiber orientation on the properties of Epoxy-Banana Fiber Composite Laminate
Paridhi Malhotra	Amity University, Noida	**OT17**	Oral Presentation	A review on gas assisted EDM
Salah Mohammed Saif Al-Mufti	Department of Petroleum Studies, Engineering and Technology College	**OT18**	Oral Presentation	Recent Advancements in Development of Bipolar Plates for Fuel Cell
Samah	Manav Rachna International Institute of Research and Studies	**OT19**	Oral Presentation	Natural Photosensitizer as a Promising Dyes for Green Energy Harvesting

Samiksha Dabas	University of Delhi	**OT20**	Oral Presentation	Investigation on structural and dielectric properties of Gd-doped BiFeO3-BaTiO3 based solid solutions
Sandeep Saini	Department of Physics, Indian Institute of Technology Roorkee	**OT21**	Oral Presentation	Study of the role of defects in green energy production by Ni substituted lithium ferrite based Hydroelectric cell
Sumona Kumar	Acharya Narendra Dev College, University of Delhi	**OT22**	Oral Presentation	Understanding the photocatalytic properties of g-C3N4 using Secondary data
Swati Singh	R.B.S. College	**OT23**	Oral Presentation	Study the behavior of different materials under explosive conditions.
Uma Sharma	IILM College of Engineering and Technology, Greater Noida	**OT24**	Oral Presentation	A Review on Structural and Mechanical Behavior of Aluminum Based Metal Matrix Composite
Arya M S	University of Calicut	**OT25**	Oral Presentation	Synthesis of SnS Nanoparticles for Next Generation Photovoltaic Applications
Anita Panwar/Deepak Kumar	University College of Engineering & Technology, Bikaner	**OT26**	Oral Presentation	Railway Ticket Booking and Authentication using a Smart System
Asha Dahiya	Bharati Vidyapeeth's College of Engg., New Delhi	**OT27**	Oral Presentation	Transition metal effect on different properties of lead –free KNN ceramics
Avirup Das	VIT Bhopal University	**OT28**	Oral Presentation	Role of clay intercalation in the structural, and thermal property of a polymer blend electrolyte
Dipak Bhowmik	Department of Physics, IIT Kanpur	**OT29**	Oral Presentation	Study of low energy ion beam induced sputtering parameters of Muscovite Mica [KAl 2 (Si 3 Al) O 10 (OH)2] using Monte Carlo Simulation
Devinder Singh	Amity University, Lucknow	**OT30**	Oral Presentation	Effect of processing parameter on the formation of shear bands in metallic glasses
Dharmendra Singh	Department of Computational Sciences, Central University of Punjab, Bathinda	**OT31**	Oral Presentation	Micro-structural characteristics and indentation behavior of Ce-Al-Ga alloys
Dipendra Sharma	Department of Physics, DDU Gorakhpur University, Gorakhpur, India-273009	**OT32**	Oral Presentation	Molecular structure, spectroscopic (IR, Raman, NMR, UV-vis) and molecular docking studies of an anticancer drug: isoDC81
Krishna Kumar Pandey	Deptt. of Physics, School of Basic Sciences and Research, Sharda University, Greater Noida, India	**OT33**	Oral Presentation	Mechanical and Acoustical Properties of Silver Chloride from 100K to 600K
Mahesh Chand	Complex Fluids Group, Faculty of Planaltina Campus - University of Brasília, 70910-900-Brasília (DF), Brazil	**OT34**	Oral Presentation	Mechanism of chain formation under shearing forces in magneto-rheological fluids
Pratima Sharma	Raj Kumar Goel Institute of Technology, Ghaziabad, U. P., India	**OT35**	Oral Presentation	Classification and Characterization of Nanomaterial's
Vijaylakshmi Dayal	Maharaja Institutes of Technology Mysore, (Aff: VTU-Belagavi),	**OT36**	Oral Presentation	Effect of Film Thickness on Electrical and Magnetotransport Properties in Pr0.5Sr0.5MnO3Thin Films Grown on LaAlO3 (011)
Hira Joshi	Gargi College, University of Delhi	**OT37**	Oral Presentation	Magnetoplasmonics in Au-nanostructures
Imran Khan	Ramjas College	**OT38**	Oral Presentation	LANDAU LEVELS IN GaAs QUANTUM WELLS: SPIN SPLITTING IN THE VALENCE BAND

Jagadish Chandra Mahato	Ramakrishna Mission Residential College (Autonomous), Narendrapur	**OT39**	Oral Presentation	Silicon nanodots via sputtering of Si(111)-7×7 surfaces and post-annealing
Kajal Jindal	Department of Physics, Kirori Mal College, University of Delhi	**OT40**	Oral Presentation	Influence of magnetic ordering on the electronic, optical and magnetic properties of Bi2Fe4O9
Mamta Bhatia	Acharya Narendra Dev College, University of Delhi	**OT41**	Oral Presentation	Smart materials for cardiovascular devices
Mohd Sadiq	ARSD College, University of Delhi	**OT42**	Oral Presentation	Studies on Structural, Electrical and optical properties of PEG-PVP-PVA Polymer Electrolytes
Nayan Kr. Debnath	University College of Engineering and Technology, Bikaner (Rajasthan)	**OT43**	Oral Presentation	Characterization of Fly Ash Solid-Waste for Low-Cost Insulation Refractory Bricks
Nidhi Agrawal	Netaji Subhas University of Technology	**OT44**	Oral Presentation	Analysis of Electromechanical Properties of Electrode for Enhancing Electrostrictive Capacitive Sensor Response
Gaurav Goel/ Payal Sachdeva	Chitkara University	**OT45**	Oral Presentation	A Review study based on the application of Nanomaterials in Concrete
Pramod Kumar Mishra	Kumaun University	**OT46**	Oral Presentation	A theoretical estimate on the probability of the formation of a self-avoiding copolymer macromolecule
Prateek Mittal	Manav Rachna International Institute of Research And Studies, Faridabad	**OT47**	Oral Presentation	Comparison of Dry and Lubricated Wear Behaviour of 22MnB5 Uncoated Ultra High Strength Steel
Rachana Kumar, Seema Gupta	Department of Physics, Kalindi College, University of Delhi	**OT48**	Oral Presentation	Study of Adsorption Kinetics of Pristine and Functionalized Carbon Nano Tubes for NH3 and NO2 gases
Ribu Mathew	VIT Bhopal University	**OT49**	Oral Presentation	Recent advances in ZnO based electro-chemical ethylene gas sensors for evaluation of fruit maturity
Sudha Pal	MBGPG College Haldwani	**OT50**	Oral Presentation	Synthesis and Radiative property of Samarium ion with Zinc Oxide nanomaterial
Suraj Prakash	Department of Physics, GLA University, Mathura, U.P.	**OT51**	Oral Presentation	Studies of Refractive Index Modulation in BaB2O4 slab for Photonic Applications
Vinaya Phaneendhra K	Sri Y N College (Autonomous), Narsapur	**OT52**	Oral Presentation	Internet of Things- a new way to Smart Devices
Vishwas Acharya	University College of Engineering and Technology, Bikaner (Rajasthan)	**OT53**	Oral Presentation	Solution Processed Ion-conducting Dielectric for Low Voltage and High-performance IZTO Thin Film Transistor
Sakshi	Auxein Medical Private Limited	**OT54**	Oral Presentation	Antibiotic releasing agents for treating implant infection-A Review
Fabian N. Murrieta-Rico	Universidad Nacional Autónoma De México, Centro De Nanociencias Y Nanotecnología	**OT55**	Oral Presentation	Evaluation of naturally synthesized ZnO for optoelectronic applications using EIS
Fabian N. Murrieta-Rico	Universidad Nacional Autónoma de México, Centro de Nanociencias y Nanotecnología	**OT56**	Oral Presentation	Zeolites as initial structures for the preparation of functional materials
Akash Gupta/ Anjali Sharma	Physics Department, Atma Ram Sanatan Dharma College, University of Delhi	**OT57**	Oral Presentation	Reconnoitering the capabilities of Al:ZnO thin films for self- power generating devices
S. Shankar	Experimental Research Laboratory, Department of	**OT58**	Oral Presentation	Structural and impedance spectroscopy in $BiFeO_3$–$BiCoO_3$–$BaTiO_3$ ternary system

	Physics, ARSD College, University of Delhi,			
Hera Tarique	Department of Physics, A.R.S.D. College, University of Delhi and Department of Physics, Jamia Millia Islamia, New Delhi	**OT59**	Oral Presentation	Phase formation and ionic conduction in Alkali metal doped strontium meta silicate
Rakesh Kumar	Department of Applied Sciences, MSIT (Affiliated to IP University), Janakpuri, Delhi, India-110058	**OT60**	Oral Presentation	Effects of Backbone Functionalization on Electrical and Shielding Behaviour of Conducting Polyaniline Composites
Hema Bhandari	Department of Chemistry, Maitreyi College, University of Delhi	**OT61**	Oral Presentation	Smart Self-Healing Coating of Epoxy Based Conducting Poly(Aniline-Co-2-Flouroaniline)/ZnO Nanocomposites for Corrosion Protection
Abid Hussain	Physics Department, Atma Ram Sanatan Dharma College, University of Delhi	**OT62**	Oral Presentation	Synthesis and characterization of lead free NKLNTS ceramic
Gunjan Yadav	Department of Physics and Astrophysics, University of Delhi	**OT63**	Oral Presentation	Structural and optical study of GaN thin films grown on sapphire substrate using Laser Molecular Beam Epitaxy technique
Manisha Bharati	Department of Physics and Astrophysics, University of Delhi	**OT64**	Oral Presentation	Theoretical simulations of SAW based sensor on PVDF
Shaan Ameer	Department of Physics and Astrophysics, University of Delhi	**OT65**	Oral Presentation	Growth and optimization of *Pbam* $Bi_2Fe_4O_9$ and *R3c* phase of $BiFeO_3$ by pulsed laser deposition
Vandana	Department of Physics and Astrophysics, University of Delhi	**OT66**	Oral Presentation	Photovoltaic response of Sol gel derived PZT thick films under UV illumination
Avanish Pratap Singh	Department of Physics, Atma Ram Sanatan Dharma College, University of Delhi, Delhi –21	**OT67**	Oral Presentation	Synthesis and incorporation of copper nanoparticles into the Carbon fiber matrix to absorb microwave pollution
Monika Mishra	Department of Physics, Netaji Subhas University of Technology, Delhi – 78	**OT68**	Oral Presentation	Utilization of waste Flyash as cost effective Microwave shield
Vinay Kumar	Department of Electronics & Communication Engg. Graphic Era University, Dehradun	**OT69**	Oral Presentation	Significant enhancement in energy storage performance of (1-x) BaTiO3 – xSrY0.5Nb0.5O3 composite ceramics
Reema Gupta	Department of Physics, Hindu College, University of Delhi	**OT70**	Oral Presentation	Detection of Water Quality for Purity Assurance Using Optical Means
Kaushal Jha	Bhagalpur College of Engineering, Bhagalpur-813210, Bihar, India	**OT71**	Oral Presentation	Biocompatible Hydroxyapatite Phosphor via Surfactant Assisted Aqueous Precipitation Method for security application
Kalyani	Department of Chemistry, University of Delhi, New Delhi	**OT72**	Oral Presentation	Antiwear Nano-lubricants of Calcium-doped zinc oxide: Applicable to Tribological Activities

Poster Presentation

Name	Affiliation	Code	Type of Presentation	Title of Abstract
Abhishek Upadhyay	Institute of Science, Banaras Hindu University, Department of Physics, Varanasi	**PP1**	Poster Presentation	Sensitivity enhancement by using adlayer MoS 2 heterostructure in a common path Mach-Zehnder interferometric method for biochemical sensor
Akshay Singh Tomar	Academy of Scientific and Innovative Research (Acsir) - AMPRI, Bhopal, India	**PP2**	Poster Presentation	Exploration of corrosion protective properties of geopolymer based coating for structures of mild steel
Bibhuti Bhusan Sahoo	SOA DEEMED UNIVERSITY, Bhubaneswar.	**PP3**	Poster Presentation	Self-Assembled 3D Graphene-Based Aerogel with Au Nanoparticles as High-Performance Supercapacitor Electrode
Debarati Pal	IIT(BHU), Varanasi	**PP4**	Poster Presentation	First-principles Calculation of Sb_2Te_3 Topological Insulator Under Pressure
Deepanshi Pathak	Jaypee Institute of Information Technology, Noida	**PP5**	Poster Presentation	Nano-formulation for respiratory disorders
Devika O.K	University of Calicut, Calicut	**PP6**	Poster Presentation	Hydrothermal Growth of MoS_2 Quantum Dots for Catalytic Hydrogen Evolution
Vinay K Shukla	Indian Institute of Technology, Kanpur	**PP7**	Poster Presentation	Interplay of magnetism and ferroelectricity in charge ordered manganites
Poonam Rani	Jayoti Vidyapeeth Women's University, Jaipur, Rajasthan, India	**PP8**	Poster Presentation	Role of silver nanoparticles for enhancing pea productivity and its comparison with chemical pesticides under in situ conditions
Rahul Arya	Academy of Scientific And Innovative Research-Acsir-AMPRI, Bhopal, India	**PP9**	Poster Presentation	New Generation Red Mud Based X- ray Shielding Tiles
Shani Kumar	Acharya Narendra Dev College, University of Delhi	**PP10**	Poster Presentation	Antibacterial Property of Graphene oxide Nano flakes
Souryadipta Maiti	Department of Physics, Banaras Hindu University, Varanasi	**PP11**	Poster Presentation	Comparative analysis of silica fiber Bragg grating and chalcogenide fiber Bragg grating
Varsha Agrawal	CSIR AMPRI, Bhopal (M.P.)	**PP12**	Poster Presentation	Green Conversion of Red Mud into X-Ray Opaque Material
Vernica Verma	University of Lucknow, Lucknow	**PP13**	Poster Presentation	Humidity sensing and Williamson-Hall analysis of pure and tungsten doped ZnO nanoparticles
Vijay Bhatt	DDUC, University of Delhi, New Delhi	**PP14**	Poster Presentation	Entanglement Dynamics via Periodic Modulations in Optomechanical Semi-Conductor Resonator Coupled to Quantum-Dot Exciton
Hema	M. B. Govt. P. G. College Haldwani	**PP15**	Poster Presentation	Study of molecular interaction in the ternary liquid mixture of n-hexane, ethanol and benzene
Kalyani	Department of Chemistry, University of Delhi, New Delhi	**PP16**	Poster Presentation	Tribological characteristics of quinolone derivatives: Theoretical and experimental approaches
Aditya Jain	Department of Electronics & Communication Engg. Graphic Era University, Dehradun	**PP17**	Poster Presentation	Effect of Cr and Ni doping on the electrical and magnetic characteristics of BaTi0.80Zr0.20O3 ceramic

Renu Bala	Maharishi Markandeshwar (Deemed to Be) University, Mullana Ambala	**PP18**	Poster Presentation	A review on Zinc Oxide Nanoparticles and Their
Prayas Chandra Patel	DFT and Materials Laboratory, Department of Chemistry, Indian Institute of Technology Roorkee, Roorkee-247667, India.	**PP19**	Poster Presentation	Low temperature magnetic study of α-NiS nanoparticles synthesized via Hydrothermal Technique
Yogesh Kumar	Department of Physics, Deen Dayal Upadhyaya College (University of Delhi), Sector -3, Dwarka, New Delhi-110078, India.	**PP20**	Poster Presentation	Growth and Characterization of One Dimensional ZnO Nanorod Film
Preeti Rani	Sharda University, Knowledge Park III, Greater Noida, UP-201310, India	**PP21**	Poster Presentation	Design of Photonic crystal OR gate with multi-input processing capability on a single structure
Amit Kr. Vishwakarma	Department of Physics, Atma Ram Sanatan Dharma College, University of Delhi, Delhi –21	**PP22**	Poster Presentation	Lanthanide doped Niobate phosphor for security applications
Manish Kumar	Experimental Research Laboratory, Department of Physics, ARSD College, University of Delhi, New Delhi-21, India	**PP23**	Poster Presentation	Band-gap tuning and quantum efficiency analysis in double perovskite La2NiMnO6 based solar cell device via SCAPS simulation
Arvind Kumar	Materials Science Research Lab (Theory and Experimental), Department of Physics, A. R. S. D. College, University of Delhi, India	**PP24**	Poster Presentation	A First Principle study of magnetic and opto-electronic properties of half metallic Heusler alloy, Co2TiSi
Sweta Chauhan	Department of Applied Science and Humanities, School of Engineering and Technology, Soldha, Bahadurgarh, Haryana, India)	**PP25**	Poster Presentation	X-Ray Sensing by Titanium di-Oxide- Poly Methyl Methacrylate Composite

Keynote Lecture

Study of GaN and InGaN heterostructures and quantum wells by Laser MBE technique for short wavelength photonic devices

Vinay Gupta

Department of Physics and Astrophysics, University of Delhi, Delhi 110007

Efficient solid-state lighting sources hold the promise for compact, energy saving and durable light systems, which could significantly cut down the energy consumption worldwide. Gallium Nitride (GaN) based LEDs are the most promising candidates in this field, due to the excellent structural and optical characteristics of GaN. InGaN/GaN based multiple quantum- well (QW) structures are employed as active layers in the LEDs, since it allows tailoring of the emission spectrum from ultraviolet to visible region by varying the in composition. The advent of MOCVD grown GaN/InGaN blue LEDs in particular have revolutionised the field of white solid-state lighting in the past few years. However, the requirement of fairly high growth temperatures and reactive chemical gases, hampers the choice of substrates in MOCVD. Alternatively, Laser Molecular Beam Epitaxy (LMBE) Technique is a relatively user-friendly growth technique for the fabrication of crystalline GaN films in NH_3 free environment at moderate temperatures.

In the present work, GaN and InGaN heterostructures and Quantum Well structures were grown on c-plane sapphire substrate using LMBE Technique. The LMBE system used in the present work is an ultra-high vacuum deposition chamber interfaced with a KrF excimer laser (λ=248 nm, τ=20 ns), wherein sintered ceramic targets of GaN and InGaN were employed for laser ablation in the presence of RF cell processed N_2 gas. The structural and optical properties of the prepared films were studied using X-Ray Diffraction and UV-Visible spectroscopy respectively. The surface morphology and composition of the films were analysed using SEM and EDAX analysis. Multiple Quantum well structures of GaN and InGaN films were grown on sapphire substrate under optimized processing parameters. Furthermore, the surface plasmon resonance (SPR) technique has been used to study the effect of varying number of InGaN/GaN quantum wells which were grown using LMBE technique. 5 nos. of QWs structure is deduced from SPR study for maximum charge confinement which is in agreement with the UV-Vis spectroscopy and Photoluminescence studies. A dispersion in refractive index (n) is observed with wavelength of incident laser light. The PL analysis of the Quantum Well structures revealed room temperature emission peaks corresponding to GaN and InGaN which is advantageous for the utilization of GaN/InGaN QW structures in LEDs. The LEDs demonstrated rectifying I-V characteristics with room temperature electroluminescence around 370 and 440 nm.

Invited – IT1

Recent Developments in Thin Film Photovoltaic

UDAI P SINGH*

School of Electronics Engineering

KIIT University, Campus-3, Patia

Bhubaneswar-751024, India

Today the PV market is dominated by the well-established poly and single crystalline Si products. Polycrystalline thin film technologies offer further cost reduction potential for PV, as well as new product configurations such as light-weight and flexible modules. Thin film solar cells and modules, however, suffer from certain limitations caused by the polycrystalline nature of the semiconductor absorber layers used in the device structures. Manufacturing experience for thin film modules is also rather limited. Despite these difficulties, thin film technologies based on Cadmium Telluride (CdTe) and Copper Indium Gallium Selenide (CIGS) polycrystalline absorber layers showed great advancement during the last decade. Small area CIGS and CdTe solar cells demonstrated conversion efficiencies of nearly 23% and 22%, respectively. A world record efficiency of 20.4% on polyimide film has also been achieved recently, revealing that flexible solar cells with performance close to rigid solar cells can be developed. The CIGS solar cells may limited by the long term availability of In and CdTe suffered due to the involvement of toxic Cd and the availability of Te. The world attention has shifted to more environmental friendly and abundant material CZTS (Copper Zinc Tin Sulfide) and it has made a steady progress with time. The main advantage of this cell over CIGS solar cells are low production cost and the replacement of the expensive Indium (In) by less expensive Tin (Sn) and Zinc (Zn). The highest efficiency achieved at lab scale for CZTSe and CZTSSe is 12.6% and 11.1% respectively. In this presentation the review of the development of polycrystalline thin film PV technologies, their present status and future prospects will be discussed.

*e-mail: singhup@kiit.ac.in

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Invited – IT2

Rare-Earth Doped Photoanodes for Organic Molecule based Solar Energy Conversion Devices

Raavi Sai Santosh Kumar and Venkata Seshaiah Katta

Ultrafast Photophysics and Photonics Laboratory, Department of Physics, Indian Institute of Technology Hyderabad, Kandi 502285, Telangana, India.

sskraavi@phy.iith.ac.in

Titanium dioxide (TiO2) based photo-anodes are ubiquitous in various photovoltaic, photocatalytic and water splitting applications due to their favorable position of the conduction band, relatively low fabrication costs and high electron drift mobility high electron lifetimes. Both mesoporous TiO2, and compact TiO2 layers are routinely used as electron acceptors in dye-sensitized solar cells, perovskite solar cells, as electron extraction/transport layers in bulk heterojunction solar cells and as photoanodes for photoelectrocatalytic conversion of solar energy to electricity and hydrogen. Nonetheless, numerous studies have shown the presence of a high density of electronic trap states lying below the CB as a major limitation for the applications of TiO2 electrodes. Doping TiO2 with various elements was found to be an easy way to come over this limitation like aiding in improved electronic properties, reduced charge recombination, increased electron transport, faster electron injection, and favorable shifting the band-edge. In general, upon doping TiO2, a downward shift conduction band (CB) position results in an increased electron injection, while an upwards shift increased the open-circuit voltage (Voc). Furthermore, doping also plays an important role in modifying the oxygen vacancies which play a major role in a variety of technological applications. Rare-earth doped titania photoanode is a proven concept for obtaining enhanced performances in solar energy conversion devices. Nonetheless, there is still a paucity of reports that present an overall comprehensive picture correlating the physics of the doped material and the solar conversion devices. Herein, we focus our attention on understanding the physics of neodymium (Nd) doped TiO2 and their application as Photoanodes in DSSC, QDSC, and PEC water splitting.

Invited – IT3

The search for a practical multiferroic material: The BFO-BST case

Subhash Sharma

Conacyt-Universidad Nacional Autónoma de México, Centro de Nanociencias y Nanotecnología, Km. 107 Carretera Tijuana-Ensenada. Apartado Postal 14, C. P. 22800, Ensenada, B. C. México

Abstract

In the present time the focus of many researchers is to enhance the multiferroic properties of pure and doped $BiFeO_3$ based materials. However, the materials community has not yet achieved the desired multiferroic properties in single doped $BiFeO_3$. Therefore, in this talk we will talk about multiferroic samples with composition (1-x) $BiFeO_3$- (x) $(Ba_{0.70}Sr_{0.30})TiO_3$ (BFO-BST) system. The focus of talk will be on structural, magnetic, dielectric, electrical and ferroelectric properties.

Acknowledgement

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Invited – IT4

Investigation of piezoelectric, magnetic and structural properties in BFO-BST nanoparticles

Avneesh Anshul

CSIR-National Environmental Engineering Research Institute (NEERI), Nagpur-440020, India

Recently, $BiFeO_3$ (BFO) based nanoparticles have got enormous attention due to inherent magnetoelectric coupling. BFO is quite popular because of its magnetoelctric coupling at room temperature but it is difficult to observe the Magneto-electric coupling containing saturated ferroelectric loop in bulk BFO. It is also hard to achieve superior ferroelectric property due to generation of large leakage current. These problems can be solved by doping of BFO with Ti^{2+}, Ba^{2+}, and Sr^{2+}, synthesized through different chemical routes. In the present work, we have studied the BFO multiferroic compounds with $BaSrTiO_3$ (BST) doping and investigated the piezoelectric, magnetic and structural properties. The obtained revealed that the ferroelectric properties are improved in BST doped BFO. The less dielectric loss and high dielectric constant is observed in the doped sample.

