INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

(AN AUTONOMOUS INSTITUTE OF DEPARTMENT OF SCIENCE AND TECHNOLOGY),
GOVERNMENT OF INDIA

"KNOWLEDGE OF NANO SCIENCE FOR THE NATION"

ANNUAL REPORT

2023-24

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From the Desk of the Director, INST

The Institute of Nano Science and Technology (INST) is the first Nano-research institute in the country, which was established in 2013 for cutting-edge research in nanoscience and nanotechnology with an interdisciplinary nature in the domains of energy, environment, agriculture, health care, and quantum materials, etc., Scientists at INST with training in physics, chemistry, biology, pharmacy, engineering, and agriculture work together to develop nanotechnology to address scientific issues. INST has made significant scientific contributions in a very short time, as evidenced by research publications. In commemoration of the 10th anniversary of the institute, INST has organized an international conference, ***Trends in Emerging Nano Science: Energy, Healthcare & Quantum Materials (TENS-2023)***, from 5th to 8th November 2023 for the growth of existing collaboration and foster new ones and explore opportunities for students. The themed collection 'INST Mohali 10th anniversary' will be published in ***Nanoscale (RSC Journal)***.

The state-of-the-art Nano Anusandhan Bhawan at the Institute of Nano Science & Technology (INST) was inaugurated and dedicated to the nation by ***Dr. Jitendra Singh, Hon'ble MoS*** (Independent Charge), Ministry of Science and Technology, Govt. of India at its campus at Sector 81, Mohali on 2nd December 2023. The 5-storied research block has dedicated labs for cutting-edge research on biomaterials for regenerative medicines, cancer nanotherapeutics, nano-agriculture, wearable electronics, renewable energy materials for battery and supercapacitors, green hydrogen evolution, and carbon sequestrations.

An Indo-France Seminar on Metal Nanoclusters, supported by the Indo-French Centre for the Promotion of Advanced Research, was organized from 02-5th October 2023. A few name lectures, such as JC Bose Memorial Lecture 2024, P C Ray Lecture, Dr. APJ Abdul Kalam Memorial Lecture, GN Ramachandran Lecture, and S.S. Bhatnagar Memorial Lecture, were given by eminent scientists from India and abroad.

Regarding the recently published Nature Index-2024, the INST, Mohali, stands 24th in Chemistry (2nd among DST institutes) and 23rd in the Physical Sciences category (2nd among DST institutes). Regarding several publications in reputed journals, INST researchers manage 266 with an average I.F of 6.3 and 33 Ph.D. students, who graduated this year.

Extramural grants from different funding agencies and some industrial projects have been collaborated with Unilever Industries, BPCL, IFFCO, etc.

INST's faculty and researchers have been conferred with several prestigious awards such as the CRSI Bronze medal, Har Gobind Khorana-Innovative Young Biotechnologist Fellowship (IYBF), Associate Fellow of Indian National Science Academy (INSA), INSA Distinguished Lecture Fellow (2024), and Professor K. Kishore Memorial Award.

INST organizes various outreach programs for school and college students, and FALAK is an educational outreach program that benefits the children of INST workers.

I thank my faculties, administrative staff, students, and shareholders for their continued support in upholding the Institute's objectives and fulfilling our motto, "Knowledge of Nano Science for the Nation".

In the end, I take this opportunity to thank the Department of Science and Technology, Government of India, for their continued faith and support.

(Amitava Patra)
Director, INST

Inauguration of Nano Anusandhan Bhawan on 02.12.2023 by Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge), Ministry of Science and Technology, GoI

The state of the art Nano Anusandhan Bhawan at Institute of Nano Science & Technology (INST), An Autonomous Institute under Dept. of Science and Technology was inaugurated by Dr. Jitendra Singh, Hon'ble MoS (Independent Charge), Ministry of Science and Technology, Govt. of India at its campus at Sector 81, Mohali on 2nd December, 2023.

The 5-storied research block has dedicated labs for cutting-edge research on biomaterials for regenerative medicines, cancer nano therapeutics, nano agriculture, wearable electronics, renewable energy materials for battery and supercapacitors, green hydrogen evolution and carbon sequestrations.