Keywords: Doping; multiferroic compounds; Magneto-electric coupling; Piezoelectric; Dielectric

***Authors to whom correspondence should be addressed:**

anshul@neeri.res.in, avneesh.anshul@gmail.com (A. Anshul)

Invited – IT5

Aerosol Deposited Thick Films with highly Stable Energy Efficiency for Energy-Storage Applications

Ajeet Kumar[1,] *, Jungho Ryu

[1]*School of Materials Science and Engineering, Yeungnam University, Gyeongsan, South Korea-38541*

*E-mail: jkajeet@yahoo.co.in, Tel.: +82-10-6551-7267

Abstract: Generally, the electro-ceramics with different nature like dielectrics, paraelectrics (PE), ferroelectrics (FE), relaxor ferroelectrics (RFE) and anti-ferroelectrics (AFE) are used for energy storage properties in bulk, thin and thick films forms. As compare with PE and FE, the slim and double type of polarization–electric field (*P–E*) hysteresis loop of RFE and AFE ceramics, respectively makes them a good candidate for storage applications. Thick films of RFE and AFE compositions of PLZT FE material were fabricated at room temperature on Pt/Si substrates by aerosol deposition (AD) method and their energy storage properties were explored. Usually, AD grown thick films has a small size of grains with high dielectric breakdown strength (DBS). PLZT RFE and AFE AD thick films were thermally annealed at higher temperatures (400-700^{o}C) to achieve the grain sizes larger than the critical grain size for ferroelectricity. The phase (X-ray diffraction) microstructure (scanning electron microscopy), dielectric properties (with frequency and temperature) and ferroelectric properties (bipolar and unipolar *P–E* hysteresis loop) were investigated for the as-deposited and thermal annealed PLZT AD thick films (RFE and AFE). The PLZT RFE AD thick film exhibited a high energy-storage density (~44 J/cm^3) with high energy efficiency which is almost-electric-field (~81%, change of ~6%) and temperature-independent which makes it a promising material for high-temperature energy-storage capacitor applications. The room temperature deposited PLZT AFE AD thick film shows the excellent energy storage properties.

Keywords: PLZT, Relaxor ferroelectric; Anti-ferroelectric; Energy storage capacitor; Aerosol deposition; Thick films

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Keynote Lecture

Size Induced Structural Changes and Charge Transport Mechanism: An In-Depth Study by Experimental and Simulations

Sevi Murugavel

Department of Physics and Astrophysics, University of Delhi, Delhi-110007

Email: murug@physics.du.ac.in

The development of new and novel electrode materials for energy storage devices has become the intensive research by the materials science community because of its importance in the portable electronic devices, electrical vehicles and many other applications. During the last two decades lithium ion batteries have been ruling the world with their better electrochemical performance as well as the advancement in the newer technology which is based on the new electrode and electrolyte materials. The development of lithium ion battery includes the discovery of many new electrode materials along with the modifications in the existing electrode and electrolyte materials. As per the global demands for the requirement of energy storage/supply increasing exponentially, the prices of the lithium ion batteries are also rising day by day due to limited resources of lithium in the earth crust. In such situations, we need to address with the low cost and high natural abundant element-based batteries. In this regard, the fifth most abundant material in the earth's crust and second lightest element among the alkali metals is sodium. Hence, sodium-based cathode material could be the alternative choice for the next generation of rechargeable batteries. However, the electrode materials available currently for sodium ion batteries do not fulfill the necessary requirements or they are not equivalent to those commercial grade cathode materials for lithium ion batteries. In this context, we have carried out systematic crystallite size dependent structural and charge transport investigations on maricite-NaFePO (m-NFP) through experimental and theoretical simulation. Rietveld refinement analysis reveals that decrease in the unit cell parameters which lead to the volume contraction upon reduction in crystallite size. Further, the atomic multiplet simulations on x-ray absorption spectra provide unequivocally the change in the site symmetry of transition metal ion. The high-resolution oxygen K-edge spectra reveal substantial change in the bonding character with reduction of crystallite size, which is the fundamental cause for the change in unit cell parameters of maricite- $NaFePO_4$. In parallel, we performed first-principles density functional theory (DFT) calculations on maricite-$NaFePO_4$ with different sodium ion vacancy concentrations. The obtained structural parameters are in excellent agreement with the experimental observations on the mesostructured maricite-$NaFePO_4$. We observe polaronic conductivity enhancement of approximately an order of magnitude at the nanoscale level as compared with its bulk counterpart. In parallel, we performed DFT calculations on m-NFP with different sodium ion vacancy concentrations. The volumetric changes with respect to crystallite size are related to the compressive strain resulting into the improvement in the electronic diffusivity. The nano-crystalline maricite-$NaFePO_4$ with better kinetics will open the new avenue for its usage as cathode material in sodium ion batteries.

Keynote Lecture

How known physical observations were converted to 20th century technology

Amita Chandra

Department of Physics & Astrophysics
University of Delhi, Delhi-110 007

E-mails: achandra@physics.du.ac.in
amitach1@yahoo.com

This talk shall focus on how the field of Solid-State Ionics, a technologically oriented field, came into existence due to the scientific temper of the chemists and physicists. The relevance of building up on existing knowledge base which ultimately led to the Noble Prize in Chemistry in 2019 will also be discussed.

Invited – IT6

PHYSICS AT NANOSCALE: RAMAN SCATTERING, SPECTROSCOPY AND BEYOND

Rajesh Kumar*

Discipline of Physics, Indian Institute of Technology Indore, Simrol, 453552 India

E-mail: rajeshkumar@iiti.ac.in

Raman effect, after its discovery, is one of the most widely used techniques for materials' characterization [1]. In the current nanoscience and nanotechnology regime also Raman scattering has come up as an extremely important and unavoidable spectroscopic tool. In the nano regime, Raman spectroscopy enables one to identify whether the material is suitable designed to show nanoscopic properties. Raman spectroscopy is helpful in understanding various physical phenomena taking place in low dimensional materials including amorphous ones [2]. In nanomaterials, Raman spectroscopy enables one to investigate properties, which is not possible otherwise and that also with precision. Acoustic phonons in semiconductors are unable to participate in Raman scattering due to zone centre phonon selection rule as acoustic phonons has zero frequency at the zone centre of the phonon dispersion relation. In nanomaterials, due to quantum confinement effect, the zone centre selection rule breaks down and acoustic phonons with non-zero frequencies, corresponding to non-zero wave-vectors, are available to participate in Raman scattering [3]. On the other hand Raman scattering also helps in quantifying the extent of short-range order in amorphous materials which is otherwise known to be a qualitative concept [4].

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Invited – IT7

POLYMER –IONIC LIQUID SOLID ELECTROLYTE FOR ENERGY APPLICATIONS

Pramod Kumar Singh

Department of Physics

Sharda University, Greater Noida 201310, Uttar Pradesh, India

Corresponding author: pramodkumar.singh@sharda.ac.in

Polymer electrolytes present a number of desirable properties, such as mold in wide variety of shapes and sizes, ability to form thin films, flexibility, light weight, elasticity, longer life and greater safety. In contrast to the cases of brittle glassy or crystalline solid conductors, polymer materials form high conducting composites and can accommodate volume changes, which make them particularly suited for applications together with intercalation materials, such as the anode and cathode in a rechargeable battery [1-4]

This talk emphasizes the synthesis, characterization and application of low viscosity ionic liquids (ILs) incorporated into polymer matrix. The samples were characterized using various experimental tools. Complex impedance spectroscopy shows that conductivity of polymer host increases with increasing ionic liquid (IL) concentration attains maxima and then decreases. Optical microscopy and x ray diffraction pattern (XRD) reveals the reduction of crystalline matrix of polymer host by adding IL. The primarily fabricated devices using maximum conductivity film affirms that this highly conducting IL doped polymer electrolyte (ILDPE) material is promising candidate for electrochemical double layer supercapacitor (EDLC) and dye sensitized solar cell (DSSC) (Fig. 1) application.

Fig.1. Photograph of assemble EDLC and DSSC using maximum conducting ILDPE.

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Invited – IT8

Recent Developments and Future Directions of Metal Matrix Composites/Nanocomposites

Dr. Pallav Gupta*,

Department of Mechanical Engineering, Amity School of Engineering and Technology,
Amity University Uttar Pradesh, Noida-201313 (INDIA)

*E-mail Id of Speaker: pgupta7@amity.edu

Abstract

Metal Matrix Composites (MMCs) is a class of materials which relatively serves with better metallurgical, mechanical and corrosion properties. Moreover, advancement in MMCs has led to the development of Metal Matrix Nanocomposites (MMNCs) which has the particle size of final product less than 100 nm. MMNC products are fabricated using stir casting, powder metallurgy (P/M), physical vapor deposition (PVD), chemical vapor deposition (CVD) etc. Stir Casting is being used due to its simplicity, flexibility and applicability to large quantity production with cost advantage. On the other hand, Powder Metallurgy technique shows uniform distribution of particles in the metal matrix with or without less excessive reactions between matrix and the reinforcement. Another important factor which plays a vital role in the development of the quality MMNCs is the particle size and its distribution.

The present lecture will focus on the fabrication of metal matrix composites/nanocomposites using Aluminium, Copper and Iron as the matrix material with the use of wide range of ceramic reinforcements. Aluminium and Copper based composites were fabricated using Stir Casting whereas Iron based nanocomposites were fabricated using Powder Metallurgy. Property evaluation has been done in respect of structural, mechanical and corrosion behaviour. Apart from this an attempt has also been made to use the metal matrix composite as an efficient coating material for wear prone industrial applications. The results so obtained are critically analyzed and discussed to illustrate the interaction of various processing parameters involved. It is expected that the results of the present work will be beneficial in developing quality MMC/MMNC products for wide engineering applications.

Keywords: Metal Matrix Composites/Nanocomposites; Stir Casting; Powder Metallurgy; Coatings; Property Evaluation.

Invited – IT9

ARPES study of magnetic topological insulators

Shiv Kumar

Hiroshima University, Japan

Topological insulator (TI) is a new quantum state of matter in condensed matter physics which has attracted great attention because of their unique properties and potential technological applications such as quantum computation, spintronics and low power-dissipation electronic devices. Bi_2Se_3, Bi_2Te_3 and Sb_2Te_3 are most studied 3D TIs, but so far very few reports are available on the termination dependent ARPES measurement on intrinsic magnetic TI compounds $MnBi_2Te_4/(Bi_2Te_3)_n$ (n=0,1,2,3…). In this presentation, I will show our recent results on electronic band structure measured by using angle-resolved photoemission spectroscopy technique.

Invited – IT10

Inevitable Carbon in multiferroic BFO – First principle studies and Experimental investigations

Pradip K. Jha[a], Shaan Ameer[b], Monika Tomar[c], Kajal Jindal[d], Vinay Gupta[b]

[a] *Department of Physics, DDU College, University of Delhi, New Delhi, India*

[b] *Department of Physics and Astrophysics, University of Delhi, India*

[c] *Department of Physics, Miranda House, University of Delhi, New Delhi, India*

[d] *Department of Physics, Kirori Mal College, University of Delhi, India*

$BiFeO_3$ (BFO) owing to its room temperature multiferroic properties has been one of the most studied materials in recent years and has find wide applications in the field of photovoltaics, magnetoelectrics, memories etc. Various A-site and B-site dopants such as rare earth metals and transition metals respectively have been exploited to reduce the leakage current in BFO. Unintentional impurities like carbon may easily incorporate in $BiFeO_3$ during material processing by various mechanisms such as diffusion and migration and may significantly influence the electronic properties of $BiFeO_3$. Literature studies reveal that the conductivity in BFO is governed by the dominance of the defects: Bi/Fe vacancies (p-type) and O vacancies (insulator) that mainly depend on the chemical environment during the growth of BFO.

In the present work, studies based on density functional theory have been carried out to incorporate carbon at substitutional and interstitial sites in BFO and determine the chemical environment that allows the incorporation of BFO, the formation energy of various carbon related defects and their role in influencing the conductivity of BFO. The theoretically obtained results have been validated by the experimental studies in which carbon doped BFO (BCFO) thin films with a doping concentration of 5% were fabricated using Pulsed laser deposition technique. DFT calculations and experimental studies of BCFO/BFO/ITO based heterostructure suggest that carbon dopant may lead to p-type conductivity in an undoped intrinsic BFO.

A computational approach to enhance the device efficiency of lead-free $CsGeI_3$ based perovskite solar cell

Abhishek Raj[a,b], Manish Kumar[c], Avneesh Anshul [a,*]

[a]*CSIR-National Environmental Engineering Research Institute (NEERI), Nagpur-440020, India*

[b]*Academy of Scientific and Innovative Research (AcSIR), Ghaziabad-201002, India*

[c]*Experimental Research Laboratory, Department of Physics, ARSD College, University of Delhi, New Delhi-110021, India*

Abstract

Over the past 10 years, Organic-inorganic lead halides perovskite solar cell achieved rapid evaluation in the field of photovoltaic technology. The developed devices already achieved maximum power conversion efficiency of 25.2%. Despite of this significant advancement the toxicity of lead and stability of device is the major concern. In the present study, computational approach is used to simulate perovskite solar cell with lead-free perovskite light absorbing layer. Inorganic lead-free light harvesting layer $CsGeI_3$ is simulated with different hole transporting material (HTM), electron transporting material (ETM) and metal electrodes at different temperature. The obtained result reveal that the device efficiency can be further enhance through optimizing the thickness of ETM, HTM and absorbing material and proper selection of metal electrodes.

Keywords: Lead-free perovskite, ETM, HTM, Scaps-1D, Light absorbing material.

Automated Low temperature Resistivity Measurement Set-Up: Design and Fabrication

Ajay Kumar Saw[1], Ganesha Channagoudra[1], Tejas Pethker[2], K V Gangadharan[2], and Vijaylakshmi Dayal[1#]

[1]Department of Physics, Maharaja Institute of Technology Mysore, Karnataka, 571477, India

[2]Mechanical Engg, Center for System Design (CSD), Institute of Technology, Surathkal, 575025, Karnataka, India

The automated low temperature four probe resistivity measurement set-up has been designed for the DC electrical resistance measurement from 300 to 80 K. The overall set-up consists of low temperature four probe sample holder, 350 Lakeshore Temperature Controller, Kithley make Delta mode 6221 AC/DC current source and 2182A nanovoltmeter and vacuum system. Pt 100 Sensor is used for measurement of the sample temperature. The mentioned measuring device are interfaced with the computer using IEEE cable. The control programis written using the 2018 version Lab-view software. In this experimental set up, both bulk and thin film samples can be investigated, making it versatile. Well-characterized ceramic $Pr_{(1-x)}Sr_{(x)}MnO3$ (x=0.33 and 0.40) Perovskite oxide synthesized using solid state reaction method are used as test sample. To confirm the resistivity data accuracy measured using the fabricated experimental set-up, the data is compared with the resistivity measurement data carried out for the test sample at UGC-DAE-Consortium for scientific research, Indore and found to be comparable.

Reference

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Acknowledgment: This work is supported by SERB-DST, New Delhi (EMR/2016/005424) and UGC DAE CSR, Indore (CSR-IC/CRS-89/2014- 2019) granted to VD. Authors are indebted to Dr. Rajeev Rawat, UGC-DAE-Consortium for scientific research, Indore for necessary guidance and discussion.

Oral - OT3

Evaluation of Mycogenic Silver Nanoparticles as Potential Control Agent Against Late Blight of Potato (*Phytophthora Infestans*)

Amardeep Singh[1*], Shailendra Singh Gaurav[1], Gyanika Shukla[1] and Poonam Rani[2]

[1]*Department of Genetics and Plant Breeding, Chaudhary Charan Singh University, Meerut (UP), India.*

[2]*Jayoti Vidyapeeth Women's University, Jaipur, Rajasthan, India.*

[*]Corresponding author: *amardeep95singh@gmail.com*, Mobile No. +91-8126849594

Abstract

Potato (*Solanum tuberosum* L.) is one of the most important vegetable crops across world and India is second largest producer of this crop across the world. Late blight disease has been the most serious threat to world's potato production, resulting in 80-100 % yield loss. The causal agent of late blight is fungi, *Phytophthora infestans.* The present investigation was carried out to evaluate the efficacy of mycogenic silver nanoparticles as an antifungal agent against *P. infestans*. The silver nanoparticles were synthesized biologically by using *Aspergillus niger* biomass and characterization of silver nanoparticles was done by UV-Vis Spectroscopy, Field Emission Scanning Electron Microscopy, Energy Dispersive X-Ray, Dynamic Light Scattering and Fourier Transform Infra-Red. The inhibition percentage of *P. infestans* caused by silver nanoparticles treatment was established *in vitro*. Field experiment was conducted to compare the efficiency of silver nanoparticles and chemical fungicide at the parameters of disease severity, tuber number and tuber weight. The data were analysed by SPSS software for descriptive statistics and analysis of variance including least significance difference and results were found to be significant for different parameters at 0.05 significance levels. It may be concluded by the experiment that silver nanoparticles may be proved to be potential fungicides in near future and it is an excellent alternative to chemical fungicides.

Keywords: *Solanum tuberosum, Phytophthora infestans, Aspergillus niger*, nanoparticles, nono-fungicides, SEM, EDX.

Oral – OT4

300 keV Ar ion induced effects in GaAs and 4H-SiC

Anusmita Chakravorty, * Budhi Singh, Sunil Ojha, D Kabiraj

Inter-University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi-110067, India
**Corresponding author: anusmitachakravorty@gmail.com*

Ion implantation is an essential step to realize a semiconductor device. Radiation damage is associated with every ion implantation, thus the study of damage evolution with ion irradiation is a very important field of research. In this work, 300 keV Ar ion radiation responses of two binary semiconductors namely GaAs and 4H-SiC are studied and the radiation damage effects on their structures are investigated. GaAs is a direct bandgap material (1.43 eV) with comparatively lower displacement threshold energies (Ed_{As}=10 eV and Ed_{Ga}=10 eV) [2] and low melting point (1238 °C), Whereas 4H-SiC, is an indirect wide bandgap material (3.26 eV at RT) with high displacement threshold energies (Ed_{Si} = 35 eV and Ed_{C} =20 eV) [1] and high sublimation temperature (~2700 °C). Rutherford Backscattering/Channeling (RBS/C) and Raman spectroscopy have been employed to evaluate the response of the materials to energetic ions. RBS/C shows that irradiation leads to a significant increase in backscattered yield which eventually touches the random level and extends towards the crystal surface and larger depths with increasing ion fluence. The materials exhibit a two-step damage build-up character and display a sigmoidal behavior as opposed to the linear trend simulated using TRIM [3]. Damage accumulation follows a three-stage process: (i) sublinear damage growth at low fluences, (ii) super-linear transition to a higher disorder level, and (iii) defect-induced lattice disorder saturation. For GaAs and 4H-SiC, the transition from the first stage to the second stage which marks the onset of amorphization is observed at the same disorder level of 0.3 dpa (dpa = displacement per atom, 1dpa = all atoms are displaced at least once from their respective lattice sites). The system transforms into an amorphous phase very rapidly within 0.3 to 0.5 dpa. As a consequence of damage build-up, the materials experience loss of crystallinity and chemical modifications as revealed by Raman spectroscopy. A decrease in the crystalline fraction usually is related to an increase in the amorphous phase. In the case of SiC, Raman intensity of the dominant E2 (TO) mode, related to crystalline 4H-SiC, decreases with increasing fluence and new Si–C vibration bands, homonuclear Si–Si and C–C bands appear. For GaAs, the Raman intensity of the dominant LO phonon observed from the crystal decreases and dominance of the bands corresponding to distorted/ amorphous GaAs increases with increasing fluence. For both the materials a rapid fall in the Raman intensity of the dominant mode is observed at the disorder level of 0.3 dpa. Despite the differences in the physical and chemical properties of GaAs and SiC, it is worth noting that at the same disorder level (0.3 dpa) there is an abrupt structural modification observed in both the materials using RBS/C and Raman Spectroscopy. The damage buildup cross-section is evaluated using the multi-step damage accumulation (MSDA) model [4]. In our case, a two-step mechanism better reproduces the damage build-up than a single-step. The values of the cross-section obtained from the RBS/C analysis based on the two-step MSDA model are

equal 4.96×10^{-15} cm^2 and 2.37×10^{-12} cm^2 for the first step, 1.32×10^{-15} cm^2 and 1.99×10^{-14} cm^2 for the second step for SiC and GaAs, respectively. This result indicates that SiC possesses much better radiation hardness over GaAs.

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Oral – OT5

Effect of Annealing on Growth and Properties of Electrodeposited InSb Thin Films

Joginder Singh*, Rajaram Poolla, and Monika Devi

Vikrant Institute of Technology and Management, Gwalior (MP), India-474011

E-mail: joginderchauhan82@gmail.com

Abstract: Indium Antimonide (InSb) thin films were grown on stainless sheet substrates by DC electrodeposition. The electrodeposited thin films were annealed at various temperature 100 °C, 200 °C, and 300 °C. X-ray diffraction studies revealed that single phase, polycrystalline thin films were obtained at 300°C and show predominant orientation along the (111) plane. The particle size (D), dislocation density (δ) and strain (ε) were evaluated. The crystallite size increases with the increase of annealing temperature, which was found to be in the range from 61.64 nm to 66. 27 nm. The elemental composition of the InSb films annealed at 300°C was found to be 50.28 % (In) and 49.72 % (Sb). The SEM images confirm that surface of as grown and annealed thin films are well covered with uniform spherical submicrons particles. The presence of transverse optical phonon mode (178 cm^{-1}) in Raman spectrum reveals that annealed thin films were having the good crystalline nature. The optical band gap of thin films decreases with increase in annealing temperature and was found to be 0.12 eV for the samples annealed at 300°C.

Comparative evaluation of *Aspergillus niger* and *Fusarium pallidoroseum* for their mycogenic silver nanoparticles producing efficacy

Gyanika Shukla[1*], Shailendra Singh Gaurav[1], Amardeep Singh[1], Poonam Rani[2],

[1]*Department of Genetics and Plant Breeding, Chaudhary Charan Singh University, Meerut (UP), India.*

[2]*Department of Soil Science, Jayoti Vidyapeeth Women's University, Jaipur, Rajasthan, India.*

[*]*Corresponding author: gyanikashukla@gmail.com, Mobile No. +91-9639488161*

ABSTRACT

The present study was carried to establish and compare the mycogenic silver nanoparticle synthesizing ability of two fungal species *Aspergillus niger* and *Fusarium pallidoroseum.* The wet biomass of the fungi was used in 100mg and 1g biomass per 100ml of 0.002M silver nitrate solution. The synthesis of nanoparticles was confirmed by UV-Vis (ultra violet - visible) Spectroscopy and further characterization was done through techniques *viz* Field Emission Scanning Electron Microscopy (FESEM), Energy Dispersive X-Ray (EDX), Dynamic Light Scattering (DLS), Fourier Transform Infra-Red (FTIR), Atomic Force Microscopy (AFM) and inductively coupled plasma mass spectrometry (ICPMS). The UV-Vis spectroscopy showed peak ranges corresponding to silver nanoparticles. The FESEM results showed the synthesis of fine sized silver nanoparticles in the samples synthesized with 1g biomass as compared to 100mg biomass for both the fungi. The DLS result further confirmed the same. EDX analysis confirmed the elemental composition of the synthesized nanoparticles. FTIR analysis depicted information about all the chemical interactions of nanoparticles with environmental molecules. AFM image depicted the three-dimensional conformations of the nanoparticles and ICPMS ascertained the concentration of synthesized silver nanoparticles in different samples. It was concluded in the study that 1g *A. niger* biomass per 100 ml of silver nitrate solution was found to be best among all the evaluated combinations for the synthesis of fine-sized silver nanoparticles.

Keywords: Keywords: *Aspergillus niger*, *Fusarium pallidoroseum*, silver nanoparticles, DLS, FTIR, SEM, EDX, ICPMS.

Physical and optical analysis of Sm^{3+} doped zinc phosphate glass

Himani Tiwari[1*] and Charu Chandra Dhondiyal[2]

[1]*Research Scholar, Department of Physics, M.B. Govt. P.G. College, Haldwani, Nainital, Uttarakhand, India, 263139*

[2]*Associate Prof., Department of Physics, M.B. Govt. P.G. College, Haldwani, Nainital, Uttarakhand, India, 263139*

E-mail: himanitiwari1991@gmail.com, charu_dhondiyal@yahoo.co.in

ABSTRACT

Physical and optical properties of Sm^{3+} doped zinc phosphate glass with varying concentrations of Sm^{3+} have been studied. A conventional melt quenching technique has been used to prepare all the glass samples. The density of the samples increases from 2.648 to 2.776 g cm^{-3} whereas their molar volume decreases from 65.483 to 62.675 $cm^{3/}$mol as we increase the concentration of Sm_2O_3. The UV-Vis absorption spectroscopy was carried on in the wavelength range of 400–700 nm. UV-Vis absorption spectra reveal five absorption bands corresponding to the transitions from the ground state $^6H_{5/2}$ to the excited states $^6P_{3/2}$, $^4G_{9/2}$, $^4I_{11/2}$, $^4F_{3/2}$, and $^4G_{5/2}$ respectively. The other parameters like oxygen packing density, refractive index, molar refractivity, metallization, dielectric susceptibility, transmission coefficient, and electronic polarizability have also been studied.

Keywords: Rare earth ions, Zinc phosphate glass, Physical properties, Optical properties.

Synthesis of Carbon Dots from medicinal plant for Bioimaging and Drug delivery

P. Sunitha[1], K. Sandeep[2], Josny Rose[3], K.J. Saji[4]

[1]*Department of Physics, Government Victoria College, University of Calicut, Kerala*

[2]*Department of Chemistry, Government Victoria College, University of Calicut, Kerala*

[3]*Sree Vivekananda PadanaKendram Arts and Science College, University of Calicut, Kerala*

[4]*International School of Photonics, Cochin University of Science and Technology, Kochin-22*

Abstract

Carbon dots are superior candidate for bioimaging, biosensor, drug delivery, optoelectronic devices, display applications, etc. We synthesized carbon dots from a medicinal plant *plectranthus amboinicus.* We were not used any type of harmful chemicals and other compounds for the preparation. It is done by microwave assisted method. Figure 1 shows the prepared carbon dots. These carbon dots were characterized by spectroscopic, microscopic and scattering techniques. The synthesized carbon dots have an emission peak at 446.5nm [figure 2(a)] and shows strong luminescence on the blue region of the spectrum which is useful for the bioimaging. For this we can introduce solvents to living body which contains carbon dots. Moreover, the produced carbon dots have average size of 3nm that is confirmed by transmission electron microscopy [figure 2(b)] and also by the dynamic light scattering. The small size, low toxicity and highly biocompatible nature of carbon dots helpful for drug delivery system. The Carbon dots have an absorption peak at 283nm [figure 2(c)] and the amorphous structure is confirmed SAED. The low cost and large scale production of carbon dots from the medicinal plant opens new doors to the medical field.

Oral – OT9

Role of thermal spray and hard facing techniques on Slurry Erosion and Wear Behaviour: A Review

Kanwalpreet Sahni[1], J.S. Grewal[2]

[1]*Department of Production Engineering, Guru Nanak Dev Engineering College, Ludhiana.*

[2]*Department of Production Engineering, Guru Nanak Dev Engineering College, Ludhiana.*

Corresponding author: kanwalpreet145@gmail.com

Abstract: Slurry Erosion and Wear are the normal issues been faced by production and manufacturing units. Hardfacing, hardening and thermal spray coatings have proved to give outstanding results amongst other procedure to give excellent resistance against slurry erosion and wear. Above techniques lead to low porosity and high bond strength. Various compositions of WC-Co, AlO-TiO, NiCr, etc. are widely used in a for applications like rotavator blades, hydraulic turbines, aircrafts, boilers, etc. Considerable data is available for high velocity oxy-fuel, plasma spray, hard facing and D-gun as coating techniques. For the development of new coatings efforts are being made by many research scholars with various compositions. In this review paper, in-depth and critical analysis of various kinds of spray coating along with their applications have been done on the available literature.

Keywords: thermal spray, hard facing, erosion, corrosion and Wear

Reduced graphene oxide and sequentially deposited quantum dots for efficient quantum dot sensitized solar cell

Karan Surana[1], R. M. Mehra[1], Bhaskar Bhattacharya[1,2,*]

[1]*Material Research Laboratory, School of Basic Sciences and Research, Sharda University, Greater Noida, U.P. - 201310, India*

[2]*Department of Physics, MMV, Banaras Hindu University, Varanasi, U.P. - 221005, India*

[*]corresponding author email: bhaskar.phys@bhu.ac.in

Keywords: QDSSC; reduced graphene oxide, CdSe; CdS; DSSC

Abstract

Quantum dots (QD) have drawn research interest all over the scientific community chiefly because of their exquisite size-dependent optical and electronic properties. They have surfaced from being just another intriguing nanocrystal to applications in diverse areas such as LED, solid state lighting, displays, infrared photodetectors, photovoltaics, transistors, quantum computing, medical imaging, biosensors etc.. Reduced graphene oxide (rGO) or similar forms of carbon in turn have also proved to be useful in innumerable applications because of its crystalline 2D structure.

In the present work we have synthesized rGO via a low cost microwave synthesis route and used it as a thin transparent layer on the working electrode of quantum dot sensitized solar cell (QDSSC) prior to coating of TiO_2. Further colloidal CdSe and CdS QD prepared using mixed solvent consisting of water and methanol were deposited by dip coating. ZnS passivation layer was coated by 3 SILAR cycles. Solid polymer electrolyte consisting of Iodine redox couple was poured on top followed by completing the sandwich structure with Pt coated FTO glass. An efficiency of 1.81% with a V_{oc} of 0.915 V and a J_{sc} of 4.50 mA/cm^2 was obtained which was approximately 8 times the efficiency of DSSC using ruthenium dye.

Acknowledgments

The author KS, is thankful to Council of Scientific and Industrial Research (CSIR) for providing the Senior Research Fellowship (SRF, 9/1078(0002)/18 EMR-I).

Visible light active Au@g-C_3N_4 core-shell plasmonic photocatalyst

K. Baruah, A. Kumar and Pritam Deb

Department of Physics, Tezpur University, Tezpur 784028, Assam, India

Abstract: We synthesized a core shell structure of Au nanoparticle and graphitic carbon nitride (g-C_3N_4) by using sonication assisted reduction by using sodium citrate. Noble metal nanoparticles have low dispersion stability in solution and have tendency to aggregate which reduces its activity. Corrosion of noble metal nanoparticles also restricts the practical use of noble metal. Keeping this in mind, we developed a core shell structure of gold as the core and semiconductor graphitic carbon nitride as the shell. This core shell structure formation is confirmed by XRD, TEM, EDX and UV spectroscopy. We used this nanocomposite for wastewater (containing Methylene Blue dye as the contaminant) treatment and found that Au@g-C_3N_4 with 1 wt% of Au salt has successfully degraded 41% Methylene Blue in simulated wastewater in just 60 minutes. This faster degradation of Methylene Blue is due to the Surface Plasmon Resonance effect of the Au nanoparticles.

Keywords: Core shell, Au nanoparticle, Graphitic carbon nitride, Photocatalytic degradation, Surface plasmon resonance.

Biomaterials for Transdermal Delivery: Preparation and Characterization

Mansi Sharma [(1)] ; Dr Rachana*

Department of Biotechnology, Jaypee Institute of Information Technology, Noida-201301

Email: mansish41997@gmail.com

Corresponding Email:rachana.dr@iitbombay.org

ABSTRACT

This review highlights recent work on formulation and characterization of biomaterials-based drug delivery system for the treatment of several disorders. Advancement of biomaterials for drug delivery is enabling significant progress in the field of biology and medicine. Biomaterials such as chitosan, poly (lactic-co-glycolic acid) and bacterial cellulose have gained special attention in drug delivery due to their unique chemical structure, nontoxicity bioactivity, biodegradability and biocompatibility. Herein considering all the pharmaceutical, biomedical sectors we reviewed biomaterials bases gels, patches and their drug delivery potentialities. The major objective in designing patches or gels are to manage particle size, surface properties as well as drug release. Hence, characterization of these biomaterial-based drug delivery system are very critical to control their desired *in vitro* and *in vivo* behaviour. Characterizations are based on the size, morphology and surface changes via advanced microscopic techniques as scanning electron microscopy, transmission electron microscopy and atomic force microscopy. Finally, conclusions are drawn about the current state of such delivery system as applied to various treatment strategies along with some thought of future directions of the field.

Keywords: Biomaterials, Characterization, Drug delivery, Patches or gels, Formulations

Towards the Origin of Magnetic Field Dependent Storage Properties: A Case Study on Supercapacitive Performance of $FeCo_2O_4$ Nanofibers

Milan Singh, Asit Sahoo, K L Yadav, Yogesh Sharma*

Department of Physics, Indian Institute of Technology, Roorkee

Roorkee, India-247667

(*Corresponding author *E-mail: yogeshfph@iitr.ac.in*)

Despite of many reports in literature for magnetic field dependent energy storage properties of metal oxides, origin of magnetic field dependent supercapacitive properties is still not clear. Since electrode's properties such as physical (electrical and magnetic properties), structural and microstructural (surface area, pore sizes and their distribution) and electrolyte's properties (ionic diffusion, ionic conductivity and cation size etc.) are very crucial for investigating the effect of magnetic field on energy storage properties of metal oxides. In this manuscript, the effect of magnetic field on some of above properties and thereby on the supercapacitive properties of $FeCo_2O_4$ (FCO) nanofibers are thoroughly investigated. The local magnetic environment of magnetized electrode (magnetic gradient force, susceptibility etc.) is proposed to be crucial for tuning the storage properties of electrode material. Magnetic field mediated resistive properties of electrode material, and thereby induced magnetic gradient force at electrode surface seem to be helpful in lowering the Nernst layer thickness and improving the electrode/electrolyte interfacing for smoother ionic exchange resulting in the 56% increment in the capacitance values of FCO nanofiber. A series of electrochemical experiments (cyclic voltammetry and galvanostatic charge-discharge) and magnetic properties of bare and cycled electrode is carried out and the proposed mechanism/hypothesis is validated by carrying out ex-situ magnetic properties and results are discussed in detail.

Er^{3+} ions doped borosilicate glasses for photonic applications

Mohit Kumar, A. S. Rao*

Materials and Atmospheric Science Research (MARS) Lab, Department of Applied Physics, Delhi Technological University, Delhi 110 042, India

**Email: dsrasrallam@gmail.com*

ABSTRACT

Trivalent erbium (Er^{3+}) ions doped lithium bismuth alumino borosilicate (LiBiAlBSi) glasses were prepared with various concentrations of Er^{3+} through melt quenching method. The studied of optical properties using various spectroscopic techniques such as absorption, excitation, emission, and time resolved photoluminescence (TRPL) spectrum were recorded and analyzed. The properties of glassy materials such as simpler preparation technique, lower production cost, high durability, and chemical and excellent mechanical stabilities make the glasses superior over their crystalline material counterparts for photonic applications. Absorption spectrum confirm that Er^{3+} ions in glasses absorb the photons in visible and near-infrared region. The emission spectrum of prepared glasses recorded in visible region (intense peak λ= 547nm) and infrared region (intense peak λ= 1538nm) under excitation wavelengths 378 and 523 nm respectively. The dipole-dipole interaction between Er^{3+} ions confirms from the Dexter theory using the emission spectrum. The transition $^4I_{13/2} \rightarrow {}^4I_{15/2}$ shows intense peak at wavelength 1538nm. The TRPL were recorded at 1538 nm under 523 nm excitation wavelength. Our prepared glass system is potential candidate for medium and source material for various photonic applications such as infrared emitting, optical amplifier, communication device and NIR laser applications

Keywords: *Glass, Optical, Dexter theory, Luminescent properties*

Acid-catalyzed transesterification of palm kernel oil (PKO) to biodiesel

Onome Ejeromedoghene [a,b]*

[a] *School of Chemistry and Chemical Engineering, Southeast University, Jiangning District, Nanjing, Jiangsu Province, 211189, PR China.*

[b] *Department of Chemistry, College of Physical Sciences, Federal University of Agriculture, PMB 2240 Abeokuta, Ogun State, Nigeria.*

* To whom correspondence should be addressed:

Tel.: +86-18851663211

Email: oejeromedoghene@seu.edu.cn (O. Ejeromedoghene)

Abstract

The quest for a green and sustainable environment has triggered the diversification from fossil-based fuel to biofuel. Thus, this study examines an environmentally friendly process for developing biodiesel from agricultural feedstock, palm kernel oil (PKO) obtained from palm kernel fruits. The PKO was transesterified into biodiesel using an acid catalyst and methanol at ambient conditions to produce 98 % biodiesel. The as-prepared laboratory-scale biodiesel was analyzed according to the American society for testing and materials (ASTM) procedure and the results reveals a Specific Gravity of 0.8888 kg/L, Kinematic viscosity of 23.04 cSt, and Total Acid number, of 0.64 mg KOH/g. Furthermore, the Flash point, pour point and distillation parameters of the biodiesel was 136, 9 and 204-365 ^{o}C respectively. The obtained results show that the biodiesel from PKO is of good and comparable quality to other biodiesels made from other common feedstocks, thus, it can be used as an alternative fuel for diesel engines.

Keywords: Biodiesel, Palm kernel oil, Alternative fuel, Transesterification, Acid-catalyzed

Effect of fiber orientation on the properties of Epoxy-Banana Fiber Composite Laminate

Paramveer[1*], Swati Varshney[1], Kanwarjeet Singh[1], Gaurav Arora[1]

[1] *Delhi Institute of Tool Engineering, Okhla, Delhi, India-110020*

ABSTRACT

The aim of this work is to find out the effect of fiber orientation on the properties of epoxy- banana fiber laminate. The hand lay-up method was used to fabricate these laminates by using epoxy resin and hardener in a ratio of 3:1. The fibers were arranged at the angles of 0°, 30°, 45°, 60° and 90° to get optimized properties of epoxy laminate. These laminates were characterized by using universal testing machine to check tensile strength and flexural strength of laminates and it was found that tensile strength is maximum for laminate having 90° fiber orientation and laminate with 45° fiber orientation shows maximum flexural strength. Scanning electron microscopy has been used for micro structural analysis and it has been observed that most of the fibers were broken rather than pulled out which may be due to the strong interfacial bonding between the fibers and epoxy matrix. This strong bonding also attributed to improved mechanical properties of laminates.

Key Words: - Epoxy, Banana Fiber, Laminate, Composite, Hand Lay Up.

A review on gas assisted EDM

Paridhi Malhotra

Amity university, Noida

Abstract-: Electrical discharge machining is one of the most prevailing unconventional machining processes deployed for machining of hard to cut materials. In spite of distinctive applications such as deep drilling, small-scaled machining of the Electrical discharge machining, high tool electrode wear rate, low metal removal rate, formation of cracks is some of the constraints of the process. To overcome all these limitations various hybrid processes emanated from EDM are employed to machine high strength material. The present paper reviews assess the contemporaneous research trends in gas-assisted EDM. Gas-assisted EDM is one of the recent evolutions of the EDM process attributed to enhanced MRR. The paper discusses all the concerns and research gap in the relevant area of research

Recent Advancements in Development of Bipolar Plates for Fuel Cell

Salah M.S. Al-Mufti, S.J.A. Rizvi *

Department of Petroleum Studies, Aligarh Muslim University, Aligarh – 202002, India

Abstract

Bipolar plates (BPs) play a major role in efficiency, volume, cost and weight of fuel cell which expend around 55% of total weight and expend around 37% of the total cost of fuel cell stacks. The bipolar plates (BPs) have many functions such as collecting and transport electrons within the fuel cell, providing thermal conduction and mechanical strength to help regulate temperature and support the thin membrane, separating individual cells in the stack and heat and water management within the fuel cell. Coated Metals, non-coated metals, non-metals and composites are the calcification of bipolar plate materials. Recently the carbon-based composite materials such as thermoplastic and thermoset composites have attracted research attention from researchers due to good processing, highly resistant to corrosion, low cost and diverse functional application. In the present article thermoplastic and thermoset composites for bipolar plate have been reviewed. Some practical options were suggested to overcome all the challenges in this field.

Natural Photosensitizer as a Promising Dyes for Green Energy Harvesting

S Alhorani[1, *], S Kumar[1], M Genwa[2] and P L Meena[3]

[1]*Department of Applied Sciences (Physics), Faculty of Engineering and Technology, Manav Rachna International Institute of Research and Studies, Sector-43, Faridabad – 121001, India.*

[2]*Department of Chemistry, Deen Dayal Upadhyaya College, University of Delhi, Sector-3, New Delhi-110078, India.*

[3]*Department of Physics, Deen Dayal Upadhyaya College, University of Delhi, Sector-3, New Delhi-110078, India.*

[*]Corresponding author: samah_alhorani@yahoo.com

Abstract:

This study covers the fabrication and characterization of DSSC using leaves of Beal trees as the natural photosensitizer. An organic dye solution was extracted from fresh powdered leaves using absolute ethanol as the extracting solvent. The photosensitizer characterized using 3-Spot (TLC) thin layer chromatography and UV-Vis spectroscopy. The UV-Vis figure show absorption peaks at wavelength 410 and 663 nm for ethanol extract solution which is the characteristics of chlorophyll. The TiO_2/FTO photoelectrode prepared using a doctor blade method. Counter electrode was prepared using graphite powder and the ethanol paste doctor bladed on FTO slide. Iodide/Iodine in organic/inorganic solvent was used as an electrolyte between the two electrodes. The current–voltage (I–V) characteristic curves were measured using Keithley 2450 Source Meter. The assembled DSSCs tested at the lab condition, LED, in such a way that the light entered through the TiO_2 side of the cell. The amount of light measured using Lux meters. The photovoltaic performance such as open circuit voltage (Voc), the short circuit current (Isc), the fill factor (FF) and efficiency (η%) were evaluated. The essential electrical parameter such as shunt resistance (Rsh) and series resistance (Rs) were inspected through the equivalent circuit model.

Key word: Natural Extract, DSSC, TLC, Conductivity, UV-Vis

Investigation on structural and dielectric properties of Gd-doped $BiFeO_3$-$BaTiO_3$ based solid solutions

Samiksha Dabas[1], Manish Kumar[2] and O. P. Thakur[1, a)]

[1]*Material Analysis & Research Lab, Department of Physics, NSUT, New Delhi 110078, India*

[2] *Experimental Research Laboratory, Department of Physics, ARSD College, University of Delhi, New Delhi, 110021, India*

[a)] Corresponding author O. P. Thakur, Email: opthakur@nsut.ac.in

Abstract

$BiFe_{0.95}Gd_{0.05}FeO_3$-(x) $BaTiO_3$ (BGF-xBT) with x = 0, 0.1, 0.2 and 0.3 was successfully prepared using solid state reaction method. The X-ray diffraction study confirmed formation of solid solutions with the structural getting evolved from rhombohedrally distorted to cubic in BGF-0.3 BT. Rietveld analysis suggested the unit cell expansion with an increasing BT content. X-ray Photoelectron Spectroscopy revealed the spin-orbit splitting energy to be 13.3 eV for Fe 2p and 5.3 eV for Bi 4f in case of BGF-0.3BT. Moreover, energy distribution curve of O 1s revealed decrease in oxygen vacancies in case of BGF-0.3BT. Thus, reduced oxygen vacancies resulted in inhibition of grain growth as confirmed through SEM micrographs. The peak anomaly was observed near Neel temperature of $BiFeO_3$ in dielectric study indicated toward the existence of magneto-electric coupling in solid solutions.

Keywords: multiferroic; ferroelectric; XPS, SEM, dielectric.

Study of the role of defects in green energy production by Ni substituted lithium ferrite based Hydroelectric cell

Sandeep Saini[1], Jyoti Shah[2], R. K. Kotnala[2], K. L. Yadav[1]

[1]*Department of Physics, IIT Roorkee, Roorkee, India*

[2]*CSIR-NPL, New Delhi, India*

Email: ssaini@ph.iitr.ac.in

Abstract:

In this work, solid-state reaction method has been used to synthesis of oxygen-deficient nanoporous nickel substituted lithium ferrite (LNFO). Crystal structure of LNFO has been affirmed by X-ray diffraction (XRD) as cubic spinel. The presence and reduction of imperfections with the increment in calcination temperature have been verified by analysing photoluminescence (PL) and X-ray photoelectron spectroscopy (XPS) results. LNFO pellets used for Hydroelectric cell (HEC) fabrication were calcined at two different temperatures (750 ºC, 800 ºC), and generated output current densities of 3.8 mA/cm^2 and 3.6 mA/cm^2 respectively. These current densities are double of the earlier reported lithium substituted magnesium ferrite HEC.

References

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Understanding the photocatalytic properties of g-C_3N_4 using Secondary data

Sumona Kumar, Amit Garg

Acharya Narendra Dev College, University of Delhi

Govindpuri, Kalkaji, New Delhi-110019, India

Email amitgarg@andc.du.ac.in

Familiarization with modern research techniques is important yet not accentuated among university undergraduates. An undergraduate student needs to learn the research methodologies to develop their research aptitude and innovation strategies. This is a multistep process that involves identifying the societal challenges in the areas of your research interest, the research progress made through literature survey, devising possible solutions through a scientific and innovative approach, defining the problem statement and objective of the research work, understanding the required experimental and characterization techniques which is followed by collection of the experimental data with its scientific analysis. In this research paper, we have studied the role of photocatalytic materials for harnessing energy. The objective of this work was to understand the importance of solar energy conversion using new material and to study various aspects of implementing photocatalysts for energy harnessing and reducing environmental pollution using graphitic Carbon Nitride (g-C_3N_4). On the basis of secondary data used from a scientific database, various characterization techniques like X-ray diffraction (XRD), Scanning electron microscopy (SEM), Electrochemical impedance spectroscopy (EIS), Photoluminescence (PL), Ultraviolet-visible spectroscopy (UV-Vis) and X-ray photoelectron spectroscopy (XPS) were studied. In this study, we have examined the mathematical and analytical method of analyzing XRD data for grasping the fundamentals. The surface morphology is evaluated by SEM image. Also, results were obtained by plotting and interpreting data on OriginLab and Microsoft Excel for EIS, PL, UV-Vis and XPS. The preliminary results of the research show that g-C_3N_4 is a good photocatalytic material. The detailed studies have given us a complete insight and understanding about the meaning, interpretation and usefulness of the characterization techniques. We have developed confidence to carry it out for any sample including the experiment that we have planned for our studies before the lockdown.

Study the behavior of different materials under explosive conditions

Swati Singh[1], Ramvir Singh Chauhan[1], Inderpal Singh Sandhu[2] and Prince Sharma[2]

[1] *Department of Physics, R. B. S. College, DR. Bhimrao Ambedkar University, Agra, Uttar Pradesh, India*

[2] *Terminal Ballistic Research Laboratory (DRDO), Chandigarh, India*

Abstract –Different materials are studied to understand the influence of explosive conditions on their response/behavior. The materials like, steel, aluminum, rubber etc. show a great promise in the area of providing safety against blast loading. These materials and their applications are still being explored scientifically to understand their full potential for this purpose. Designing an effective protective structure needs a good understanding of the various parameters like their capability to (safely) absorb the blast energy, the behavior etc. of such materials. In this paper single and the combination of two or more materials are studied. These materials are kept at a certain distance from the explosive charge. Various parameters like energy, velocity, displacement are observed to understand the response of these materials.

Keywords: Energy absorbing materials, explosive conditions, TNT charge, ANSYS Autodyn.

A Review on Structural and Mechanical Behavior of Aluminum Based Metal Matrix Composite

Uma Sharma[1*], Naseem Ahamad[1]

[1]*Department of Mechanical Engineering, IILM College of Engineering and Technology Greater Noida (INDIA)*

**Corresponding Author: umasharma945@gmail.com*

Abstract

From the last few decades, the researchers are working on Al based hybrid composite material. In hybrid composite material, the strength to weight ratio, the stiffness to weight ratio and toughness are superior as compared to steel and aluminium, which is beneficial in automobile sector, aerospace industry, marine transport and rail transport. Properties of Al based hybrid composite are affected due to variation of different types of reinforcement. This paper gives a brief about a review on structural and mechanical behavior of aluminium matrix on reinforcing (TiO_2 , Al_2O_3 , Gr, Si_3N_4, SiC) by stir casting the results of which are monitored closely. X-ray diffraction reports the intermediate phase formation between added dual ceramic and Al matrix. Scanning electron microscope shows that reinforcements are distributed uniformly in Al matrix. Hardness decrease and impact strength increase due to variation of reinforcement TiO_2 & Al_2O_3 in Al matrix. Hardness and tensile strength increase due to addition of SiC reinforcement. It is observed that mechanical properties of the composite improved with a variation of dual reinforcements in Al matrix. These specifications make hybrid composite popular in automobile and aerospace industry. Hybrid composite is a better replacement of conventional materials.

Keywords: Aluminium Metal Matrix Composite; Stir Casting; XRD; SEM; Mechanical Behavior.

Synthesis of SnS Nanoparticles for Next Generation Photovoltaic Applications

A.P. Sunitha[1], S. B. Rakesh Chandran[2], M.S.Arya[3], K. J. Saji[4]

[1]*Department of Physics, Government Victoria College, University of Calicut*

[1]*Department of Physics, Sanathana Dharma College, University of Kerala*

[3]*Sree Vivekananda PadanaKendra Arts and Science College, University of Calicut*

[3]*International School of Photonics, CUSAT, Kochin-22*

E-mail: sunithaganesh@gvc.ac.in

Abstract

SnS is one of the promising materials for the development of photo chemical cells,photo detectors, state batteries, sensors,capacitors etc. Herein, we synthesized SnS by wet chemical method for next generation eco-friendly solar cells and other photovoltaic applications.It is the method which involves growing of nanoparticles in a liquid medium having different reactants. Here Tin chloride and Sodium sulfide were taken as the reactants. Figure 1 shows the prepared SnS nanoparticles. These SnS nanoparticles characterized by spectroscopic, microscopic, and scattering techniques. From the absorption spectroscopy the prepared SnS nanoparticles have an average bandgap of 2.2 eV which is suitable to act as an active layer for solar cells shown in Figure 2(b). Moreover, the produced SnS nanoparticles shows the uniform size formation of SnS nanoparticles with a size in range 2-5 nm which is acceptable for the gas sensing. Figure 2(a) shows the Transmission Electron Microscope image of prepared SnS nanoparticles. In the XRD analysis, The Sharp and strong diffraction peaks indicate that the nanoparticles were well crystallized and were indexed to pure orthorhombic phase of SnS which shown in Figure 2(c). The average particle size of SnS was characterized by Dynamic Light Scattering measurement. The poly crystalline nature of SnS were found by SAED pattern. Thus, the synthetic methodology opens up the possiblity of generating low cost photovoltaic devices based on SnS film as an active layer through a scalable chemical pathway.