The Hon'ble minister stressed on the importance of Nano Science as it is still in its nascency. He said "It is the need of hour to translate the basic nano science knowledge to solve some of the country's problem in collaboration with industries". He also interacted with the students and faculty members in the CV Raman Auditorium.

Inauguration of Nano Anusandhan Bhawan on 02.12.2023 by Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge), Ministry of Science and Technology, Govt. of India.

Felicitation of Hon'ble Minister by Prof. Amitava Patra, Director, INST

Vision

To emerge as a globally competitive India's foremost research institution in Nano Science and Technology and to contribute to society through applications of nanoscience and nanotechnology in the field of agriculture, medicine, energy and environment.

Mission

To be a world class research institution by carrying out cutting-edge research through outstanding scientists from different branches of science and engineering, encouraging them to carry out their individual scientific research to be published in the best journals along with their mandate to jointly work on interdisciplinary projects to develop devices/technologies based on nano science and technology. To encourage all aspects of nanoscience and nanotechnology with major thrust on the following areas: agricultural nanotechnology, sensors, medical nanotechnology, nanotechnology based solutions for energy and environment. The ultimate goal is to make a difference in society through nanoscience and technology.

Objectives

To advance knowledge and educate young minds in nano science and technology that will best serve the nation. Impart advanced training courses and laboratory techniques of nanotechnology at the highest level.Encouraging innovative and challenging technology/ product based scientific projects. Boosting translational research (from laboratory to industry) and fostering interactions with industry.Sensitizing public and media about the advantages andsafeguards in Nano Science and Technology.

Decision Making Bodies (BoG, RAAC, Finance Committee)

Board of Governors (BOG)

The Administrative, Financial and Research activities of the Institute is being taken care of by the Board of Governors (BoG) having the following composition

DR. T. PRADEEP
(Chairman)

Department of Chemistry
Indian Institute of Technology Madras, Chennai

Director
Member (ex-officio)

Indian Institute of Science Education & Research (IISER) Mohali – 140 306

Secretary
Member (ex-officio)

Department of Science and Technology
Technology Bhawan, New Mehrauli Road, New Delhi

Secretary
Member (ex-officio)

Department of Chemistry
Indian Institute of Technology Madras, Chennai

Secretary
Member (ex-officio)

Department of Chemistry
Indian Institute of Technology Madras, Chennai

Secretary
Member (ex-officio)

Department of Agricultural Research and Education (DARE) Room 105, Krishi Bhawan, New Delhi

Secretary
Member (ex-officio)

Department of Chemicals and Petrochemicals, New Delhi

Financial Advisor
Member (ex-officio)

Financial Advisor
Department of Science and Technology
Bhawan, New Delhi

PROF. G. U. KULKARNI
FASc, FNASc, President (Member)

Jawaharlal Nehru Centre for Advanced Scientific Research
Jakkur P.O., Bangalore 560 064, India

PROF. RAJEEV AHUJA
Director

Indian Institute of Technology Ropar
Rupnagar-140001, Punjab

PROF. S. ANANTHA RAMAKRISHNA
Director

CSIR - Central Scientific Instruments Organisation
Sector-30 C, Chandigarh

PROF. AJAYAGHOSH A.
Director

National Institute for Interdisciplinary Science and Technology (NIIST) CSIR,
Thiruvananthapuram

Dr. Amulya K. Panda
Ex. Director

National Institute of Immunology
Aruna Asaf Ali Marg,New Delhi

MEMBER

Principal Secretary to Govt. of Punjab
Department of Science, Technology & Environment
Chandigarh

Executive Director
(Member)

Punjab State Council for Science & Technology
MGSIPA Complex (2nd Floor), Sector –26, Chandigarh

Prof Amitava Patra
Director
(Member)

Institute of Nano Science and Technology
Knowledge City, Sector-81, SAS Nagar, Mohali-140306

Shri Nimesh Kaushik
CFAO
Member-Secretary (ex-officio)

Institute of Nano Science and Technology
Knowledge City, Sector-81, SAS Nagar, Mohali

RESEARCH AND ACADEMIC ADVISORY COUNCIL (RAAC)

The functions of the Academic Council include planning, execution, and co-ordination of research and academic activities of the Centre. It regulates the courses of study, procedures for admission of students, examination, etc. This Council makes its recommendations on all academic matters to the Council of Management.