Figure 1: Synthesized SnS nanoparticles

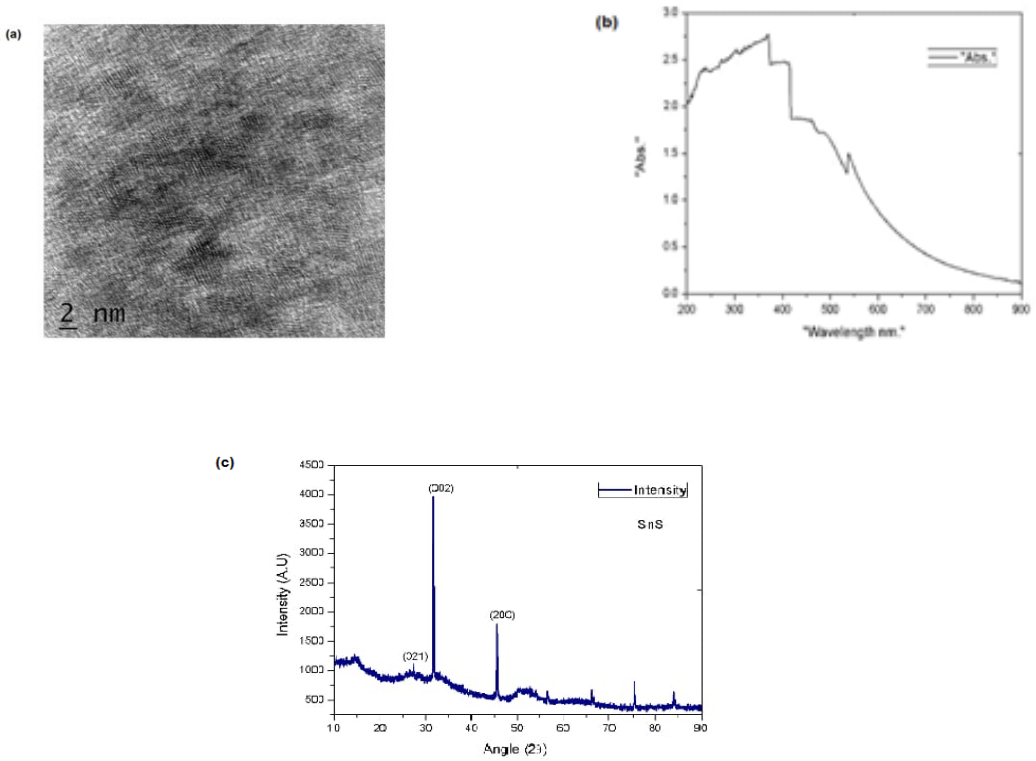

Figure 2: (a) Transmission electron microscopic image of SnS nanoparticle (b) Absorption spectrum of SnS naopaticle (c) XRD pattern of SnS

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Railway Ticket Booking and Authentication using a Smart System

Anita Panwar[1,a)], Deepak Kumar[2,b)] , Shashwat Kanwar[3,c)]

Asst Professor[1], UG Scholar[2] , UG Scholar[3] Department of Electronics and Communication Engineering, University College of Engineering and Technology, Bikaner Technical University, Bikaner (Rajasthan),

[a)]anitapanwar15@yahoo.co.in, [b)]deepak1961997@gmail.com,[c)]shashwatkunwar@gmail.com

Abstract: - The world is rapidly advancing towards digitization. The use of android application makes day-to-day tasks more efficient and secure. At railway stations often we find problems related to crowd management at railway ticket counter and In spite of having vacant seats people travel without reservation also there is no information regarding location of the travelling passenger. We prepared a system which will overcome all this problem through an app in which QR (Quick Response) code will be generated were ticket information will be stored in encrypted form, user has to scan the QR code from smart phone which will act as QR scanner at the railway station.All the details of the passenger will be directly sent to Railway Central Database. At entrance of train coach QR code scanner will be installed after the scanning of QR-code passenger's ticket information will be verified.The biometric data of passenger will also be captured using the android app. And after verification of biometric data user's identity will be verified. This IoT-based approach is to create a user-friendly and hassle-free environment for visitors and also for passenger. By implementing this, booking and verification problem will be easier and reduced to a large extent.

Keywords: - *IoT: Internet of Things, Android App, QR Code, Biometric*

Transition metal effect on different properties of lead –free KNN ceramics

Asha Dahiya[1]*, O P Thakur[2], A. K. Singh[3]

[1]*Department of Applied Sciences, Bharati Vidyapeeth's College of Engg., New Delhi*

[2]*School of Applied Sciences, Netaji Subhas University of Technology, New Delhi.*

[3]*Department of Physics, ARSD College, New Delhi.*

Abstract

Material series with compositional formula $K_{0.5}Na_{0.5}A_xNb_{1-x}O_3$ ($0 \leq x \leq 0.06$, in steps of 0.02) were prepared where A is transition metal Mn. X-ray diffraction studies showed pure perovskite phase with orthorhombic structure of $K_{0.5}Na_{0.5}Mn_xNb_{1-x}O_3$ compositions. The lattice parameters (c, a) were found to increase with Mn content. The room temperature dielectric constant (ε) was found to increase with addition of Mn. The dielectric constant increased with temperature for $K_{0.5}Na_{0.5}Mn_xNb_{1-x}O_3$ with $x \leq 0.04$ compositions and decreased for $x > 0.04$. The maximum dielectric constant $\varepsilon_{max} = 4517$ at T_c=421ºC at 100 kHz frequency was achieved for x=0.02 composition. Ferroelectric behavior of samples was also studied. The highest value of piezoelectric constant (d_{33} =178pC/N) was observed for x = 0.02.

Keywords: Transition; Dielectric Properties; Piezoelectric constant.

Oral – OT28

Role of clay intercalation in the structural, and thermal property of a polymer blend electrolyte

Avirup Das[1*], Awalendra K. Thakur[2]

[1]*School of advance science and languages, VIT Bhopal University, Madhya Pradesh-466114, INDIA.*

[2]*Department of Physics, Indian Institute of Technology Patna-800013, INDIA*

Email id: rup.dasph@gmail.com

This study focuses on the effect of clay intercalation/exfoliation in a polymer blend – salt complex prepared with Polyethylene Oxide (PEO) - Polydimethylsiloxane (PDMS) as the polymer matrix, $LiCF_3SO_3$ as the lithium salt and organomodified hectorite clay as nano filler. X-ray diffraction shows evidence of exfoliation of polymer chain over clay nano sheets at low clay concentration whereas, intercalation at higher clay concentration. Further, a systematic enhancement of polymer d spacing (~ 4.64 Å to 4.66 Å) along with the disappearance of uncomplexed Li salt peak upon nanocomposite formation clearly proves exfoliation/intercalation of the polymer chain in clay channel. Further, thermal transition temperature and conductivity have been investigated with a variation of clay. A lower temperature shift of polymer melting peaks indicates a decrease of crystallinity due to exfoliation/intercalation.

Study of low energy ion beam induced sputtering parameters of Muscovite Mica [$KAl_2(Si_3Al)O_{10}(OH)_2$] using Monte Carlo Simulation

Dipak Bhowmik[1, a)] and Joy Mukherjee [2]

[1] *Department of Physics, Indian Institute of Technology Kanpur, Kanpur-208016, Uttar Pradesh, India.*

[2] *Variable Energy Cyclotron Centre, HBNI, 1/AF, Bidhannagar, Kolkata -700064, India.*

[a)]Corresponding author: dipakb@iitk.ac.in

Abstract. Naturally available Muscovite mica [$KAl_2(Si_3Al)O_{10}(OH)_2$] is an multi-elemental insulating 2D material for widely used in atomic force microscopy calibration, biological substrate deposition, electronic device material etc. Since the ion beam technique is a versatile, precise, and controlled way, the modification of single or multiple layers is possible by choosing proper parameters. The modification of several layers of mica surface is basically the consequence of sputtering of different mica elements, which can be understood by the sputtering yield (Y) of mica elements. The trend of sputtering yield with ion incidence angle, projectile mass, and ion energy is studied here through Monte Carlo Simulation using Stopping and Range of Ions in Matter (SRIM) freeware. The sputtering yield of upper K atoms as well as mica is found to increase first with ion incidence angle and becomes maximum around 70^0 and 80^0 for 500 eV and 10 keV ion, respectively; then decreases for all the ions considered. The K vacancy profile is calculated and found to be consistent with sputtering yield results. The sputtering yield of mica increases with increase of projectile ion mass and ion energy except for He^+ ion, which is explained using ion penetration depth.

Effect of processing parameter on the formation of shear bands in metallic glasses

Devinder Singh[1], Dharmendra Singh[2], Kiran Mor[3], Anurag Pandey[1], R.S. Tiwari[4]

[1]*Amity School of Applied Sciences, Amity University, Lucknow 226028, India*
[2]*Department of Computational Sciences, Central University of Punjab, Bathinda 151001, India*
[3]*Department of Physics, Panjab University, Chandigarh 160014, India*
[4]*Department of Physics, Institute of Science, Banaras Hindu University, Varanasi 221005, India*

Plastic deformation of metallic glasses is localized within relatively thin regions called shear bands, resulting in a very low macroscopic plastic flow limit. The plastic strain can be improved by enhancing the homogeneity in microstructure through high quenching rate. The high quenching rate may result in the configurationally looser atomic packing and thus more free volume zones which therefore contribute to larger plasticity.

In this presentation, the results of our recent studies with respect to the effect of processing parameter (quenching rate) on the initiation and propagation of shear bands in melt spun ribbons of Zr-based metallic glass has been discussed. The plastic deformation behaviors of metallic glasses have been compared. The variation in the formation of shear bands has been observed for these alloys and this change may be referred to the different microstructures of these melt-spun alloys. It has been observed that the ribbons synthesized at higher quenching rate contains the large free volume and has the highest shear band density as compared to the ribbons synthesized at lower quenching rate. To further confirm this, pile up parameter has been calculated which is related to the generation and propagation of shear bands.

Keywords: metallic glasses, melt spinning, free volume, quenching rate

Oral – OT31

Micro-structural characteristics and indentation behavior of Ce-Al-Ga alloys

Dharmendra Singh[a], Devinder Singh[b] and R.S.Tiwari[c]

[a]*Department of Computational Sciences, Central University of Punjab, Bathinda, 151001*
[b]*Amity School of Applied Sciences, Amity University, Lucknow, 226028*
[c]*Nanoscience and Technology Unit, Department of Physics, Banaras Hindu University Varanasi. 221005*

The first report of phase separation in metallic glass has attracted significant attention due to their unique micro-structural variations of amorphous phases at different domain size. In the continuation of this the view is to understanding the genesis of phase separation in Ce based metallic glass. In this presentation, we present extensive investigations with particular reference to low concentration of Ga in Ce-Al-Ga metallic glass. Micro-structural characteristics and indentation behavior of melt spun $Ce_{75}Al_{25-x}Ga_x$ metallic glass has been investigated by X-ray diffraction (XRD) and Transmission electron microscopy (TEM). The small amount concentration of Ga substitution has caused to appearance of second diffuse halos in the X-ray diffraction (XRD) pattern. The observation of "bi-amorphous phases" is thus found in Ce-Al-Ga metallic glass. Indentation characteristics of these metallic glasses have been also investigated. It has been observed that Ga substitution improved the micro hardness property of Ce-Al-Ga alloys. Shear bands around the indentation periphery has also been observed.

Molecular structure, spectroscopic (IR, Raman, NMR, UV-vis) and molecular docking studies of an anticancer drug: isoDC81

Gargi Tiwari[1], Abhishek Kumar[2] and Dipendra Sharma*[3]

[1]Department of Physics, Patna University, Patna, India

[2]Department of Physics, University of Lucknow, Lucknow, India

[3]Department of Physics, D.D.U. Gorakhpur University, Gorakhpur, India

(tiwarigargi89@gmail.com, abhishekphy91@gmail.com, d_11sharma@rediffmail)*

Abstract

7-Hydroxy-8-methoxy-pyrrolo-[2,1-c][1,4] benzodiazepine-5-one or isoDC81 is an anticancer drug that belongs to the pyrrolo-[2,1-c][1,4]benzodiazepine (PBDs) family. It is a member of the group of naturally occurring antitumour antibiotics produced by various Streptomyces species. Molecular geometry of isoDC81 has been optimized by DFT (B3PW91) method with 6-31G(d,p) basis set. The MEP and HOMO-LUMO surfaces have been scanned. Further, HOMO-LUMO energies have been used to calculate ionization potential, electron affinity, electronegativity, global hardness and softness parameters of the drug molecule. IR, Raman, UV-vis and ^{1}H NMR spectra were recorded and ^{1}H NMR chemical shifts of the drug molecule have been calculated using the GIAO method. The inhibition activities of the drug molecule with guanine and cytosine receptors have been investigated with the help of molecular docking studies. An attempt has been made to elucidate the chemical and biological properties of the drug molecule.

Mechanical and Acoustical Properties of Silver Chloride from 100K to 600K

Krishna Kumar Pandey

(Department of Physics, SBSR, Sharda University, India)

Abstract:

Silver Chloride (AgCl), which is having the FCC crystal structure is characterized in this research paper. On behalf of the mechanical properties, the different nine elastic constants have been calculated in the higher temperature region i.e. from 100K to 600K. For further characterizations of AgCl, the Acoustic wave such as ultrasonic wave is used to find its attenuation when it passes through AgCl along <111> crystallographic direction in both the modes of propagation i.e. longitudinal as well as shear in the higher temperature region i.e. from 100K to 600K. The Ultrasonic attenuation due to screw and also due to edge dislocations has been computed in higher temperature region.

PACS Nos.: 43.35.Cg, 62.65.+k, 62.20.Dc

Keywords: Screw and Edge dislocations, Mechanical Properties, Ultrasonic attenuation, AgCl

E-mail: krishnakumar.pandey2@sharda.ac.in

Oral – OT34

Mechanism of chain formation under shearing forces in magneto-rheological fluids

Mahesh Chand[1,3], Ajay Shankar[2], A. P. Singh[3], M. C. Mathpal[4], R. P. Pant[5]

[1]*3Nano Lab, Faculty UnB Planaltina, University of Brasilia, Brasilia-DF, 73300-000, Brazil*

[2]*Department of Chemistry, Indira Gandhi National Tribal University, MP, India*

Department of Physics, ARSD College, University of Delhi, New Delhi 110021, India

[4]*Institute of Physics, Universidade de Brasília, Brasilia, DF, 70910900, Brazil*

[5]*CSIR- National Physical Laboratory, Dr K. S. Krishnan Marg, New Delhi, 110012, India*

E-mail: ac.maheshphy@gmail.com

Abstract

Magneto-rheological (MR) fluids are a topic of contemporary research due to their physical and potential technological applications mainly includes damping, sensing, shock-absorbing etc. In this article, we focus the basic physics of structure formation: chain formation and chain dynamics that make change in rheological properties. We studied the influence of shear rate and magnetic field on the formation and deformation of chain like structures in MR fluids at room temperature. The structural, morphological and magnetic properties of MR fluids particles were studied using XRD, SEM/TEM and VSM. A rheomicroscopy set up was used to record the in-situ videos under field force and a sequence of images were obtained using ImageJ software. The chain length as a function of oscillatory shear rate under different magnetic fields reveals competing dipole- dipole interactions forces and shear forces.

Oral – OT35

Classification and Characterization of Nanomaterial's

Pratima Sharma, Reeta Chauhan, Mamta Goel

Raj Kumar Goel Institute of Technology Ghaziabad

Abstract:- Nanostructure science and technology is a broad and interdisciplinary area of research and development activity that has been growing explosively worldwide in the past few years. However, scientific research on nano- and micro-sized materials has reached a saturation state. As a result, researchers planning to further develop nanomaterials need an outlook on recent advances in synthesis, classification and characterization of nanomaterials. There is a need in particular for an overview of synthesis using biological materials namely bacteria, fungi, yeast, and plants, in order to design eco-friendly nanomaterials. Methods used to characterize these synthesized nanoparticles must also be reviewed to suggest the appropriate techniques in terms of spectroscopic and microscopic methods to study the physio-chemical properties of nanomaterials.

Keywords:- Nanomaterial classification, Synthesis methods, Microscopy.

Oral – OT36

Effect of Film Thickness on Electrical and Magnetotransport Properties in $Pr_{0.5}Sr_{0.5}MnO_3$ Thin Films Grown on $LaAlO_3$ (011)

Ajay Kumar Saw[1], Shalabh Gupta[2], Vitalij Pecharsky[2]and Vijaylakshmi Dayal[1#]

[1]Department of Physics, Maharaja Institutes of Technology Mysore, (Aff: VTU-Belagavi), 571477 India
[2]Division of Materials Science and Engineering, Ames Laboratory, US Dept. of Energy, Ames, Iowa 50011-3020, USA

Thin films of $Pr_{0.5}Sr_{0.5}MnO_3$ of various thickness (16, 25, 40and 70 nm) have been deposited on $LaAlO_3$ (110) single crystal substrate using pulsed laser deposition technique. The 16 nm, 25 nm and 70 nm films show semiconducting insulating behavior, both at 0T and 5T magnetic field. The 40 nm film shows melting of charge ordering and occurrence of metal to insulator transition at temperature 178 (230) K. The application of magnetic field decreases the resistivity showing a significant magnetoresistance (MR). The high temperature semiconducting resistivity is governed by variable range hopping (VRH) transport mechanism, whereas metallic region in 40 nm film follows empirical relation of third order polynomial. The insulating electrical behavior and metal-insulator transition are observed to depend on the nature of strain that is experienced by the film.

Acknowledgment: This work is supported by financial grant of SERB-DST (EMR/2016/005424) and UGC-DAE-CSR, Indore (CSR-IC/CRS-89/2014-2018) to VD. AKS gratefully acknowledges to UGC DAE CSR for project fellow II. Authors gratefully acknowledge Dr. Mukul Gupta and Layanta Behera for XRD, Dr. Rajeev Rawat and Sachin Kumar for resistivity Dr. D. M. Phase, Dr. R. J. Choudhary and Mr. Mohan Gangrade for PLD and magnetic measurement. Characterization was partly supported by the Division of Materials Sciences and Engineering of BES Program of the Office of Science of the U.S. Department of Energy.

Oral – OT37

Magnetoplasmonics in Au-nanostructures

Hira Joshi

Department of Physics, Gargi College, University of Delhi

hirajoshi123@gmail.com

Plasmons play a large role in the optical properties of metals. The rapidly developing field of magneto-plasmonics merges the concepts from plasmonics and magnetism to realize novel and unexpected phenomena which deal with the manipulation of light at the nanoscale. Magnetoplasmonics combines strong local enhancements of electromagnetic fields in surface plasmon excitations with magneto-optically active ferromagnetic materials. Surface Plasmon (SPs) are very different in the presence of external magnetic field, usually called surface magneto plasmons (SMPs). The external magnetic field excites the electric current in the metallic structures. The magnetic moment associated with the circular current flowing in nanoparticles (nps) results in the magnetic response of the system. In magnetic plasmonic resonance (MPR) nps behave as magnetic dipole as in SPR these act as electric dipoles. Shift in resonant wavelength can be seen with the variation in refractive index of the matrix. The dielectric constant of matrix can be changed by choice of different matrices or by an external agent such as temperature, pressure or magnetic field. Here we are studying optical properties of noble metal structures in the presence of static external magnetic field. Magnetoplasmonics is combination of magnetism and plasmonic, having vital applications as in active plasmonic devices and in magnetic resonance imaging, nanoantennas, hyperthermia and bioimaging and in biomedicines.

We have studied theoretically optical properties of noble metal structures in the presence of external static field using Mie's formalism in the static regime where the size of nanoparticles is smaller than wavelength of incident light. Extinction Coefficient which is sum of scattering and absorption, is calculated for diferernt sizes of metallic nanoparticles and for various external matrix in which these nanoparticles are embedded in. Resonant wavelength is red shifted with increase in value of external medium refractive index without and with magnetic field. In case of Au metal nanostructures the effect of magnetic fields on the resonant wavelength is blue shift i.e.going towards lower wavelength.

Oral – OT38

LANDAU LEVELS IN Gaas QUANTUM WELLS: SPIN SPLITTING IN THE VALENCE BAND

[1]Imran Khan, [1]Sunil Kumar,[2] Sushil Kumar

[1]Department of Physics. Ramjas College, University of Delhi. New Delhi. India.
[2]Department of Physics. Hansraj College, University of Delhi. New Delhi. India.
Email for correspondence: *masterimran@gmail.com*

We have studied the electroluminescence spectra from an n-i-p LED as a function of magnetic field. This sample incorporated three GaAs quantum wells in the intrinsic region. This device had excess n-type doping and as a result. The quantum wells were populated by a 2D Landua electron gas. The broad B=0 field emission band evolved into a series of discrete features in the presence of a magnetic field. These were identified as inter-band transitions between the ℓ = 0, 1, and 2: Landau levels associated with the e1 and h1 sub-bands, with the selection rule $\Delta\ell = 0$. The EL spectra were analyzed in their σ+ (LCP) and σ- (RCP) components. An energy splitting between the two polarized components was observed for each Landau level transition. This was found to be equal to the sum of the conduction and valence band spin splittings. We used the know value of elctron's g-factor (g = - 0.44) to determine the valence band spin splittings. Our experimental values were compared to the numerically calculated values shown in reference(1) and were found to be in reasonable agreement. Work done at SUNY was supported by ONR and NSF.

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Silicon nanodots via sputtering of Si(111)-7×7 surfaces and post-annealing

J. C. Mahato[1,*], Debolina Das[2], Arindam Pal[3], Rajib Batabyal[4], Anupam Roy[5], and B. N. Dev[6]

[1]*Department of Physics, Ramakrishna Mission Residential College, Kolkata 700103, India*

[3]*Department of Physics, Haldia Government College, Haldia, Debhog 721657, India*

[2]*Department of Physics, Yogoda Satsanga Palpara Mahavidyalaya, West Bengal, India*

[4]*University of Copenhagen Faculty of Science, Denmark*

[5]*Microelectronic Research Center, The University of Texas,USA*

[6]*Department of Physics and School of Nano Science and Technology, Indian Institute of Technology Kharagpur, Kharagpur 721302, India*

Abstract

We present the evolution of Si quantum dots on Si(111)7×7 surfaces by Ar+ ion sputtering and sub-sequent annealing of the sputtered silicon substrate in molecular beam epitaxy (MBE) under ultrahigh vacuum (UHV) using *in-situ* scanning tunneling microscopy (STM). The electronic properties of the sputtered surface as well as that of annealed Si(111) surfaces have been probed by *in-situ* scanning tunneling spectroscopy (STS) measurements. We closely monitor how the surface atomic arrangement changes upon annealing the sputtered Si(111) surfaces at ~ 600˚C. The STM measurement reveal rough sputtered Si(111) surfaces of the sputtered substrate at room temperature. There is no significant change of the surface atomic arrangement or roughness upon annealing the sputtered surfaces at ~500˚C. But when the sputtered Si(111) surface is annealed at ~ 600˚C substrate temperature, recrystallization starts. STM measurement reveals the annealed Si(111) surfaces form thinly separated plateau of silicon islands. The top surface of these nanoislands reconstructs in predominantly in Si(111)7×7 units, but there are also Si(111)2×2 and Si(111)5×5 reconstruction. The silicon plateau contains smaller silicon nanodots at the edges. *In-situ* scanning tunneling spectroscopy measurement shows the these silicon nanodots are metallic in nature.

Keywords: Self-organized epitaxial nanostructure, nanodots, scanning tunneling microcopy

[a)]Electronic mail: jagadishchmahato4@gmail.com

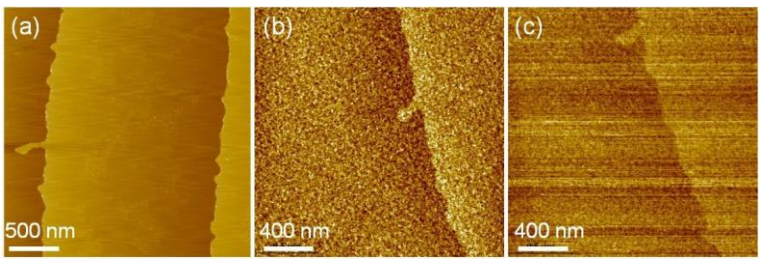

Figure 1: (a) shows STM image of atomically clean Si(111)-7×7 surface, (b) and (c) show Ar^+ sputtered Si(111) surface at room temperature and after annealing at ~500˚C, respectively.

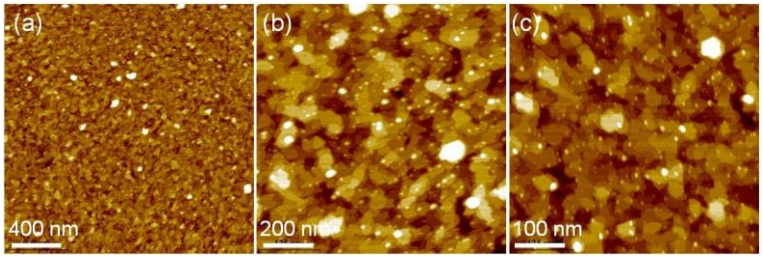

Figure 2: (a-c) show STM images of the Ar^{+} sputtered Si(111) surfaces after annealing at ~ 600˚C.

Oral – OT40

Influence of magnetic ordering on the electronic, optical and magnetic properties of $Bi_2Fe_4O_9$

Kajal Jindal[a], Shaan Ameer[b], Monika Tomar[c], Pradip K. Jha[d], Vinay Gupta[b]

[a] *Department of Physics, Kirori Mal College, University of Delhi, India*

[b] *Department of Physics and Astrophysics, University of Delhi, India*

[c] *Department of Physics, Miranda House, University of Delhi, New Delhi, India*

[d] *Department of Physics, DDU College, University of Delhi, New Delhi, India*

$Bi_2Fe_4O_9$ is an accompanying mullite phase that is often encountered in the formation of $BiFeO_3$ owing to the high volatility of Bi. It is known to be an excellent visible light photocatalyst due to its low band gap (~ 2.0 eV). Moreover, it possesses an orthorhombic structure and displays antiferromagnetic order with Neel temperature of around 250 K and is also employed for magnetoelectric applications. The ferromagnetic order can be induced in $Bi_2Fe_4O_9$ due to the uncompensated spins which may arise easily either due to the canted spin structure in $Bi_2Fe_4O_9$ or due to the size effects. Thus, the properties of $Bi_2Fe_4O_9$ can be tuned in different magnetic orderings.

In the present work, density functional theory calculations were performed by imposing ferromagnetism and non-collinear antiferromagnetism onto Fe spins in $Bi_2Fe_4O_9$. Results based on spin polarized electronic properties suggest that $Bi_2Fe_4O_9$ is an indirect band gap semiconductor having an optical band gap of 1.732 eV in ferromagnetic configuration whereas, it is a multiband semiconductor in antiferromagnetic spin configuration. Density of states suggest that the multiband nature mainly arises due to unoccupied spin states of Fe present at tetrahedral sites. The linear optical response of ferromagnetic $Bi_2Fe_4O_9$ is also investigated. The value of refractive index of $Bi_2Fe_4O_9$ in the visible electromagnetic spectrum is calculated to be about 2.5–3.0.

Oral – OT41

Smart materials for cardiovascular devices

Mamta Bhatia and Snigdha Bhatia

Acharya Narendra Dev College,University of Delhi

Abstract:

Shape memory alloys belong to the category of Smart materials which are gaining popularity and have great potential for various medical applications. The property of undergoing deformation and retaining the original shape after removal of external stimuli makes these materials most suitable for their use in designing implants. This paper focuses on use of Ferromagnetic Shape Memory Alloys (FSMA) and magnetostrictive materials for designing cardiovascular devices which can be most suitable for pediatric heart patients. These materials change their shape in response to a magnetic field. Materials with unique crystal structure are being reviewed for stent designs and coronary applications. This work demonstrates how stents made of FSMAs can be magnetically activated and find their applications in peripheral and coronary heart diseases, thus replacing the current stent technology.

Key words: Shape Memory Alloys, Ferromagnetic Shape Memory alloys, Stent, cardiovascular device

Studies on Sturtural , Electrical and optical properties of PEG-PVP-PVA Polymer Electrolytes

Mohd Sadiq[a,d] ,S.K. Chaurasia[b] , Ankit kumar[a], Anjani Kumar Singh[a], Javid Ali[d*], M. M. Hasan Raza[d], Mohammad Zulfequar[d] , Yogesh Kumar[a], Raghvendra[a]

[a]*Department of Physics, ARSD College University of Delhi-110021, India*
[b]*Centre for Nanoscience & Technology, Prof. Rajendra Singh (Rajju Bhaiya) Institute of Physical Sciences for Study and Research, V.B.S. Purvanchal University, Jaunpur-222003,*
[c]*Department of Physics, ARSD College University of Delhi-110021, India*
[d]*Department of Physics, Jamia Millia Islamia University-110025, India*

**Corresponding Author E-mail: javidphy@gmail.com ,Contact no.7889822120*

ABSTRACT

This report investigates the series of preparation of polymer electrolytes based on PEG-PVP-PVA +x wt. of NaNO3 using solution cast technique. Structural analysis concludes formation of a smooth surface that evidences the increase of amorphous content. FTIR provides the presence of various interactions (between polymer-ion) in between the constituents of the polymer electrolytes. The fraction of free anion and ion pair was calculated. The electrical conductivity was enhanced and may be due to interaction of polymer chains between polymer –ion . The electrochemical stability window of polymer electrolytes films is also obtained of~2.3 volt via cyclic Voltammetry which is a range at par with the presently used electrolyte in the energy storage device applications.

Keywords: XRD, polymer electrolytes, sodium ion, Ionic Conductivities.

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Characterization of Fly Ash Solid-Waste for Low-Cost Insulation Refractory Bricks

Nayan Kr Debnath[ab*], Vishwas Acharya[b], Surendra Jangu[b], Prakash Singh[b], M.R. Majhi[a], V.K. Singh[a]

[a]*Department of Ceramic Engineering, Indian Institute of Technology (BHU), Varanasi-221005.*

[b]*Department of Ceramic Engineering, University College of Engineering and Technology, Bikaner-334004, India.*

**nayancct@gmail.com*

Abstract

Fly ash from Barsingsar, Bikaner thermal power plant in northern India, is significantly generating solid-waste. In India, coal is of poor quality having high ash content around 30–45 wt. %, fly ash created at coal thermal power plants. The present work investigates the possible utilization of fly ash waste for the preparation of insulation refractory bricks. Fly ash is considered as a powdered material being collected by dust collectors built-in boilers of thermal power plants with the use of coal as a fuel. The chemical, thermal, crystallographic and morphological analysis of fly ash waste has been determined by XRF, DTA-TG, XRD and SEM, respectively. The XRF results show the fly ash waste is alumina and silica-rich. XRD results also reveal that the material is composed of mullite and quartz crystals. SEM investigation exhibits the morphology of fly ash waste is needle-like mullite and fibrous-like quartz type of structure, which supports the XRD results. It can be concluded from the inquiry that fly ash waste is the potential low-cost raw material for insulation refractory bricks.

Keywords: Fly Ash, Solid-waste, Insulation refractory bricks.

Analysis of Electromechanical Properties of Electrode for Enhancing Electrostrictive Capacitive Sensor Response

Nidhi Agrawal[a*], O.P. Thakur[a] and Anjani Kumar Singh[b]

[a]*School of Applied Sciences, Netaji Subhas Univeristy of Technology, Sector 3, Dwarka, New Delhi, 110078, INDIA*
[b]*Atma Ram Sanatan Dharma (ARSD) College, University of Delhi*

[*]itznidhi@gmail.com

Abstract

The choice of electrode's material, it's topography like shape, size, and position play a very important role in determination of sensitivity of an electrostrictive capacitive sensor. The electrode material is required to be in mechanical and electrical compliance with the dielectric material for getting optimum performance of the sensor. Choice of electrode's material with particular conductivity and flexibility also depends on the nature of sensing application.

A mathematical analysis for the estimation of contribution from edge effect has also been carried out for different sizes of electrodes and separation between the electrodes. It has been observed that error due to edge effect is of the order of 10^{-3} in case of Electric Double Layer (EDL) capacitive sensors with separation between plates in nanometric range and area of plate in millimetric range. However, in case of nanometric capacitive sensors having both area of plates and separation between them in nanometric range, the error due to edge effect has been found to be beyond 5% which is considerably high and can't be neglected. Edge effect can be reduced by use of compliant electrodes but the compliant electrodes have a disadvantage too, as it can reduce the breakdown strength of dielectric material.

Keywords - capacitive sensor; compliant electrode; edge effect; electrostrictive material.

A Review study based on the application of Nanomaterials in Concrete

Gaurav Goel[1], Payal Sachdeva[2]

[1, 2] Assistant Professor, Chitkara College of Applied Engineering, Chitkara University, Punjab, India

Abstract

Concrete after water is the second universally used construction material. However, the cement as a part of concrete is very brittle material which possesses low ductility, weak tensile strength, early development and micro-crack's propagation due to shrinkage at early ages. Observing the last 2 decades scenario, concrete's output has been improved magnificently by incorporating various supplementary cementitious materials (SCMs) and the nanoparticles. Nanomaterials due to its small size of fragment and larger area of surface have great caliber of enhancing the characteristics of concrete. Following recent trend and using nano technology, we can present concrete as a smart material with multi functions. In our study, inclusion of nanomaterials in the concrete and its effects has been reviewed. Since, nano materials possess higher area of surface to its volume rate thereby provide exceptional contribution to the chemical reactions within the concrete, can enhance entire performance of it.

Keywords: Nanomaterial, nanotechnology, concrete, surface area, strength

Oral – OT46

A theoretical estimate on the probability of the formation of a self-avoiding copolymer macromolecule

Pramod Kumar Mishra

Department of Physics, DSB Campus, Kumaun University, Nainital,Uttarakhand (INDIA)

Abstract. A lattice model of the directed self-avoiding walk is used to estimate the possibility on the formation of an infinitely long linear semi-flexible copolymer chain. The copolymer chain is assumed to composed of four different types of the monomers. A method of the recursion relations is used to solve the proposed model analytically to show that the probability of the formation of a self-avoiding semi-flexible copolymer chain is independent of the stiffness of the chain. It is a distinct result from our earlier study on the formation of a Gaussian semi-flexible copolymer chain and the Gaussian chain is made up of these four monomers, [P. K. Mishra, J. of Adv. Appl. Sci. Res. **2(4)** 1-8 (2020)]. We have also calculated the average number of different types of the bonding in the copolymer chain to show the distinctions in the behaviour of the self-avoiding copolymer chain from the Gaussian polymer chain.

Key words: Self avoiding copolymer, stiffness, phase transitions, analytical calculations

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P K Mishra (2020) (**to be published**).

Comparison of Dry and Lubricated Wear Behaviour of 22MnB5 Uncoated Ultra High Strength Steel

Jimmy Mehta[1], J. S. Grewal[2], Prateek Mittal[1*], Paridhi Malhotra[3] and Pallav Gupta[3]

[1]Department of Mechanical Engineering, Manav Rachna International Institute of Research and Studies, Faridabad, Haryana, (INDIA)

[2]Department of Production Engineering, Guru Nanak Dev Engineering College, Ludhiana, Punjab, (INDIA)

[3]Department of Mechanical Engineering, A.S.E.T., Amity University Uttar Pradesh, Noida, (INDIA)

Abstract

Objective of this work is to effectively enhance the working life of boron steel (22MnB5) having application in agricultural area, where the most common problem is wear. Boron steel also known as medium carbon steel. It has carbon content rangingfrom 0.19-0.26 by weight percentage. Specimens were made ready and wear tests were conducted using pin-on-disc tribometer. SEM and XRD analysis techniques were used to study the microstructure and phase morphology of worn out surfaces. Specimens were tested both in wet and dry conditions using lubricating oil. Wear tests were carried out at 3 different load conditions in 7 cycles. Results have shown that under lubricated conditions even at high loads, wear rate is less and thus volume loss is also negligible. This study is expected to provide the insights into the wear behaviour of 22MnB5 uncoated ultra-high strength steel (UUHSS) and contribute to the development of more wear resistant materials for agricultural applications.

Keywords: Wear rate; pin-on-disc tribometer; lubrication; SEM; XRD

Study of Adsorption Kinetics of Pristine and Functionalized Carbon Nano Tubes for NH_3 and NO_2 gases

Seema Gupta[1], Ankur Anand[1], Neeru Mann[2], Rachana Kumar[1*]

[1] *Department of Physics, Kalindi College, University of Delhi.*

[2]*Solid State Physics Laboratory, DRDO.*

seemagupta1g@gmail.com

*Corresponding Author *rachanabkumar@gmail.com*

Abstract

Carbon Nano Tubes open a promising field of research due to their unique structural and exciting electrical and mechanical properties. They are studied widely as gas sensors. They play an important role in controlling environmental pollution, food quality and monitoring industrial pollution. However, due to their slow recovery rate and limitation of sensing at low concentration of gases, they leave a wide scope of study seeking their continual performance improvement.

In the present work, Single walled carbon nano tubes (SWNT) are studied in pristine and SnO_2 functionalized form for their sensitivity towards NH_3 and NO_2 gases (concentrations ranging from 0.5-20 ppm). The electrical model of CNT networks and its dependence on gas concentration has been investigated. Considering the physisorption of NH_3 and NH_2, Langmuir adsorption model has been applied to study the conductance change with varying gas concentration. Experimental data has been fitted with Langmuir isotherm and an increment has been observed in the Langmuir coefficients from pristine to functionalized SWNT. These parameters are indicative of adsorption capacity of SWNT surface as well as concentration of gas molecules adsorbed on CNT networks. The results suggest that enhancement may be linked to improvement of surface adsorption kinetics when SWNT surface is modified with a functional group.

Keywords: Carbon Nanotubes, Adsorption, Langmuir Isotherm model, Pristine and functionalized SWNTs

Recent advances in ZnO based electro-chemical ethylene gas sensors for evaluation of fruit maturity

Ribu Mathew[1] & Avirup Das[2]

[1]*School of Electrical and electronics Engineering (SEEE), VIT Bhopal University, Bhopal-466114*

[2]*School of Advance science and Languages (SASL), VIT Bhopal University , Bhopal-466114*

Abstract:

India economy is driven by agriculture sector and its associated industries as it employs more than 50% of Indian work force and contributes 17% to18% of India's GDP. According to a report from FAO in the year 2014, India is the largest producer of fruits and vegetables in the world. However, a major portion of agro-products are wasted during harvesting, shipping and storage i.e. negligence in the food supply chain management (FSCM) system. According to a report, globally one third of food produced is wasted. Importantly, two-third of wastage of food occurs due to limitations in the supply chain management system. Wastage of perishable agro-products due to negligence FSCM is a critical issue, especially in the case of agro-products like fruit. Therefore, the early detection and segregation of agro-products like fruits is critical to reduce agro-product wastage. A typical indicator of maturity and ripening of fruits is the rate of generation and concentration of ethylene gas.

Even though literature encompasses examples of a variety of ethylene gas sensors, ZnO based electro-chemical ethylene gas sensors have numerous advantages compared to other sensor variants. ZnO is an extensively studied wide band gap semiconductor for sensing applications. When used as a sensing layer material it 'senses', ethylene gas by changing its band gap and thereby electrical property. Further, the sensitivity and selectivity of the pristine ZnO varies with shape, substrate, and metal doping. This paper elucidates a comparative study of material perspective of ZnO based electro-chemical sensors and their performance metrics. A detailed investigation has been carried out to understand a electro-chemical ethylene sensor at various levels of abstraction that includes material, device and system levels. The results reported in this work have wide implications not only in design and development of electro-chemical ethylene gas sensors but also in the development of a generic gas sensor at various levels of abstraction.

Synthesis and Radiative property of Samarium ion with Zinc Oxide nanomaterial

Sudha Pal

MBGPG College Haldwani (Uttarakhand)

Abstract- In order to have a better understanding of rare earth ions doped in ZnO nano material, an attempt has been made to study optical properties of tripositive rare earth doped ZnO nano material. The present study involves the synthesis of Sm^{3+} doped ZnO nanomaterial by the zinc chloride and rare earth oxide chemical synthesis method. The synthesized nano ions were characterized with respect to their crystal structure, crystal morphology, particle size and photoluminescence (PL) properties using scanning electron microscopy (SEM), transmission electron microscopy (TEM) and PL-spectroscopy respectively. PL spectra of ZnO: Sm^{3+} nano ion show approximate spherical shape to ZnO nanoparticles and the size of the particles around 100-20 nm. Their absorption spectra were measured in 300-1100 nm regions at room temperature. Various spectroscopic parameters such as Slater-Condon, Racah, spin-orbit interaction, Nephelauxetic ratio, bonding and Judd-Ofelt parameters have been computed from the observed band. The Fluorescence spectra have been recorded of Sm^{3+} ion doped ZnO material using with intense absorption bands (583 nm) at room temperature in visible region.

Keywords-Samarium Sm^{3+}doped ZnO nanoparticles, Absorption Spectra, and Fluorescence Spectra and Radiative properties

Studies of Refractive Index Modulation in BaB_2O_4 slab for Photonic Applications

Suraj Prakash

Department of Physics, GLA University, Mathura (U.P.)

E-mail: surajpbhu@gmail.com, Mob: +91 78390 74838

Tunable photonic band gap crystals are centre of attraction nowadays. A photonic crystal is an optical platform, which can be used to manipulate electromagnetic wave propagation. It does not allow a range of frequency (Photonic Band Gap) to propagate through it, hence manipulates. Refractive index contrast and thickness of material used for fabrication of crystal decides this range. Thus modulation in refractive index of material provides a way to tune electromagnetic forbidden range. In this work, theoretical analysis of refractive index modulation in BaB_2O_4 material slab via GHz plate waves has been presented. Exciting fundamental symmetric plate mode in slab at GHz frequency forms alternate low and high strain field patterns in slab along the direction of plate wave propagation. These strain filed patterns affects refractive index of material, which can be estimated using photo-elastic relations. The found modulated refractive index pattern is of sinusoidal in nature. This generated low and high refractive index pattern repeats itself after a period equals to wavelength of excited plate wave. Thus plate wave perturbed slab with modulated refractive index along one direction will behave like a one dimensional photonic crystal and can be used for photonic applications.

Keywords: BaB_2O_4 Crystal, Band Gap, Lamb Wave, Photo-elastic effect.

Oral – OT52

Internet of Things- a new way to Smart Devices

Vinaya Phaneendhra K,
Assistant Professor,
Department of Electronics,
Sri Y N College (Autonomous) - Narsapur

Abstract:

The Internet of Things, or IoT, refers to the billions of physical devices around the world that are now connected to the internet, all collecting and sharing data. Connecting up all different objects and adding sensors to them adds a level of digital intelligence to devices that would be otherwise dumb, enabling them to communicate real-time data without involving a human being. The Internet of Things is making the fabric of the world around us smarter and more responsive, merging the digital and physical universes. Based on the existing literature, this paper chooses the term smart device as a starting point towards the development of an appropriate definition for the devices present in the IoT. This investigation aims at exploring the concept and main features of smart devices as well as role of IoT in the Smart devices. This paper follows current research in this field. It has been identified smart devices as the primary objects interconnected in the network of IoT, having an essential role in this paradigm.

Keywords: Internet of things, Smart devices, Digital intelligence

Solution Processed Ion-conducting Dielectric for Low Voltage and High-performance IZTO Thin Film Transistor

Anand Sharma[a] , Vishwas Acharya[ab]*, Nayan Kr. Debnath[b] and Bhola N. Pal[a]

[a]*School of Materials Science and Technology, Indian Institute of Technology (Banaras Hindu University), Varanasi-221005, India*

[b]*University College of Engineering and Technology, Bikaner-334004*

vishwasacharya59@gmail.com

Abstract:

Metal-oxide thin film transistors (TFTs) have been promising components for application in energetic framework active-matrix light-emitting diodes (AMLEDs), biosensors, light emitting transistor and phototransistors because of its outstanding interface and charge transporting properties. In this report we have fabricated a high-performance low voltage ion-conducting dielectric based TFT using a transparent semiconductor indium-zinc-tin oxide through a very convenient and cost-effective sol-gel technique. The combination of this dielectric and semiconductors exhibited a of high mobility 4 $cm^2V^{-1}s^{-1}$ with very high on/off ratio (10^3) and very low subthreshold swing (210 mV/decade) at very low voltage. Now days low power consumption is in demand and a key factor for low power and portable electronics. Thus, this research idea will open a new window for low voltage TFT fabrication and give a option for low power consumption and flexible devices.

Keywords-Thin film Transistor (TFT), Sol-Gel Process, Low Voltage.

Antibiotic releasing agents for treating implant infection-A Review

Sakshi

Auxein Medical Private Limited

ABSTRACT

Implantable grade biomaterials play an important role in ongoing success of orthopaedics. However, Bacterial infections is the leading constrained for failure the implant with huge medical expenses. According to the published research, biofilm formation is the critical stage in the development of infection on implants, which starts after the adhesion on implants. Immune system and systemic antibiotics protest against the formation of biofilm. In the last decades, some research have examined that the surface modification of implant may reduce the tendency of bacterial adhesion as well as biofilms. To go through in forward direction, we will be familiar with distinctive technologies or method, which are already in market, distinguish as follow: Active surface finishing, passive surface finishing and local antibacterial drug coating. This article compiles advanced innovation of antibacterial coating material using polymer-based compounds to overcome the osteomyelitis and deep wound infection.

Evaluation of naturally synthesized ZnO for optoelectronic applications using EIS

Fabian N. Murrieta-Rico[1,a], Mizael Luque[2,b] , Gerardo Romo-Cárdenas[3,b] , Priscy A. Luque[4,b],

[a]*fmurrieta@cnyn.unam.mx,* [2]*mizael.luque@uabc.edu.mx,* [3]*romo.gerardo@uabc.edu.mx,* [4]*pluque@uabc.edu.mx,*

[a]*Universidad Nacional Autónoma de México, Centro de Nanociencias y Nanotecnología*

[b]*Universidad Autónoma de Baja California, Facultad de Ingeniería, Arquitectura y Diseño*

Green synthesis methods offer an alternative to traditional techniques, for obtaining desired products, while the environmental effect is reduced. ZnO is among the materials synthetized through these methods. The green synthesis procedure allowed to simplify the obtention of this material, and at the same time, made more efficient its synthesis. ZnO is a semiconductor material with plenty of applications, among them are of special interest the generation of optoelectronic devices, such as photodetectors or generation of optical waveguides. Electrochemical Impedance Spectroscopy (EIS) is a characterization technique where frequency dependent characteristics can be assessed. In this sense, in the literature the ZnO is shown to be traditionally evaluated using EIS. In the present work, ZnO nanoparticles were obtained using two different reducing agents; namely *Menta spicata* [1] and *Citrus reticulata* [2]. These samples were characterized using EIS, and their frequency dependent properties were examined. As a result, their application in optoelectronics-based technology is explored and evaluated.

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Oral – OT56

Zeolites as initial structures for the preparation of functional materials

Vitalii Petranovskii[1,a], Fabian N. Murrieta-Rico, Joel Antúnez-García, Rosario I. Yocupicio-Gaxiola, Donald H. Galván

vitalii@cnyn.unam.mx[1], fmurrieta@cnyn.unam.mx[2], joel.antunez@gmail.com[3], ryocu@cnyn.unam.mx[4], donald@cnyn.unam.mx[5].

[a]Universidad Nacional Autónoma de México, Centro de Nanociencias y Nanotecnología

Functional materials that figure prominently in high technology are not classified based on their origin (metals, ceramics, polymers, glass, etc.) or processing technologies, but are classified based on the functions they can perform. Zeolites are an interesting and important functional material. From a traditional point of view, it is an aluminosilicate oxide with a nanoporous structure. However, zeolites are adsorbents, ion exchangers, catalysts, and can be used in medicine, agriculture and construction. The availability of natural materials and methods for their synthesis and modification, developed in sufficient detail, make it possible to obtain a variety of materials with predetermined properties which are tailored for specific purposes. In the possible applications of these materials, it is of interest to define how the zeolites interact with other chemicals. This is achieved by tuning the chemical composition in the zeolitic surface.

Reconnoitring the capabilities of Al:ZnO thin films for self- power generating devices

Anjali Sharma, Aakash Gupta and Monika Tomar *

[1]*Physics Department, Atma Ram Sanatan Dharma College, University of Delhi, New Delhi, India- 110021*

[2]*Department of Physics, University of Central Florida, Orlando, Florida, USA- 32816*

[3]*Physics Department Miranda House, University of Delhi, New Delhi, India- 110007*

corresponding email id: monikatomar@gmail.com

Thermoelectric materials have gained interest of various scientists worldwide, specifically in the field of converting waste heat energy into electrical energy which can be utilized further for various applications. Thus, by using a thermoelectric material, waste terrestrial heat can be harvested which can be further converted to electrical power. The exploitation of these materials has led to a novel idea of developing self-powering devices where these devices are driven by heat from their working environment. The thermoelectric materials are usually in the form of bulk, thin film or low-dimensional structures such as Skutterudite type alloys. Since thin films are expected to have lower thermal conductivity than the bulk materials, due to the presence of strong phonon scattering at their interfaces, thin films based thermoelectric materials have opened the possibility for improvement of thermoelectric efficiency. Moreover, some thermoelectric materials, such as Bi_2S_3 and Bi_2Te_3 in the form of thin films, have found particular applications, their efficiencies are not still enough for commercial applications. Thus, there is still need for further research and development of materials with high thermoelectric efficiencies for commercialization.

In the present work, thermoelectric properties of pulsed laser deposited (PLD) Aluminum doped Zinc Oxide (Al:ZnO) thin films of varying composition of Al (1%, 2% and 4%) have been studied. An optimum composition of 2% Al in Al:ZnO thin film showed the maximum values of Seebeck coefficient, figure of merit and power factor of 26.4 $x10^{-3}$ mV/K, 7.8 $x10^{-3}$ and of 287.5 $x10^{-3}$ mW/K^2-m respectively at room temperature. These results indicate use of thermoelectric material (Al:ZnO) thin films as an integrated power source for microelectronic device applications.