PROF UDAY MAITRA (Chairman)

IISc
Bangalore

DR. SANTANU DASGUPTA (Member)

Senior Vice President,
Reliance Research & Development,
Mumbai Maharashtra

DR. SAMIRAN MAHAPATRA (Member)

Director, Open Innovation Asia,
Unilever, Bangalore

PROF. S M YUSUF (Member)

Director, Physics Group, BARC,
Mumbai

PROF. ARUN CHATTOPADHYAY (Member)

Department of Chemistry,
Indian Institute of Technology Guwahati,
Guwahati, Assam

DR. SANJEEV KHOSLA (MEMBER)

Director,
IMTECH,
Chandigarh

DR. JATINDER KAUR ARORA (MEMBER)

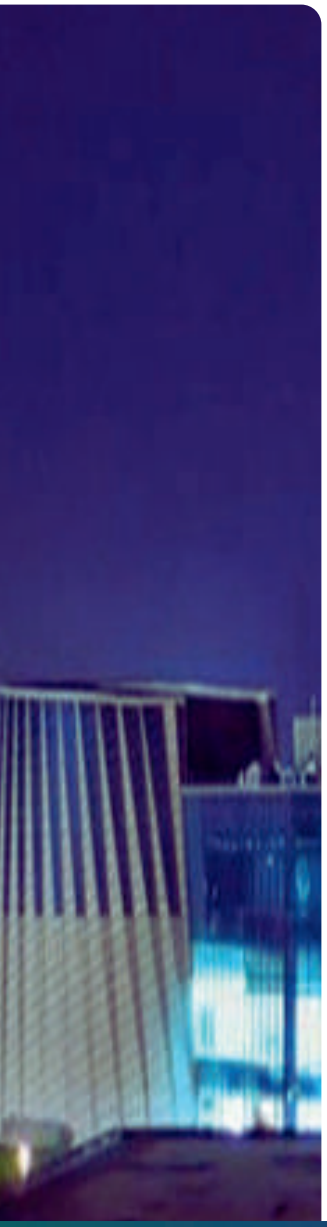
Executive Director,
Punjab State Council for Science & Technology
Chandigarh

PROF. AMITAVA PATRA (MEMBER)

Director, Institute of Nano Science and Technology,
Mohali

DR. SHARMISTHA SINHA (MEMBER)

Dean (Academics)
INST Mohali



Finance Committee

The Finance Committee of the Centre scrutinises all financial proposals and makes recommendations to the Council of Management. During 2023–24, the Committee consisted of the following members:

DR. T. PRADEEP CHAIRMAN

Department of Chemistry
Indian Institute of Technology Madras,
Chennai

JS & FA, DST (MEMBER)

Ministry of Science and Technology

PROF. AMITAVA PATRA DIRECTOR

Institute of Nano Science and Technology
Mohali

SMT VIBHA MEHTA
Finance Officer
(Member Secretary)