Oral – OT58

Structural and impedance spectroscopy in $BiFeO_3$–$BiCoO_3$–$BaTiO_3$ ternary system

I. Maurya, S. Shankar, O. P. Thakur, M. Jayasimhadri

Experimental Research Laboratory, Department of Physics, ARSD College, University of Delhi, Dhaula Kuan New Delhi 110021, India

**Corresponding Author: sssubramaniam@arsd.du.ac.in*

Keywords: Ferroelectric, dielectric and XRD

ABSTRACT

Multiferroic materials are fascinating to explore due to presence of more than two ferroic orderings in same phase. Ternary materials consisting of more than constituents are an outstanding due to different origins of ferroic orderings. These materials are expected to exhibit strong electric properties due to improved structural stability. The systematic study on structural and impedance properties $BiFeO_3$–$BiCoO_3$–$BaTiO_3$ ternary system has been reported. Structural studies have been investigated using FT-IR spectroscopy and confirms ternary systems formation. The impedance investigations confirm the role of grains and grain boundary in ternary system. The thermal dependent relaxation phenomenon is observed in $BiFeO_3$–$BiCoO_3$–$BaTiO_3$ ternary system. The ternary system also exhibited non-Debye type behavior.

Corresponding Author: S. Shankar Subramanian

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Oral – OT59

Phase formation and ionic conduction in Alkali metal doped strontium meta silicate

Hera Tarique[1,2], Raza Shahid*[2], A.K. Singh[1], Raghvendra Pandey[1]*

[1]*Department of Physics, A.R.S.D. College, University of Delhi, New Delhi-110021*
[2]*Department of Physics, Jamia Millia Islamia (Central University), New Delhi-110025*

Abstract: Alkali metal doped strontium meta silicate has been reported as ion conducting materials. Here, we report the phase formation in Alkali metal doped strontium meta silicate ($SrSiO_3$). And also explored the conduction mechanism that is responsible for high ionic conductivity in this system. The phase evolution also explains the conduction behaviour. The co-existence of crystalline along with few amount amorphous phases was also found to responsible for high ionic conduction in the material. The oxygen vacancies proposed in these structures, which were assumed as the mobile defect responsible for the high level of conductivity observed, represented a new concept for designing oxide ion conducting electrolytes.

Keywords: $SrSiO_3$; Ionic conduction, Phase formation, SOFCs

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Corresponding authors***:*** *raghvendra.sspl@gmail.com* (R. Pandey)

Effects of Backbone Functionalization on Electrical and Shielding Behaviour of Conducting Polyaniline Composites

Rakesh Kumar[a]*, Surender[b], Avanish Partap Singh[C]

[a,b] *Department of Applied Sciences, MSIT (Affiliated to IP University), Janakpuri, Delhi, India-110058*

[c]*Department of Physics, ARSD College, University of Delhi, New Delhi, India-110021*

* *rakeshkumar@msit.in*

Abstract

Polyaniline (PANi) is widely exploited for electromagnetic interference (EMI) shielding and other potential applications because of its versatile synthesis, proton doping, low cost and high environment stability in combination with relatively high conductivity [1]. However, PANi, like majority of other conducting polymers, have poor solubility and infusibility which is because of its rigid backbone [2]. Due to these drawbacks, PANi has limited processibility which hampered its use for some high-tech applications. In this regard, efforts have been made to alter the structure of polyaniline by chemical modifications and functionalization of its backbone[3]. Functionalization or incorporation of some functional group in the polymer backbone is one of the prominent methods to improve the flexibility of the rigid polymer chains[4, 5]. However, the derivatives of PANi display low electrical conductivity and can be used for applications that depend on low conductivity like corrosion inhibitors, sensors etc.[6, 7]. In the present work the derivatives of PANi such as poly(o-methoxy) aniline (POMA) and poly(o-toluidine) [POT] were synthesized by emulsion polymerization and tested for EMI shielding applications. Desired conductivity for this target was attained by *in-situ* incorporation of carbon fiber (CF) into the polymers matrix. The synthesized polymers and their composites with CF were analyzed by FTIR spectroscopy, TGA, Flexural Strength measurement and electrical conductivity measurement. The EMI shielding measurements of all the samples were carried out by Vector Network Analyzer. The results were compared to report the effects on electrical and shielding behavior of polanilne by incorporation of the bulky side groups into the rigid polymer backbone.

Keywords: Conducting polymers, Polyaniline, Electrical Conductivity, EMI Shielding.

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Oral – OT61

Smart Self-Healing Coating of Epoxy Based Conducting Poly(Aniline-Co-2-Flouroaniline)/ZnO Nanocomposites for Corrosion Protection

Hema Bhandari[1]* and Avanish Pratap Singh[2]

[1] *Department of Chemistry, Maitreyi College, University of Delhi,110021. New Delhi-110021*

[2]*Department of Physics, ARSD College, University of Delhi, Dhaula Kuan, New Delhi-110021*

Abstract

Presents work demonstrates the development of durable anticorrosive coating based on epoxy reinforced poly(aniline-co-2-fluoro aniline)/ZnO nanocomposite which enhanced the anticorrosive and mechanical properties of the coating and was found to be an excellent barrier against corrosive atmosphere. Electrochemical studies of the coating on mild steel showed remarkable reduction of corrosion current density and the corrosion protection efficiency upto 99 % was achieved using the coating in saline condition, which indicates the positive impact, both in the barrier properties and corrosion protection behavior due to copolymer/ZnO nanocomposite. Salt spray test of copolymer nanocomposite/epoxy coated mild steel surface was carried out in 5.0 wt.% NaCl solution for 180 days as per ASTM B117 method, which showed an excellent anticorrosive and self-healing properties. Physico-mechanical testing such as scratch, Taber abrasion resistance, bend test, and cross cut adhesion test were carried out to evaluate the durability and adhesion performance of coating on the metal surface.

Keywords: Conducting Polymer, Nanocomposites, Self healing, Anticorrosive.

Oral – OT62

Synthesis and characterization of lead free NKLNTS ceramic

Abid Hussain[1,2] and Binay Kumar[1]

[1]*Crystal Lab, Department of Physics and Astrophysics, University of Delhi, Delhi, India*

[2]*Physics Department, Atma Ram Sanatan Dharma College, University of Delhi, Delhi, India*

Abstract

Environment friendly lead free $Na_{0.52}K_{0.44}Li_{0.04}Nb_{0.84}Ta_{0.10}Sb_{0.06}O_3$ (NKLNTS) ceramic was prepared by solid state reaction method. The ceramic was calcined at temperature 850 ^oC and sintered at 1090 ^oC. The XRD pattern revealed the formation of pure perovskite phase having tetragonal symmetry of the synthesized ceramic. The surface morphology was studied using FESEM technique for the ceramic. The well defined grains with homogeneous microstructure were observed. The average grain size was found to be ~570 nm. In dielectric measurements, a high value of transition temperature (T_m~305 ^oC) and high value of maximum dielectric permittivity ~ 2110 (at 1 kHz) were obtained. Also, a very small value of dielectric loss (<0.6) was observed. The piezoelectric charge coefficient was obtained to be (d_{33} ~ 550 pC/N) for the ceramic. P-E hysteresis loop were traced and the value of spontaneous polarization was found to be ~11μC/cm^2 at room temperature. The pyroelectric coefficient was obtained to be very high (p ~ 1870 μCm^{-2} $^oC^{-1}$) for the present case. NKLNTS ceramic showed fatigue free nature upto 10^7 cycles. Thus, the synthesized ceramic is potential candidate for dielectric, piezoelectric and ferroelectric applications such as transducers, actuators, multilayer capacitors and memory devices etc.

Keywords: Lead-free ceramic, Field emission scanning electron microscopy, Piezoelectricity, Ferroelectricity

Oral – OT63

Structural and optical study of GaN thin films grown on sapphire substrate using Laser Molecular Beam Epitaxy technique.

Gunjan Yadav[1]*, Monika Tomar[2] and Vinay Gupta[1]**

[1]*Department of Physics and Astrophysics, University of Delhi, Delhi-110007, INDIA*

[2] *Department of Physics, Miranda House, University of Delhi, Delhi-110007, INDIA*

*e-mail: *gunjanyadav176@gmail.com, **vgupta@physics.du.ac.in*

Gallium Nitride (GaN) is an extensively employed Group-III nitride for application in UV-Photodetectors , LEDs etc. Conventionally, optimum quality GaN thin films are grown by techniques such as Metal Organic Chemical Vapour Deposition (MOCVD), Molecular Beam Epitaxy (MBE) or Vapour Phase Epitaxy (VPE). However, Laser MBE (LMBE) is a novel and relatively less explored growth technique for the fabrication of crystalline GaN thin films in NH_3 free environment at moderate temperatures. Thus, optimization of processing parameters is a crucial step for the establishment of such new deposition techniques.

In the present work, high purity polycrystalline GaN target was employed for the deposition of GaN thin films using Ultra High Vacuum (UHV) - LMBE system. Fourier-transform infrared (FTIR) spectroscopy has been employed to examine the optical properties of the deposited GaN thin films in Infrared spectrum. Structural properties were studied using X-Ray diffraction (XRD).

The FTIR spectrum confirmed the successful formation of single phase GaN thin films on Si(111). XRD pattern confirmed the formation of highly (0002) oriented GaN thin films with c-axis normal to the substrate surface .

Keywords: Gallium Nitride(GaN), Laser MBE

Oral – OT64

Theoretical simulations of SAW based sensor on PVDF

Manisha Bharati[1], Lokesh Rana[1], Monika Tomar[2],Vinay Gupta[1]*

[1]*Department of Physics and Astrophysics, University of Delhi, Delhi-110007, India*

[2]*Department of Physics, Miranda House, University of Delhi, Delhi-110007, India*
**Email: drguptavinay@gmail.com*
Web: http://emdl.du.ac.in

In this modern era of industrialization, sensor technology has grown rapidly. Among many others, Surface Acoustic Wave (SAW) based sensors have expanded due to their miniaturized dimensions, quick response, durability and stability of fundamental frequency. SAW based sensors can be used for the sensing of gases, liquids, chemical agents and biomolecules as well. Additionally, the wearable technology is emerging now a days in biomedical sector. This invites the role of flexible polymers as a substrate for the fabrication of SAW based sensors. Polyvinylidene fluoride (PVDF) is a polymer exhibiting a very good piezoelectricity, which is a key requirement for the fabrication of SAW based devices. To avoid the cumbersome and time-consuming experimental optimization of a device, it is wise to model and simulate the device theoretically.

In the present work, a PVDF based flexible membrane of 100micron thickness is being designed. It's response towards any analyte, which causes mass loading effect to the membrane is being studied theoretically. The fundamental frequency of the device was found to be 80MHz. The coupling coefficient of the device was also being studied to ensure good sensitivity of the device. Overall, size of the device studied here is 10mm×5mm, which can be varied depending upon the requirements. Finite element simulations to determine the optimum parameters is being performed using COMSOL Multiphysics.

Oral – OT65

Growth and optimization of *Pbam* $Bi_2Fe_4O_9$ and *R3c*phase of $BiFeO_3$ by pulsed laser deposition

Shaan Ameer[1], Kajal Jindal[1], Monika Tomar[2], Pradip K. Jha[3], Vinay Gupta[1]*

[1]*Department of Physics and Astrophysics, University of Delhi, New Delhi-110007, India*

[2] *Department of Physics, Miranda House, New Delhi-110007, India*

[3]*Department of Physics and Astrophysics, Deen Dayal Upadhyaya College, New Delhi-110078, India*

*Corresponding author: vgupta@physics.du.ac.in

Abstract: The growth of high-quality multicomponent oxide thin films is challenging yet crucial for the enhanced functionality of the material. The phases of bismuth iron oxide: *Pbam* ($Bi_2Fe_4O_9$) and *R3c* ($BiFeO_3$) have been reported to be potential candidate for the development of futuristic devices based on visible light photocatalysis and photovoltaics respectively. Highly oriented (along <121> direction) single phase (pbam) $Bi_2Fe_4O_9$ thin films are grown using pulsed laser deposition. The optimized conditions of the growth of the high quality $Bi_2Fe_4O_9$ thin films are obtained at low oxygen partial pressure of $10 - 150$ mTorr and the laser fluence of 1.5 J/cm^2. The structural, morphological and optical characterization of the deposited $Bi_2Fe_4O_9$ reveal the influence of oxygen partial pressure on the structure and morphology of the deposited thin films. It is found that the signature of rhombohedral *R3c* phase of $BiFeO_3$ (BFO) appear for the thin films deposited at higher partial pressure of oxygen (200 mTorr). The laser fluence is found to play a profound role in influencing the formation of *R3c* phase which was optimized further by varying oxygen partial pressure. The *R3c* BFO can be grown at 300 mTorr under laser fluence of 2.5 J/cm^2 during PLD.

Oral – OT66

Photovoltaic response of Sol gel derived PZT thick films under UV illumination

Vandana[1], Reema Gupta[1], Monika Tomar[2], Vinay Gupta[1*]

[1]*Department of Physics and Astrophysics, University of Delhi, Delhi-110007*

[2]*Department of Physics, Miranda House, University of Delhi, Delhi-110007*

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

In recent years, energy harvesters have become very important to meet the demand of energy by generating power from the waste energy available in the surrounding. It has become the most important field for the research community for the past few decades. Traditional energy sources for example fossil fuels, coals have their own limitations such as environmental pollutions like global warming, limited life time and requirement of large maintenance. Therefore, Research community is exploring different means of generating voltage either by wind, solar, mechanical, thermal or hydro energy. A lot of research attempts have been made for harvesting the energy from these renewable sources. Solar energy has been considered in the present work which can be used to generate the voltage through photovoltaic effect. The ferroelectric photovoltaic response characteristics of Lead Zirconate Titanate (PZT) thick film in metal-ferroelectric-metal (MFM) configuration is studied upon exposure to UV radiations. Lead Zirconium Titanate $Pb_{1.1}(Zr_{0.4}Ti_{0.6})0_3$ thick films have been fabricated on Nickel (Ni) substrate at different annealing temperatures using modified sol-gel technique. PZT thick films are found to be in single phase without any pyrochlore phase. Significant increase in photocurrent from $2.9* 10^{-11}$A to $3.8* 10^{-6}$A is observed for the prepared ferroelectric photovoltaic film under UV illumination.

Synthesis and incorporation of copper nanoparticles into the Carbon fiber matrix to absorb microwave pollution

Monika Mishra[1], Avanish Pratap Singh[2*], Pawan Kumar[2], Vidya Sagar[3], Hilal Ahmad Reshi[4], Rakesh Kumar Chikara[5] and Rajeev Kumar[6]

[1]*Department of Physics, Netaji Subhas University of Technology, Delhi – 78 (India)*

[2]*Department of Physics, Atma Ram Sanatan Dharma College, University of Delhi, Delhi –21*

[3]*Polymeric & Soft Materials Section, CSIR-National Physical Laboratory, New Delhi –12*

[4]*Department of physics, Govt. Degree College, kulgam, Jammu & Kashmir -192231-(India)*

[5]*Maharaja Surajmal Institute of Technology, Indraprastha University, Delhi -110058 (India)*

[6]*Light Weight Metallic Materials Division, CSIR- Advanced Materials and Processes Research Institute, Bhopal - 462026 (India)*

Abstract

Gigantic development in nanotechnology has made electronic systems smaller and has increased the density of electrical components within a device. On the other hand, it has created a new kind of problem called electromagnetic Interference (EMI). To provide an adequate solution for the EMI problem, the shielding or absorbing of the electromagnetic field is taken into account. Carbon based conducting nanocomposites can play an important role as shielding material. The matrix of C-Fiber and copper nanoparticles leads to formation of thin composite sheets possessing unique combination of both electrical and magnetic properties which makes them suitable material for electromagnetic shielding since electromagnetic waves constitute both electric field (E) and magnetic field (H) components. The ratio over E to H factor (impedance) has been subjugated for the shielding purpose. In the present work, an attempt has been made to evaluate and improve the electromagnetic shielding behavior of the copper nano particles incoporated carbon fiber matrix. Composite sheets consisting of phenolic resin filled with a mixture of copper nanoparticles and carbon fibers have been produced by compression molding. Its electrical conductivity lies in the range 0.94–4.09 S/cm. Scanning electron microscopy observations confirm the presence of nanoparticles of copper nanoparticles and carbon fiber (~1-2 mm) which gives flexural strength to composite sheets. Thermo gravimetric analysis show that the thermal stability of the sheets depends upon the amount of Cu/C-fiber and phenol resin in the composite. microwave absorption properties of the sheets have been studied in 12.4-18 GHz (Ku-band) frequency range. The maximum shielding effectiveness is observed 31.0 dB, which strongly depends on the dielectric loss and volume fraction of copper nanoparticles and in carbon fiber matrix.

Corresponding author. Department of Physics, Atma Ram Sanatan Dharma College, University of Delhi, New Delhi 110021, India.
E-mail address: apsrajput@arsd.du.ac.in (**Avanish Pratap Singh**)
ORCID.ID 0000-0002-8598-9633

Utilization of waste Flyash as cost effective Microwave shield

Monika Mishra[1]*, Avanish Pratap Singh[2] and Hema Bhandari[3]

[1]*Department of Physics, Netaji Subhas University of Technology, Delhi –78*

[2]*Department of Physics, Atma Ram Sanatan Dharma College, University of Delhi, Delhi –21*

[3]*Department of Chemistry, Maitreyi College, University of Delhi, Delhi – 21*

ABSTRACT

The modular bricks samples of size 9 inch× 4.5 inch×3 inch were cast in lab using the flyash, sodium bentonite and 2M NaOH solution in water in different weight ratios of flyash and additive sodium bentonite with different weight ratio of expanded graphite. The samples were mixed with sufficient quantity of NaOH solution to obtain working consistency for moulding. The samples were tested for different characterizations. The SEM examination was carried out to determine the particle size of flyash samples. The average particle size of flyash sample was 0.87 μm. Two distinct morphologies have been observed in fly ashes: well-rounded, solid spheres; and well-rounded cenospheres. XRD patterns of the flyash and the flyash brick materials were carried out. It can be noticed that the FA contains majority of Quartz (Q) and Mullite (ML) as crystalline ingredients, which have distinct peaks. FTIR shows each of the spectra of flyash and flyash brick have the three wide bands characteristic of the internal vibrations in silicates. The variation of hardness with different expanded graphite and sodium bentonite wt% loading in flyash brick were carried out. Hardness is found to increase with the increase in loading of expanded graphite and sodium bentonite in flyash brick. A small variation in hardness value with the increase in expanded graphite loading of 6% and sodium bentonite loading after 20 % in flyash brick indicates that 20 % loading of sodium bentonite and 6% loading of expanded graphite is enough for getting the desired value of shore hardness. These bricks can be considered to have improved mechanical properties over the conventional red bricks used in building construction. Flyash brick material containing 6 weight% loading of expanded graphite and 20 weight% loading of sodium bentonite shows total shielding effectiveness value up to 20 dB.

Keywords: Flyash, Sodium bentonite, Hardness, Electromagnetic absorbers, EMI shielding

Corresponding author: Department of Physics, Netaji Subhas University of Technology, Delhi – 110 078 (India)

E-mail address: monikanpl@gmail.com (**Monika Mishra)**

Oral – OT69

Significant enhancement in energy storage performance of (1-*x*) BaTiO3 – *x*SrY0.5Nb0.5O3 composite ceramics

Aditya Jain[a], Vinay Kumar[1a], a, and Amit K Vishwakarma[b]

[a] *Department of Electronics and Communication Engineering, Graphic Era (Deemed to be University), Dehradun, Uttarakhand 248002*

[d]*Department of Physics, Atma Ram Sanatan Dharma College, University of Delhi, Delhi –21*

Abstract

A noble lead-free (1-*x*)BaTiO3 – *x*SrY0.5Nb0.5O3 (*x* = 0.0, 0.05, and 0.10) composite ceramics were prepared by two-step ball mill process. The changes in morphological characteristics, phase transformation, and energy storage performance have been comprehensively studied to assess the commercial application of synthesized materials in energy storage capacitors. The substitution of *x*SrY0.5Nb0.5O3 (SYNO) in BaTiO3 (BT) has resulted in slight enhancement in microstructural density coupled with small reduction in grain size of the material. The morphological study of the synthesized materials shows an excellent dispersibility, which further indicate good compatibility between BT and SYNO phases. The pure BT sample exhibit a classical dielectric behavior with a sharp dielectric peak; however, a progressive increase in SYNO substitution has led to transformation of material into a relaxor ferroelectric. The ferroelectric loops have become frequency dispersive and relatively slimmer with SYNO substitution. Among the three synthesized samples, the sample with *x* = 0.05 SYNO concentration exhibit the highest discharge energy density (1.14 J/cm3) and energy efficiency (73.2%). The improvement in electrical properties along with energy storage performance in SYNO substitutes BT composite ceramics is ascribed to reduction in grain size, enhancement in material density and relatively better grain boundary interface.

[1]*Corresponding author: Dr. Vinay Kumar (vnykmr7@gmail.com)*

Oral – OT70

Detection of Water Quality for Purity Assurance Using Optical Means

Reema Gupta[1], Deepak[1] , Mani Tyagi[1] , Adarsh Singh[1,*]

[1]*Department of Physics, Hindu College, University of Delhi, Delhi-110007, India*

* *adarshsingh@hinducollege.ac.in*

ABSTRACT

Advancement in the technological development ushers undesirable effects, especially on the environment. Water pollution is one of the major concerns in many areas worldwide, having adverse consequences on human hygiene. Therefore, detection of quality of water is the only measure in decimating its adverse effects. Many purifiers are available in the market for improving the quality of water. However, while aiming for cleaner water using modern techniques, the presence of desirable ions in water is compromised, thus improving the quality of water at the cost of drastically reduced content of ions required for human consumption. This makes the choice of filter very important. In the present work an initiative has been sequenced to survey the quality of water from different sources using optical technique, which isa powerful way of determining physical properties of liquids precisely. The analysis has been carried out using the principle of minimum deviation to detect variation in refractive index using, spectrophotometer, light source and hollow prism. The variation in refractive index has been studied with temperature for four different samples, namely, ground water, distilled water, tap water and RO water. The results strongly indicate the detection of ions in water samples thus signifying the importance for selection of mode of filtration.

Keywords: Refractive index, water quality, ion content, filtration

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Oral – OT71

Biocompatible Hydroxyapatite Phosphor via Surfactant Assisted Aqueous Precipitation Method for security application

Kaushal Jha[2], Amit Kr. Vishwakarma[3], M. Jayasimhadri*[,1]

[1]*Luminescent Materials Research Lab (LMRL), Department of Applied Physics, Delhi Technological University, Delhi 110 042, India*

[2]*Bhagalpur College of Engineering, Bhagalpur-813210, Bihar, India*

[3]*Department of Physics, Atma Ram Sanatan Dharma College, University of Delhi, Delhi –21*

**Corresponding Author: jayaphysics@yahoo.com, kaushaljha096@gmail.com*

Abstract

Terbium doped hydroxyapatite (THA), Tb:$Ca_{10}(PO_4)_6(OH)_2$ phosphors were synthesized via surfactant (CTAB) assisted aqueous precipitation method. The synthesis was carried out at room temperature, except the sintering procedure at 550 ^oC for the removal of residual organic compounds. The phase, morphology, luminescent properties of THA powders were examined by using X-ray diffraction, scanning electron microscopy (SEM), excitation and emission spectra. SEM image shown in figure indicates the formation of 'micro-cubes' with uniform size distribution. Excitation spectra measured for by monitoring 541 nm emission wavelength. Emission spectra measured for the THA samples by exciting the samples at 377 nm wavelength and the samples exhibit emission bands at 493, 543, 584 and 620 nm originating from the $^5D_4$ excited state to ^7F_J (J = 6, 5, 4, 3) states of Tb^{3+}, respectively. The intensities of the emission peaks were found to be increasing with the increase of terbium concentration. The CIE chromaticity coordinates calculated for the synthesized THA phosphor, which indicates that the terbium doped hydroxyapatite phosphor exhibits yellowish green emission under 377 nm excitation.

Antiwear Nano-lubricants of Calcium-doped zinc oxide: Applicable to Tribological Activities

Kalyani[1]*, Gurmeet Singh[1]

Department of Chemistry, University of Delhi, Delhi-110007

Abstract:

The tribological properties of zinc oxide (ZnO) and 12% calcium doped zinc oxide nanoparticles (ZCOs)have been investigated by performing standard tests, ASTM D4172 and D5183on afour-ball tester. All the nanoparticles were synthesized through auto combustion method. Calcium doped zinc oxide nanoparticles of different size were prepared by varying the calcination temperature as 600^{o}C (ZCO-1) and 1000^{o}C (ZCO-2) respectively. The synthesized nanoparticles have been and characterized by various state-of- the art techniques such as powder X-ray diffraction (PXRD) and transmission electron microscopy (TEM) coupled with energy-dispersive X-ray (EDX). Incorporation of calcium as a dopant was found to enhance the antiwear and antifriction behavior of the ZnO nanoparticles. The nanoparticles ZCO-1 with smaller size, 25nm provided much better results as compared to ZCO-2, 35 nm. Furthermore, a stable suspension of the synthesized nanoparticles was prepared with an anionic sodium dodecyl sulphate surfactant (0.25% w/v with 0.1% SDS) which increased substantially the antiwear properties and reduced simultaneously the friction between moving metal surfaces. Thus, the enhanced tribological propertiesmay result in the commercial deployment of these nano-lubricants in lubrication industries.