Institute of Nano Science and Technology
Mohali

HUMAN RESOURCES

Prof. Amitava Patra
Director

Dr. Akash Deep
Scientist - G

Dr. Deepa Ghosh
Scientist - G

Dr.Surajit Karmakar
Scientist - G

Dr. Kamalakannan Kailasam
Scientist - G

Dr. Abir De Sarkar
Scientist - G

Dr. Asish Pal
Scientist - F

Dr. Indranil Sarkar
Scientist - F

Dr. Prakash P. Neelakandan
Scientist - F

Dr. Debabrata Patra
Scientist - F

Dr. Suvankar Chakraverty
Scientist - F

Dr. Ehesan Ali
Scientist - F

Dr. Dipankar Mandal
Scientist - F

Dr. Kaushik Ghosh
Scientist - F

Dr. Jayamurugan Govindasamy
Scientist - F

Dr. Sharmistha Sinha
Scientist - F

Dr. Tapasi Sen
Scientist - E

Dr. Kiran Shankar Hazra
Scientist - E

Dr. Jiban Jyoti Panda
Scientist - E

Dr. P. S. Vijayakumar
Scientist - E

Dr. Sonalika Vaidya
Scientist - E

Dr. Sangita Roy
Scientist - E

Dr. Vivek Bagchi
Scientist - E

Dr. Rahul K. Verma
Scientist - E

Dr. Chandan Bera
Scientist - E

Dr. Menaka Jha
Scientist - D

Dr. Monika Singh

Scientist - D

Dr. Ramendra Sundar Dey

Scientist - D

Dr. Bhanu Prakash

Scientist - D

Dr. Sanyasinaidu Boddu

Scientist - D

Dr. Asifkhan Shanavas

Scientist - D

Dr. Deepika Sharma

Scientist - D

Dr. Manish Singh

Scientist - D

Dr. Rehan Khan

Scientist - D

Dr. Shyamlal M

on lien

Scientist - D

Dr. Subhasree Roy Choudhury

Scientist - D

Sh. Mukesh Raja

Scientist - D

Dr. Aviru Kumar Basu

Scientist - C

Dr. Amit Kumar Mondal

Scientist - B

ADMINISTRATION

Shri Nimesh Kaushik

CFAO

(Chief Finance & Administrative Officer)