Keywords: Nanomaterials; Tribological properties; Calcium-doped zinc oxide,Surface characterization; Four-ball tester;Nano-lubricants

Poster –PP1

Sensitivity enhancement by using adlayer MoS_2 heterostructure in a common path Mach-Zehnder interferometric method for biochemical sensor

Abhishek Upadhyay, Vivek Singh

Department of Physics, Institute of Science, Banaras Hindu University, Varanasi -221005, India

Email: abhishekupadhyay218@gmail.com, Viveks@bhu.ac.in

The heterostructure of two-dimensional (2D) MoS_2 material are promising and useful in the field of biochemical sensors. In present communication, we enhance the sensitivity of a three-layer planar polymer optical waveguide having an ad-layer of MoS_2 material. Here a common path Mach-Zehnder interferometric method is presented for biological sensing applications. The effective refractive indexes of fundamental modes (TE_0, TM_0) are obtained at considered wavelength range and hence the difference of their propagation constant is calculated. It is found that the difference of propagation constant attains its maximum value at certain wavelength, and gives a parallel shift along the function value, when we increase the value of cover refractive index. The interference signal maxima at output are considered as sensing signal. The maxima of interference signal are shifted sufficiently with the cover refractive index near the maxima value of propagation constant.

Poster –PP2

Exploration of corrosion protective properties of geopolymer based coating for structures of mild steel

Akshay Singh Tomar [1], Rahul Arya [1], Deepti Mishra[1, 2,]*, Archana Singh[1, 2], Sunil Kumar Sanghi [1, 2]

[1] *Academy of Scientific and Innovative Research (AcSIR) - AMPRI, Bhopal, India*

[2] *Materials for Radiation Shielding and Cement Free Concrete Division, CSIR-Advanced Materials and Processes Research Institute (AMPRI), Bhopal- 462026 (M.P.) India*

** Corresponding authors: deeptimishrampri@gmail.com*

Abstract:

Geopolymers are fabricated by activation of aluminosilicate materials in highly alkaline solution. They are green materials because they can be prepared by utilizing silicoaluminous waste materials containing amorphous alumina and silica. Generally fly ash, red mud, metakaolin and blast furnace slag are used as raw materials for the preparation of geopolymer. Geopolymers possess wide application spectrum in areas like aerospace, construction, drug delivery, coating and many more. Among various well-known applications of geopolymer, coating application has attracted increasing attention in recent years. The present work aimed to explore corrosion protective properties of geopolymeric coating material prepared by solid state environment friendly advanced geopolymerization process utilizing industrial waste, alkali activators and additives. Developed material is coated on mild steel using spray coating technique. Developed coating material was investigated for adhesion strength, scratch test, porosity, impact test, water absorption and corrosion resistance by accelerated salt fog test as per IS methods. Based on these results it is found that the developed coating material provides excellent corrosion protection for mild steel substrate and is also suitable for the commercial application to enhance the service life of mild steel-based structure.

Keywords: Geopolymer, aluminosilicate sources, coating, corrosion

Poster – PP3

Self-Assembled 3D Graphene-Based Aerogel with Au Nanoparticles as High-Performance Supercapacitor Electrode

Bibhuti Bhusan Sahoo[a], Niraj Kumar[b], Seema Chauhan[c], Himanshu Sekhar Panda[d], Prasanta Kumar Sahoo[a,*]

[a]*Department of Mechanical Engineering, Siksha 'O' Anusandhan, Deemed to be University, Bhubaneswar-751030*

[b]*Department of Electronic Engineering, Incheon National University, Incheon 21999, Republic of Korea*

[c]*Department of Paper Technology, Indian Institute of Technology Roorkee, Saharanpur Campus, Saharanpur, 247001, India*

[d]*Sustainable Energy Laboratory,Department of Metallurgical and Materials Engineering, Defence Institute of Advanced Technology (DIAT), Pune 411025, Maharashtra, India*

[*]Corresponding author: prasantakumarsahoo@soa.ac.in

Abstract

Construction of porous three-dimensional (3D) heterostructured materials is promising for establishing high-performance energy-storage devices, which enables large surface area, facilitated ion and electron transport, and synergistic effects between multi-components. Here, we report a simple and cost efficient freeze-casting method to improve the electrochemical performance of porous 3D graphene aerogel by embedded gold nanoparticles (3D-GA/Au). The as-synthesized 3D-GA/Au was broadly characterized by XRD, Raman, SEM, and TEM. Morphology observations show that 3D-porous cellular structure of 3D-GA/Au with uniform distribution of 20 nm Au nanoparticles on the surface of graphene sheets. Based on structural merits, the electrochemical performance of as-synthesized porous 3D-GA/Au was exemplified as electrode materials for supercapacitor with a high specific capacitance of 356 F g^{-1} at 5 mVs^{-1}, and excellent cycling stability with a capacitance retention of 98 % after 1000 cycles at 100 mVs^{-1} in 1 M KOH electrolyte. In addition, the developed electrode materials are used to fabricate an asymmetric solid-state supercapacitor (ASC) device for demonstrating the practical applicability. Our method opened a new direction to synthesize porous 3D GA with various nanoparticle decorations for numerous applications as energy storage devices, catalysis, sensors, biomedical, and environmental applications.

***Keywords*:** 3D graphene aerogels, Au nanoparticles, freeze-casting method, Porous architectures, supercapacitor, ASC device

Poster – PP4

First-principles Calculation of Sb_2Te_3 Topological Insulator Under Pressure

Debarati Pal[1], Swapnil Patil[1] and Sandip Chatterjee[1]

[1]*Dept. of Physics, Indian Institute of Technology (BHU), Varanasi-221005*

Abstract- The theoretical density of states (DOS) along with bandstructure (BS) has been evaluated for Topological insulator Sb_2Te_3 upon pressure. The density functional theory (DFT) calculation shows electronic topological transition (ETT) under the application of pressure. When pressure is applied conduction band and valence shifts significantly which is indicated as electronic transition of the Fermi surfaces. The band gap between conduction band and valence band reduced at Z-high symmetry point whereas it is overserved to enhance at Γ-point with increase in pressure. Interestingly, we found semiconductor to metal transition near 2 GPa with LDA approximation [1]. The overall change in the Fermi surfaces is found to follow other topological materials like Bi_2Te_3, Sb_2Se_3 and Bi_2Se_3.

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Poster – PP5

Nano-formulation for respiratory disorders

Deepanshi Pathak[1] and Dr Rachana[1]*

[1)]*Jaypee Institute of information Technology, Noida, India, deepanshipathak14@gmail.com*

**Communicating author, Assoc. Prof. Department of Biotechnology, JIIT Noida, Sector 62, India 201307, rachana.dr@iitbombay.org*

Abstract

Our respiratory system is susceptible to various infections such as: tuberculosis, pneumonia, and other bacterial and viral infections. Other than these, there are other disorders like asthma, COPD and ARDS, as well. There are conventional strategies to deal with such pulmonary complications which are suffering from various obstructions including non-compliance to the patients and reach of low concentration of the drugs at the site of infection. To deal with such issues nano-engineered systems are being explored to develop inhalable nanomedicines which can enhance the effectiveness, compliance and quality of life, for the patients There are various types of nanosystems such as polymeric nanoparticles, lipidic nanoparticles and liposomes, etc., which have been inspected for the pulmonary delivery of various drugs. Various nano-formulations have upgraded the profile of many drugs by avoiding their side-effects and lowering the drug degradation. Apart from this, nano-formulations also offer an approach for direct delivery in the lungs which can be a viable option for local and systematic therapy of pulmonary infections. The present article analyses various types of nano-systems for pulmonary delivery and the future prospects for the same.

Poster – PP6

Hydrothermal Growth of MoS_2 Quantum Dots for Catalytic Hydrogen Evolution

A.P. Sunitha[1], K. Sandeep[2], O. K Devika[1], P. Praveen[3], K. J. Saji[3]

[1]*Department of Physics, Government Victoria College, Palakkad, Kerala-678001,University of Calicut*

[2]*Department of Chemistry, Government Victoria College,Palakkad, Kerala– 678001, University of Calicut*

[3]*International School of Photonics, Cochin University of Science and Technology, Kochin-22*

E-mail: sunivictoria82@gmail.com

Extended Abstract

The unique properties of two-dimensinonal (2D) transition metal dichalcogenides (TMDs) have been attracting researchers in smart material engineering. In the family of these TMDCs, MoS_2 is one of the most important one due to its quantum confinement properties and catalytic efficiency. The development of an earth-abundant and inexpensive catalyst for hydrogen evolution (HE) is highly desirable. HE is an example of two electron transfer reaction with one catalytic intermediate and offers the potential to produce hydrogen, a critical chemical reagent and fuel. HE is a best solution for tackling the huge energy crisis. The use of catalyst will minimize the overpotential that is needed to achieve the HE. HE performance of MoS_2 is purely depending upon electro catalytic activity of edge sulfur sites only, since in-plane sites are inert to electro catalytic activity. Therefore, increasing the number of edge active sites without compromising stability and excellent electrical properties are the current challenges faced by scientific community. In this work hydrothermal method is adopted for the synthesis of MoS_2 quantum dots (MoS_2 QDs) with ammonium tetra thiomolybdate (ATTM). The optimization of the prepared MoS_2 QDs shows the uniform size formation of the MoS_2 QDs with an average size 3 nm. Figure 1(a-b) shows the appearance of MoS_2 quantum dots prepared after hydrothermal method and MoS_2 quantum dot solution. Figure 2a shows the transmission electron microscopic image of prepared quantum dots. Photoluminescence emission is observed to be peaking at 553.3 nm. The photoluminescence emission confirms the small size of the QDs. MoS_2 QDs can be used as an efficient catalytic material for HE in acidic media, a carbon free method of Hydrogen evolution. Driving the HER with renewable sources of energy can lead to sustainable source of H_2 fuel that can stored, transported and used in a zero-emission fuel cell of combustion engine.

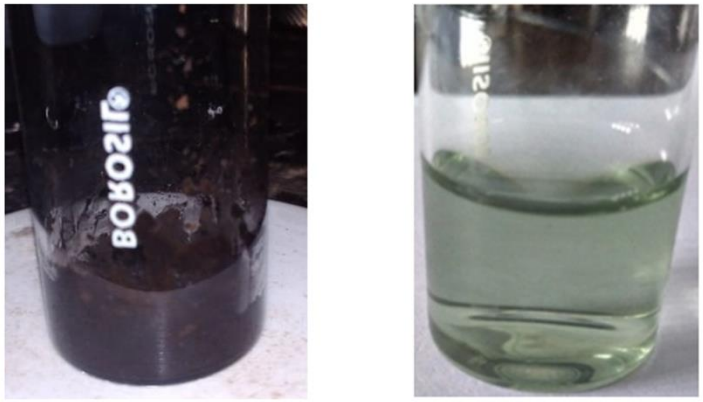

Figure 1: (a) MoS2 quantum dots after hydrothermal preparation (b) MoS2 quantum dot solution

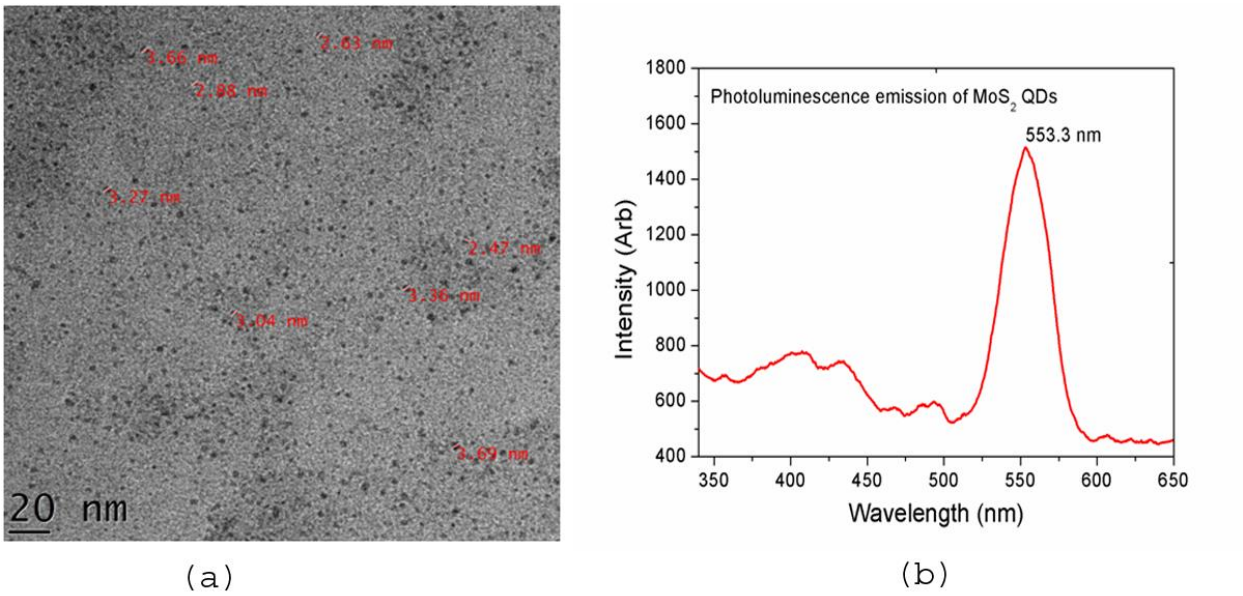

Figure 2: (a) Transmission electron microscopic image of MoS2 quantum dots (b) Photoluminescence emission exhibited by MoS_2 quantum dots

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Poster – PP7

Interplay of magnetism and ferroelectricity in charge ordered manganites

Vinay Kumar Shukla*

**Department of Physics, Indian Institute of Technology Kanpur, Kanpur-208016, U.P.*

Abstract

Interplay of magnetism and ferroelectricity plays a vital role in development of low power consuming data storage devices. The modulation in electron density in charge ordered manganites (CO-M) leads to breaking of inversion symmetry and periodic displacements in lattice via electron-phonon coupling. The magnetic properties in these strongly correlated systems are highly sensitive towards external perturbations such as chemical doping, crystallite size variations, temperature etc. In this article, we discuss the competing nature of magnetic and ferroelectric properties of CO-M by specific case of $Pr_{1-x}Ca_xMnO_3$.

Poster – PP8

Role of silver nanoparticles for enhancing pea productivity and its comparison with chemical pesticides under *in situ* conditions

Poonam Rani[1], Lily Trivedy[1], Shailendra Singh Gaurav[2], Amardeep Singh[2] and Gyanika Shukla[2]

[1]*Department of Soil Science, Jayoti Vidyapeeth Women's University, Jaipur, Rajasthan, India.*

[2]*Department of Genetics and Plant Breeding, Chaudhary Charan Singh University, Meerut*

Abstract

In developing country, agriculture surplus is the most important factor which influences the economic development of a country. For an optimum production of agriculture products, chemical pesticides have become necessary for farmers, but chemical pesticides have the major impact on the environment and human health also. So, to overcome from these problems in agriculture sector, nanotechnology play a great role in this sector, due to its promising role. Use of nanopesticides is to improve crop yield and reducing the harmful agents in crops. This study focused on the synthesis of silver nanoparticles from *Bambusa vulgaris, Ocimum tenuiflorum* and their used as pesticides to protect the pea plants from fusarium wilt. Further,the characterization of synthesized silver nanoparticles by UV-Vis Spectroscopy showed peak between the wavelengths range from 390 nm to 590 nm. Synthesized silver nanoparticles were also characterized by other techniques such as Field Emission Scanning Electron Microscopy (FESEM) showed even shaped spherical nanoparticles. Energy Dispersive X-Ray (EDX) showed absorption peak approximately at 3 keV and confirmed the elemental composition. Fourier Transform Infra-Red (FTIR) showed chemical interactions of silver nanoparticles with molecules present in the environment. Inductively coupled plasma-mass-spectrometry (ICPMS) analysis was facilitated to confirm the concentrations of the synthesized nanoparticles and Atomic force microscope (AFM) depicted the three-dimensional structure of silver nanoparticle. The study focused on characterization of *Fusarium sp.* from soil and comparison of efficacy of chemical fungicides and silver nanoparticles against Fusarium wilt in pea plants under *in situ* condition, the data was analyzed by SPSS software version 16.0. There was significant difference ($p \geq 0.05$) between the growth and yield aspects of the control and silver nanoparticles treated plants *in situ* condition. The efficacy of chemical fungicides and nanopaticles against Fusarium wilt was found to be comparable.

Keywords: Silver nanoparticles, nanopesticide, crop improvement, UV-Vis spectroscopy, FESEM, FTIR, EDX.

Poster – PP9

New Generation Red Mud Based X- ray Shielding Tiles

Rahul Arya[1], Rini Paulose [2], Varsha Agrawal[1], Akshay Singh Tomar[1], Abhishek Giri[2], Sunil K Sanghi [1, 2], Deepti Mishra [1, 2], and Shabi Thankaraj Salammal [1, 2] *

[1]*AcSIR-Advanced Materials and Processes Research Institute, Bhopal – 462026*

[2]*CSIR-Advanced Materials and Processes Research Institute, Bhopal – 462026*

** Correspondence: tsshabi@ampri.res.in / tsshabi@gmail.com*

Abstract: Red mud is an alumina industrial waste, which is produce during the production of alumina from the bauxite ore through Bayer process. It contains quite considerable amount of Fe_2O_3, Al_2O_3, TiO_2, $CaCO_3$, SiO_2, and other high Z elements that are suitable for high energy X- and ϒ-ray attenuation. Across the globe, nearly 4.7 billion tons of red mud have been left unused in the disposal plants due to inadequate technologies for the large scale utilization of it (Figure 1a).[1] Currently, 2-3% of red mud has been utilized by the construction sectors industries to fabricate cements, bricks, road construction, etc. The rest are left unused in the disposal plants and stored safely due to its hazardous nature. India is the third top most producer of red mud.

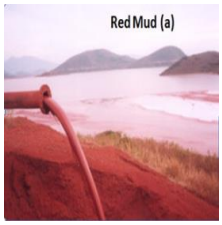

Figure 1: (a) Red mud disposal plants, (b) red mud tile and (c) CT scanner room.

We have converted this iron rich red mud into X-ray shielding tiles (Figure 1b) as an alternative of toxic lead, heavy weight concrete, barite boards, etc.[2] Since the density and atomic number of the material plays a crucial role in the attenuation of high energy X- and γ-rays, ≈3.4 g/cc red mud tiles were fabricated using red mud by adding certain weight percentage of Bismuth. The tiles were fabricated through ceramic route. Various percentage of Bismuth and Bismuth+Binder compounds were mixed with the red mud in a ball mill and then green compacted by applying 60 kg/cm^2 pressure. The green tiles of having dimension 10 x 10 x 1 cm^3 were fabricated using stainless steel mold. The green tiles were dried in hot air oven and then sintered between 900 -1150°C. The X- ray attenuation characteristics of the tiles were studied using 100 kVp, 120 kVp and 140 kVp X-ray photons and summarized in Table 1. The red

mud tiles made using red mud:Bismuth+Binder mixture shows the highest attenuation coefficient as compared to the red mud:Bismuth and red mud compounds due to its highest density (3.4g/cc) and atomic number. The half value layer (HVL) of the tiles were found to be 0.9751mm, 0.9804mm and 8.50mm for the red mud:Bismuth+Binder, red mud:Bismuth and red mud compounds, respectively. The 6.29mm thick red mud:Bismuth+Binder, 8.29mm thick red mud:Bismuth and 71.56691mm thick compound was found to be possess the attenuation of 2mm thick lead at 140 kVp, respectively, which is suitable to use in X-ray diagnosis, CT scanner and Cath labs to shield hazardous X-rays. No heavy elements were found to leach out from the tiles.

Tiles	**Attenuation Coefficient (mm^{-1})**	**HVL (mm)**	**TVL (mm)**	**Density (g/cc)**	**Thickness equivalent to 2mm lead (mm)**
Red mud	0.08	8.50	28.23	2.12	71.57
Red mud: Bismuth compound	0.71	0.98	3.26	3.02	8.29
Red mud: Bismuth + binder compound	0.72	0.98	3.24	3.41	6.29

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Poster – PP10

Antibacterial Property of Graphene oxide Nano flakes

Shani Kumar[1,2], Prateek Kumar[1], Amit Garg[1,*],Arijit Chowdhuri[1]

[1]*Acharya Narendra Dev College (University of Delhi), Kalkaji, New Delhi-110019, INDIA*

[3]*Department of Electronic Science University of Delhi, South campus, New Delhi-110021, INDIA*

[*]*Corresponding author: Email: amitgarg@andc.du.ac.in*

Abstract: Graphene oxide, a 2D material has so many unique properties like high surface to volume ratio, high sensitivity and mechanical strength, immense chemical stability, strong hydrophilicity and excellent antifouling properties and many more [1-3]. In this paper, we are reporting the antibacterial property of graphene oxide nano flakes that has potential applications in the development of graphene oxide membranes for water purification. Since antifouling membrane material is required for long time service, the present study focuses on the determination of minimum inhibitory concentration (MIC) using microdilution method [4-5], where MIC is defined as the lowest concentration of the bio active agent that inhibits the growth of microbes. On the basis of the results, it has been concluded that GO have very good antibacterial activity against the E.coli and it will act as an antibacterial agent in GO membrane for water purification.

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Poster – PP11

Comparative analysis of silica fiber Bragg grating and chalcogenide fiber Bragg grating

Souryadipta Maiti

Department of Physics, Banaras Hindu University

Abstract-

Sensing performance of silica fiber Bragg grating and chalcogenide fiber Bragg grating in presence of Bessel and Gaussian apodization functions are studied and compared. These fibers are compared on the basis of their sensitivity, detection accuracy, quality parameter and sidelobe suppression ability. Using couple modes theory and matching the fields at various boundaries the reflectivity equations are obtained. For considered apodization profiles, it is observed that the sidelobe suppression ability and sensitivities are nearly same in both chalcogenide and silica fiber Bragg grating. Since, full width half maxima value in chalcogenide-based fiber Bragg grating having Bessel apodization function is smaller therefore its detection accuracy and quality parameter is higher in our all considered cases. Hence chalcogenide-based fiber Bragg grating with Bessel apodization function is recommended for sensing application.

Poster – PP12

Green Conversion of Red Mud into X-Ray Opaque Material

Varsha Agrawal[1], Rini Paulose [2], Rahul Arya[1], Sunil K Sanghi [1, 2], Deepti Mishra [1, 2], Akshay Singh Tomar[1] and Shabi Thankaraj Salammal [1, 2] *

[1]AcSIR-Advanced Materials and Processes Research Institute, Bhopal – 462026 (Madhya Pradesh), India.

[2]CSIR-Advanced Materials and Processes Research Institute, Bhopal – 462026 (Madhya Pradesh), India.

**Correspondence:tsshabi@ampri.res.in / tsshabi@gmail.com*

Red mud (RM) is the tailing generated during the production of Alumina from its ore. Globally ≈150 million tonnes of red mud/bauxite residue is generated annually. Red Mud is highly alkaline and poses very serious and alarming environmental problem. It comprises of oxides of iron, titanium, aluminium and silica along with some other minor constituents. Large scale utilization of such noxious waste is still lacking. In the present investigation, experimental study was conducted for the development of radiation shielding tiles by mixing various percentages of high Z materials and binders with red mud to improve its density. The red mud samples were characterized by X-ray diffraction (XRD), X-ray fluorescence spectroscopy (XRF), atomic absorption spectroscopy (AAS) and thermo gravimetric analysis (TG-DTA). Red mud tiles of different trial mix were produced in the lab and test were conducted to find its physical and chemical properties. The red mud with barium(56) composites have been formulated with various composition and sintered at various temperatures from 800ºC to 1200ºC with the aim to improve its strength and density. The apparent porosity and water absorption of the tiles were found to decrease while increasing the sintering temperatures. Eventually, it found to increase the density, X-ray attenuation and the mechanical strength of the tiles. But Na_2SO_4 efflorescence was found to observe in the tiles sintered above 1000°C (Figure 1). The white efflorescence is caused by minerals that are soluble in water being dissolved and transported to the surface of the tile as the water evaporates.Various binder were added to the red mud- barium composite tile and sintered at various temperatures with the aim to reduce efflorescence on the X-ray shielding red mud tiles. The white efflorescence was arrested by optimizing the sintering temperature and binder without deteriorating the mechanical properties and X-ray attenuation characteristics of it (Figure 1b).

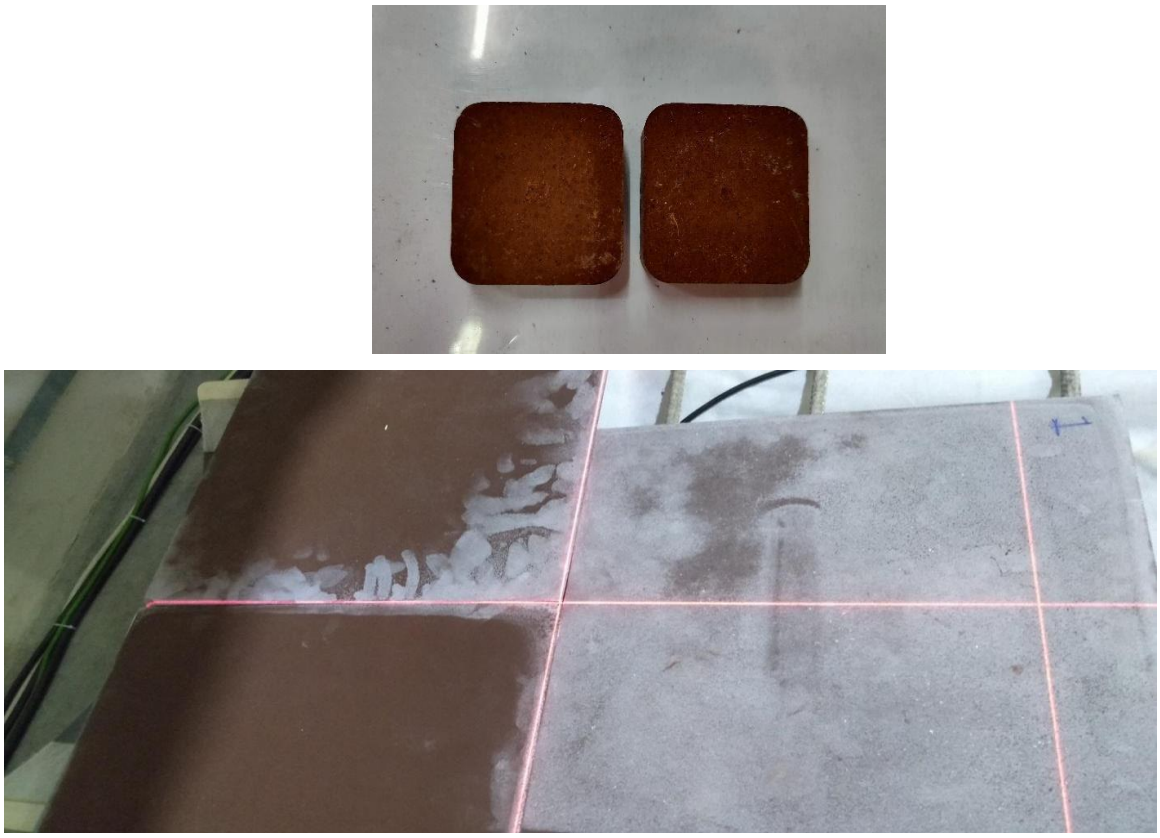


Figure 1: (a) depicts the white efflorescence on the tile and b) the pellets fabricated using disodium phosphate and sintered at 1150°C

Poster – PP13

Humidity sensing and Williamson-Hall analysis of pure and tungsten doped ZnO nanoparticles

Vernica Verma[1], Priya Gupta[2], Narendra Kumar Pandey[1]

[1]*Department of Physics, University of Lucknow, Lucknow, U.P.-226007, India*

[2]*Electronics and Communication Engineering Department, Integral University, Lucknow, U.P.-226026, India*

**Corresponding author:*

Email address: vernicaverma20@gmail.com

Abstract

In the present work we have successfully synthesized pure and tungsten doped ZnO nanoparticles by co-precipitation method. Powder X-ray diffraction results reveal that zinc oxide doped with different concentrations of tungsten from 0 to 10 mol% crystallizes in wurtzite hexagonal structure and the results are in good agreement with the standard JCPDS data (card no: 01-073-8765) with an average particle size ranging from 75 to 61nm, backed by the average crystallite sizes calculated by Scherer's formula. Scanning electron microscopy studies illustrate that both the pure and tungsten doped ZnO exhibit cuboidal morphology. Lattice strain is evaluated by the Williamson-Hall (W-H) analysis. Humidity sensing response is also studied for doping percentages from 0mol%, 3mol%, %RH to 90%RH, where 10 % tungsten doped ZnO exhibit the best response among the pure and tungsten doped ZnO samples.

Poster – PP14

Entanglement Dynamics via Periodic Modulations in Optomechanical Semi-Conductor Resonator Coupled to Quantum-Dot Exciton

Vijay Bhatt[1], Pradip K. Jha[1], Aranya Bhuti Bhattacherjee[2]

[1]*Department of Physics, DDU College, University of Delhi, New Delhi 110078, India*

[2]*Department of Physics, Birla Institute of Technology and Science, Pilani, Hyderabad Campus, Hyderabad - 500078, India*

Abstract

We study the influence of simultaneously modulating the input laser intensity and entanglement in a optomechanical semiconductor resonator embedded with a QD. We apply a sinusoidal modulation of the quantum dot (QD) frequency as well as pump frequency. We show that the modulation and the hybrid system can be engineered to attain the entanglement among the various degrees of freedom. A remarkably high degree of entanglement can be achieved by modulating only the QD frequency. The interplay between the two modulations lead to a decrease in the entanglement. This study provides new possibilities for optimal control strategies and can be used for data signal transfer as well as storage in quantum communication platforms.

Keywords: Quantum dot, modulation, optomechanical, entanglement.

Poster – PP15

Study of molecular interaction in the ternary liquid mixture of n-hexane, ethanol and benzene

Hema[1]*, Tara Bhatt[2]*

Department of Physics, M. B. Govt. P. G. College Haldwani -263139, Uttarakhand, India

Corresponding author email: itsmehemaarya@gmail.com

Abstract: Accurate and fast evaluation of interactions in molecular systems is one of the most challenging tasks in the rapidly advancing field of macromolecular chemistry, including molecular recognition, protein modelling and drug design. Theoretical and experimental methods go hand in hand and give complete insight into it. In the present investigation, interaction energies and structural changes on dimerization were studied by the geometry optimization and single point energy calculation of monomer of benzene, ethanol and n-hexane; and their dimers using Density Functional Theory (DFT) with B3LYP level theory. These changes help to understand the type of interaction between the molecules of the mixture. The ultrasonic velocity (u), density (ρ) and viscosity (η) of the ternary mixture of n-hexane+ethanol+benzene as well as of pure components at (303, 308, 313 & 318) K and 2 MHz were measured. From these experimentally measured values, excess thermo-acoustic parameters: u^E, K_s^E, L_f^E, V_m^E and Z^E have been estimated using standard relation. The variations in excess acoustic parameters with the concentration of mixtures are discussed in terms of the intermolecular interactions. Also, their variation with temperature helps to understand the effect of temperature on mixture properties. Experimental and theoretical results are reasonably in agreement.

Keywords: DFT; Excess Thermo-acoustic Parameter; Molecular interaction; Ultrasonic study;

Poster – PP16

Tribological characteristics of quinolone derivatives: Theoretical and experimental approaches

Kalyani [1]*, Gurmeet Singh[1]

Department of Chemistry, University of Delhi, Delhi-110007

Abstract:

Quinolone derivatives (QLDs) as antiwear additives are highly advantageous due to their environmentally benign properties. In the present work, we study the performance of three QLDs in paraffin oil employing a four-ball tester and the results are compared with the commercial additive zinc dialkyldithiophosphate (ZDDP). One of the QLDs evinced the outstanding antiwear and antifriction performance. Further through Scanning electron microscopy, complemented by atomic force microscopy, we present a remarkable smoothening of the worn surfaces in presence of QLDs. Moreover, Energy-dispersive X-ray results provide clear evidence of tribofilm formation on the worn surfaces which reduces the wear and friction at steel-steel interface. Density functional theory (DFT) calculations were found to correlate well with the experimental results. Our findings offer new insights for improving the antiwear and antifriction properties with high load bearing capacity.

In order to search for a better substitute of antiwear additive ZDDP which poses environmental hazards due to very high percentage of sulphur, phosphorus and zinc, some quinolone derivatives have been tested for their tribological behaviour in paraffin oil.The tribological characteristics of quinolone derivatives; 9-fluoro-3-methyl-10-(4-methylpiperazin-1-yl)-7-oxo-3,7-dihydro-2H-[1,4]oxazino[2,3,4] quinoline-6-carboxylic acid(QLD-1), 1-cyclopropyl-6-fluoro-4-oxo-7-(piperazin-1-yl)-1,4 dihydroquinoline-3-carboxylic acid(QLD-2) and 1-ethyl-6-fluoro-4-oxo-7-(piperazin-1-yl)1,4-dihydroquinoline-3-carboxylic acid(QLD-3) were studied on four ball tester in paraffin oil and compared with those of frequently used additive, zinc dialkyldithiophosphate(ZDDP). All tribological tests were performed at optimized concentration 0.25%w/v using ASTM D4172 and D5183 standards. The antiwear efficiency of these additives have been compared on the basis of the observed parameters such as mean wear scar diameter (MWD), coefficient of friction (COF), mean wear volume (MWV), running-in and steady-state wear rates. The investigated additives show excellent antiwear, antifriction properties and high load bearing capacity. Scanning electron microscopy (SEM) and atomic force microscopy (AFM) studies reveal significant smoothening of the worn surface in presence of QLDs. Energy-dispersive X-ray (EDX) study of the worn surface lubricated with QLDs exhibits presence of nitrogen, oxygen and fluorine, indicating adsorption of the additive forming a tribofilm on the surface. These *in situ* formed tribofilms are responsible for reducing wear and friction at steel-steel interface. DFT calculations correlated well with the experimental results.

Keywords Antiwear, quinolone derivatives, DFT, Surface analysis: AFM, SEM/EDX.

Poster – PP17

Effect of Cr and Ni doping on the electrical and magnetic characteristics of $BaTi_{0.80}Zr_{0.20}O_3$ ceramic

Aditya Jain[a], Vinay Kumar[1a], a, and Amit K Vishwakarma[b]

[a] *Department of Electronics and Communication Engineering, Graphic Era (Deemed to be University), Dehradun, Uttarakhand 248002*

[d]*Department of Physics, Atma Ram Sanatan Dharma College, University of Delhi, Delhi –21*

Abstract

The electrical and magnetic characteristics of high dielectric constant $BaTi_{0.80}Zr_{0.20}O_3$ (BZT) ceramic has been tailored by substituting Cr and Ni in an optimum amount. Morphological, ferroelectric, dielectric and magnetic properties of Cr and Ni doped BZT ceramic were systematically investigated. This work reports a commercially viable and facile technique for the preparation of ceramic materials. The results indicate that the substitution of 2.5 wt.% Cr and Ni doping in BZT has resulted in an improvement in dielectric and ferromagnetic properties along with transformation from traditional ferroelectric to relaxor. The enhancement in dielectric and magnetic characteristics is mainly attributed to increase in microstructural density of Cr and Ni doped BZT ceramic compared to pure BZT. Further, the reduction in grain size, and relatively easier domain wall motion in doped ceramic primarily responsible for slight improvement in dielectric constant compared to pure BZT. Magnetic measurement of Cr and Ni doped BZT ceramic indicates a slight increase in saturation magnetization and coercive magnetic field.

Poster – PP18

A review on Zinc Oxide Nanoparticles and Their Applications

Renu Bala, Ashutosh Dixit, Bhawna Pareek and Vivek Sheel Jaswal

Department of Chemistry, Maharishi Markandeshwar (Deemed to be University), Mullana (Ambala), India

Email: *renusheoran031@gmail.com; dr.pareekbhawna@gmail.com*

Abstract

In the development and use of nanoparticularly dimensioned materials, nanoparticles are a wide volume surface area and thus very precise properties. Zinc oxide (ZnO) nanoparticles have been studied in recent years due to their wide bandwidth and high energy exciton binding and have potential applications, for example Antimicrobial activity, Antioxidant activity, Cytotoxic activity, Photo catalytic degradation's, magnetic and chemical properties that are significantly different from those of bulk counterpart. The purpose of this analysis is to provide an overview of the structural, synthesis and electrochemical characteristics of ZnO nanoparticles synthesized by a variety of methods.

Poster – PP19

Low temperature magnetic study of α-NiS nanoparticles synthesized via Hydrothermal Technique

Prayas Chandra Patel[1*], Pankaj Kumar Mishra[2] and Hem C. Kandpal[1]

[1]*DFT and Materials Laboratory, Department of Chemistry, Indian Institute of Technology Roorkee, Roorkee-247667, India.*

[2]*Department of Physics, Institute of Science, Banaras Hindu University, Varanasi-221005 (U.P.), India*

Abstract:

Synthesis of material with nano-order anisotropy has always been a tricky task for the researchers, since there has to be some property-based inhomogeneity present within the homogeneous material. In this report, we discuss the emergence of Exchange Bias (EB), which is itself a case of magnetic property-based anisotropy. Here, a thorough low temperature magnetic study of nickel sulfide (NiS) nanoparticles synthesized via solution based hydrothermal technique was performed. To introduce nano-order inhomogeneity we played with different feeding flow rate of the starting materials. The synthesized samples were of highly crystalline mixed phase nature with α-NiS as a dominant phase. Variation in energy bandgap as a function of feeding rate suggests the possibility of the formation different-sized seed cluster. For sample with maximum α-NiS content, presence of very strong magnetic coupling at $T < T_b$ arising from uncompensated spins at the surface of the nanoparticles suggest its weak ferromagnetic character with a paramagnetic background. For the first time, an unusual phenomenon of exchange bias (EB) was also observed for the sample with maximum α-NiS content. The presence of EB suggests FM-AFM coupling occurring over the particle surface, which is also prudent from the fact that NiS is intrinsically an antiferromagnetic material. In short the present study opens up the possibility for the use of NiS a possible material spin based device applications.

[*]**Corresponding Author: prayasyogi@gmail.com**

Poster – PP20

Growth and Characterization of One Dimensional ZnO Nanorod Film

P. L. Meena[1,*], Pooja Bhardwaj[2], Yogesh Kumar[1] and Surinder P. Singh[2]

[1]*Department of Physics, DeenDayal Upadhyaya College (University of Delhi), Sector -3, Dwarka, New Delhi-110078, India.*

[2]*Department of Applied Physics, Amity School of Applied SciencesAmity University Manesar, Gurugram, Haryana-122413,India*

[3]*CSIR-National Physical Laboratory, Dr. K. S. Krishnan Road, New Delhi-110012, India*

*Corresponding Author: plmeena@gmail.com, plmeena@ddu.du.ac.in

Abstract

ZnO nanorods films (NRF) were grown on indium tin oxide substratethrough wet chemical routein a reaction flask with reflux condenser by using high purity $Zn(NO_3)_{2.x}H_2O$ and (HMTA; $C_6H_{12}N_4$)materials. These NRFs were characterized by Scanning Electron Microscope (SEM), X-ray Diffraction (XRD) and UV Visible (UV-Vis) spectrophotometer. SEM micrograph reveals that well aligned hexagonalZnO NRF were grown with the average diameter 125 nm and length 2500 nm.XRD data indicates a polycrystalline single phasewith wurtzite structure. Various structural parameterswere analyzed through Rietveld refinement method on the XRD data with texture coefficient (TC) 4.21 preferential growth along (002) plane. The precise cell parameters were found *a*=b=3.2208(14) Å and c=5.154(2) for ZnO NRF.UV-Vis. spectra exhibit a very strong and sharp absorption peakat wavelength of 371 nm. The first order numerical derivative (dA/dE) of absorbance indicates a band gap at 3.26 eV for these NRF.The sensing performance of the synthesized one-dimensional ZnONRF were demonstrated through I-V measurement with and without presence of ethanol vapor at room temperature.

Key Words: ZnO NRF, XRD, Rietveld refinement, nanorods, Sensing

Poster – PP21

Design of Photonic crystal OR gate with multi-input processing capability on a single structure

Chandan Kumar[1], Punit[1], Praveen Kumar[1], Preeti Rani[2], Yogita Kalra[1]

[1]TIFAC- Centre of Relevance and Excellence in Fiber Optics and Optical Communication, Department of Applied Physics, Delhi Technological University (Formerly Delhi College of Engineering) Bawana Road, Delhi-110042, India

[2]Sharda University, Knowledge Park III, Greater Noida, UP-201310, India

ABSTRACT

In this paper, the design of the cavity-based photonic crystal (PhC) 'OR' Gate has been proposed. The structure consists of three waveguides and two square resonators in a PhC composed of cylindrical rods of GaAs in air. Rod's radius is an important factor to decide operating wavelength, so rod's radius corresponding to various operating wavelengths has been analysed. The designed logic gate possesses multi input processing capability. The processing of multiple inputs on a single structure (Hardware) makes it idiosyncratic. Owing to its petiteness, fastness, and multi-input processing ability, the proposed structure overcomes constraints of modern electronics. The electric field distribution and logic table shows that the proposed structure behave like an OR gate.

Poster – PP22

Lanthanide doped Niobate phosphor for security applications

Amit Kr. Vishwakarma[1], Kaushal Jha[2], M. Jayasimhadri[3]

[1]*Department of Physics, Atma Ram Sanatan Dharma College, University of Delhi, Delhi –21*

[2]*Bhagalpur College of Engineering, Bhagalpur-813210, Bihar, India*

[3]*Luminescent Materials Research Lab (LMRL), Department of Applied Physics, Delhi Technological University, Delhi 110 042, India*

**Corresponding Author: amitphys17@gmail.com jayaphysics@yahoo.com,*

Europium doped $CaNb_2O_6$ phosphors have been synthesized by solid state reaction technique for solid state lighting applications. The thermal behavior, crystal structure, particle morphology and photoluminescence properties were investigated by using TGA-DSC, XRD and SEM and spectrofluorophotometer, respectively. The emission and excitation behavior of the synthesized samples have been measured and discussed in detail. The excitation spectra exhibit the intense sharp peak corresponding to $^7F_0 \rightarrow {}^5L_6$, $^7F_0 \rightarrow {}^5D_2$ at 266 and 395 nm due to interconfigurational 4f-4f transitions of Eu^{3+} ions in host lattice. Based on the excitation spectra, the emission properties were measured for europium doped $CaNb_2O_6$ phosphor under 266 and 395 nm excitation. The effect of energy transfer on the emission bands with Eu^{3+} concentration has been explained under the excitation of 266 nm. The concentration dependent emission properties were also measured under the excitation of 395 nm, which indicate that the emission intensity increases with Eu^{3+} concentration up to 2.5 mol%, beyond that concentration the emission intensity decreases due to concentration quenching. The intense peak observed in both the cases at 611 nm corresponding to the transition $^5D_0 \rightarrow {}^7F_2$ of Eu^{3+} ions. The CIE coordinates for these phosphors were evaluated using the emission spectra obtained by exciting at 266 and 395 nm. All the color coordinates falling near to CIE white domain under the excitation wavelength of 266 nm and this white light could be adjusted by varying Eu^{3+} concentration due to the energy transfer mechanism. Moreover, the chromaticity coordinates of these phosphors under the excitation of 395 nm are found to be (0.64, 0.34), which is close to the standard red chromaticity (0.67, 0.33) for the National Television Standard Committee (NTSC) system. Due to strong absorption in the UV and emission in the visible region, this phosphor may be excellent candidate for coating and security application as well as solid state lighting application.

Poster – PP23

Band-gap tuning and quantum efficiency analysis in double perovskite La_2NiMnO_6 based solar cell device via SCAPS simulation

Manish Kumar[a,*], Arvind Kumar[a], Abhishek Raj[b,c], Lalit Kumar[a], Avneesh Anshul[b]

[a]*Experimental Research Laboratory, Department of Physics, ARSD College, University of Delhi, New Delhi-110021, India*

[b]*CSIR-National Environmental Engineering Research Institute (NEERI), Nagpur-440020, India*

[c]*Academy of Scientific and Innovative Research (AcSIR), Ghaziabad-201002, India*

ABSTRACT

The simulation studies are main part of current solar cell research because of the basic idea of optimization of experiment and reduction of the cost of the experiment. In the present investigation, the band-gap tuning and quantum efficiency analysis in stable double perovskite La_2NiMnO_6 absorbing material have been investigated for high conversion efficiency. Inorganic lead-free double perovskite La_2NiMnO_6 photovoltaic material is sandwiched in between the TiO_2 as electron transport layer (ETL) and CuI as hole transport layer (HTL) to project the hetrostructures for the SCAPS simulation. After the careful simulation, we have optimized the band-gap of the absorbing material and achieved the enhancement in the quantum efficiency of the device.

Keywords: SCAPS simulation; Lead-free double perovskite solar cell; Quantum efficiency

***Authors to whom correspondence should be addressed:** mkumar2@arsd.du.ac.in (M. Kumar)

Poster – PP24

A First Principle study of magnetic and opto-electronic properties of half metallic Heusler alloy, Co_2TiSi

Arvind Kumar[1*] and Manish Kumar[1]

[1]Materials Science Research Lab (Theory and Experimental), Department of Physics, A. R. S. D. College, University of Delhi, India

ABSTRACT

We have investigated the half metallic Heusler alloy, Co_2TiSi via First Principle calculation using the Wien2K code. Electronic, magnetic and optical properties were studied under the realm of PBE-GGA exchange correlation functional. Density of states (DOS) profile calculated for the compound represents the half metallic character i.e, 100% spin polarization at the Fermi level. Partial (p-) DOS show that major contribution is due to Co-3d and Ti-3d states across the Fermi level. Band structure also shows a band gap of ~ 0.6 eV for spin down states whereas metallic character for the spin up states. It has been found that the calculated electronic and magnetic behavior along with estimated magnetic moment (1.98 μ_B) is in good agreement with its experimental results. Different optical parameters and transport properties (uisng Boltz Trap code) were also studied. Overall, compound shows the interesting electronic and magnetic properties along with half metallic behavior at the Fermi level which could be utilized for its potential applications in spintronic devices.

Electronic addresses:

[1*]Dr. Arvind Kumar (arvindkumar@arsd.du.ac.in)

Department of Physics, ARSD College, University of Delhi-110021(India)

Contact: +91-8826668810

Poster – PP25

X-Ray Sensing by Titanium di-Oxide- Poly Methyl Methacrylate Composite

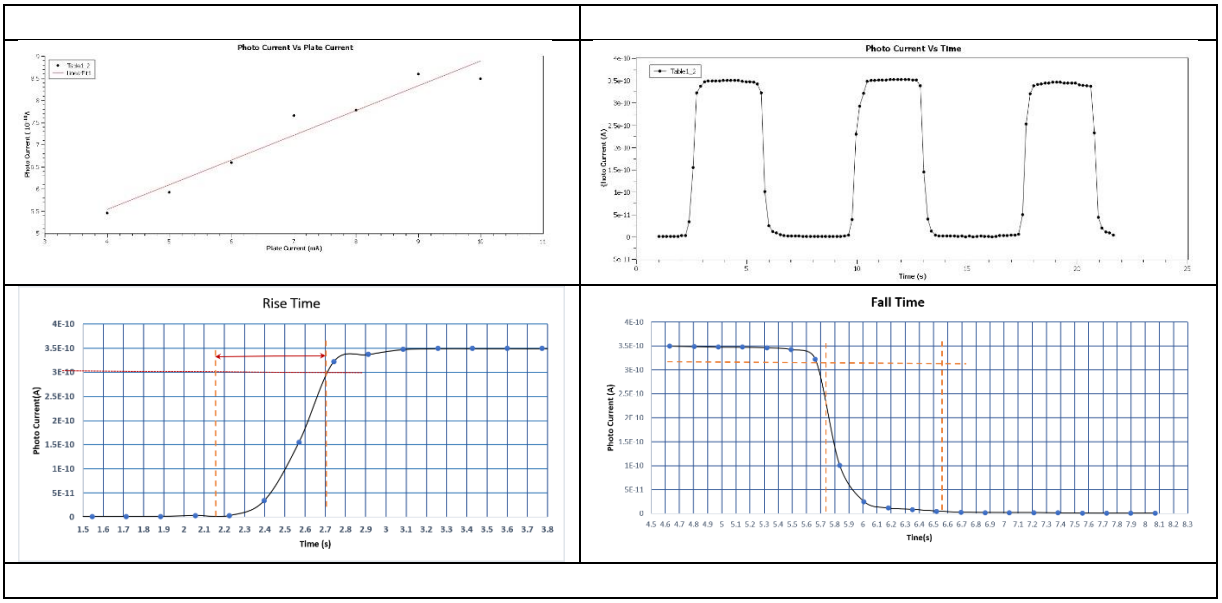
Sweta Chauhan [1], Kulvinder Singh[2]
[1](Department of Applied Science and Humanities, School of Engineering and Technology, Soldha, Bahadurgarh, Haryana, India)
[2]*(Department of Physics, Deen Dayal Upadhyaya College, University of Delhi, India)*

Abstract:

Background: Digital X-rays applications are growing fast in vast areas of material science, medical diagnostics, industrial explorations etc. These applications are imposing rising demand for effective and more user-friendly X-ray sensors. Commonly used solid-state sensors are rigid crystalline material having flat geometry. With increasing application demand for flexible and easy to shape sensor is developing fast. Keeping the demand in mind polymer-based X-ray sensors are developed using Poly Methyl Methacrylate as polymer matrix and reinforcement material as Titanium di-oxide.

Materials and Methods: Highly pure (99.999% pure) Titanium dioxide is used to cast polymer composites of Poly Methyl Methacrylate by solution method using Chloroform as solvent.1-1.3 mm thick sheets were obtained after 56 hr of settling period. These sheets were subjected to Soft X-rays switching studies at room temperature. Nickel filtered X-rays from Cu target in the energy range 8.051KeV were used in the experimentation work.

Results: Studies revealed that Titanium di-oxide- PMMA sheets show stable detection of X-rays at room temperature. Mobility-Life time product was obtained using the iterative method. It ranges in the order of $1.38X10^{-2}cm^2V^{-1}$. These sheets show quite low thermally generated charges at room temperature and high photocurrent. X-ray switching studies conducted on these sheets show low rise and fall time making the material good for imaging applications. Rise time and fall time was recorded in the order of 0.5 s.



Key Word*:* Atomic Titanium di-oxide, Detectors, Polymethylmethacrylate, Sensors, X-rays.

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