Mrs. Vibha Mehta

Finance Officer

Mrs. Sweta Belwal

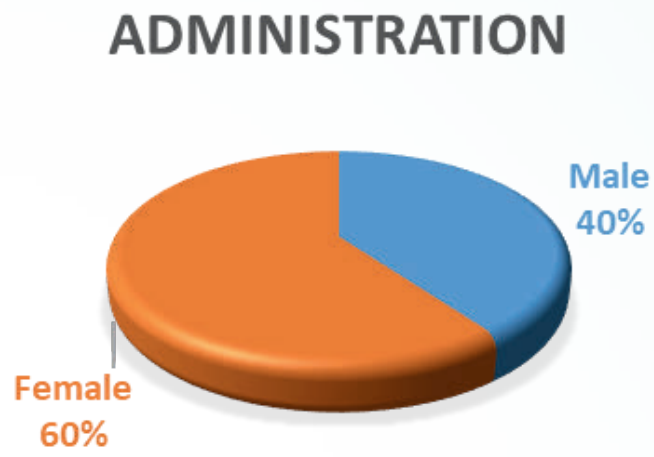
Stenographer

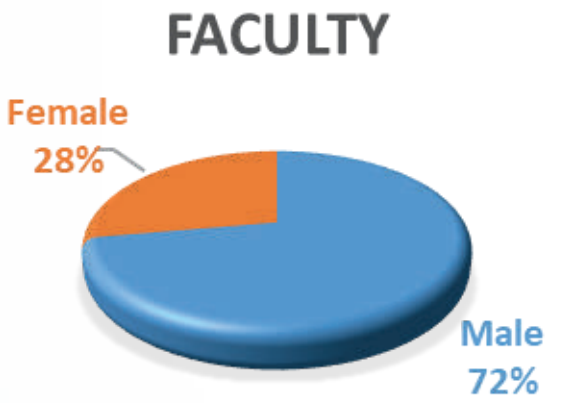
Mr. Rajpreet Singh

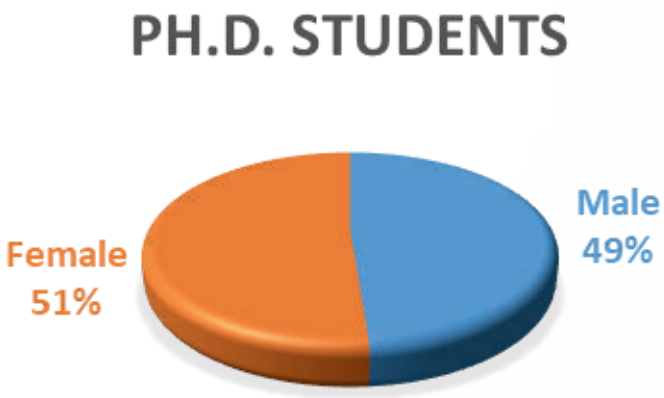
Stenographer

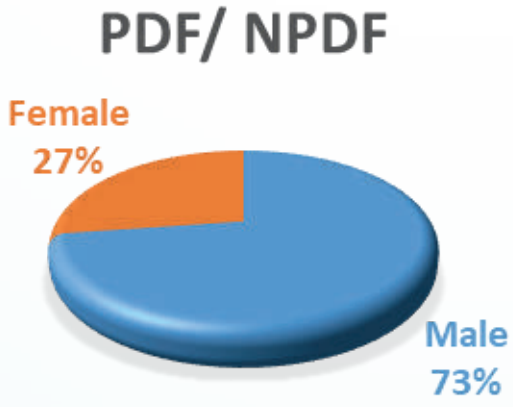
INSTians at a Glance

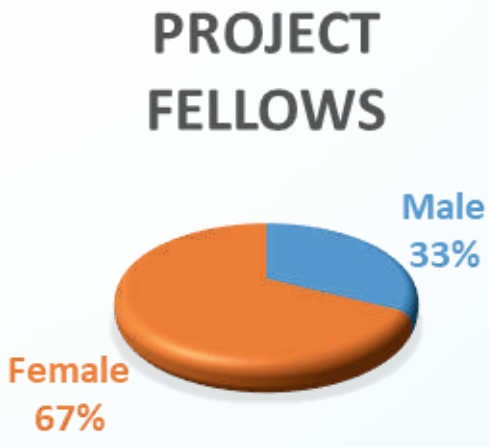
Scientists	: 38
Ph. D. students	: ~ 208
Postdocs/ National Post Doc:	06
Project fellows	: 43
Short-term students	: 6
Administration	: 04
Security/Housekeeping (outsourcing)	: ~ 100











ACADEMIC PROGRAMS

- IISER Mohali
- ACSIR
- Punjab University
- PEC

Ph. D Program

Institute RA Program

Internship Program

- Independent Interns
- Interns (MoUs)

Sponsored Academic Programs

- SERB-NPDF
- DBT PDF
- CSIR RA
- SERB-TARE

PhD PROGRAMMES

INST, Mohali has a comprehensive Ph.D. program that gives enthusiastic and motivated students the opportunity to join the highly competitive global research community. The students are financially supported by the institute or external funding agencies.

RA PROGRAMMES

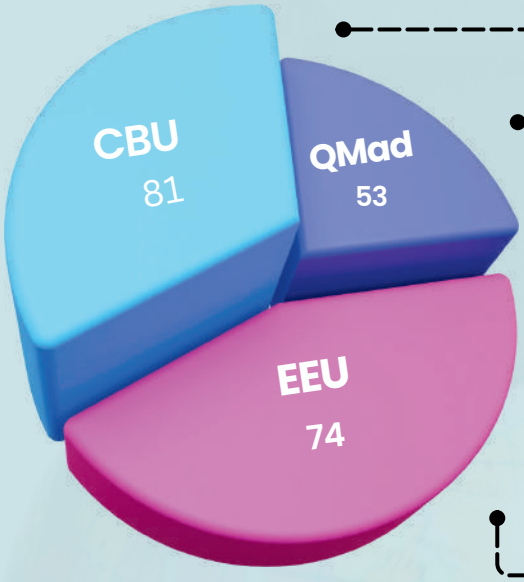
INST Mohali has also Research Associate programme supported by Institute. Post Docs supported by SERB, DBT, CSIR also join the institute with research interests overlapping with INST's Faculty members.

INTERNSHIPS

Institute of Nano Science and Technology, Mohali, provides an opportunity to exceptionally good undergraduate students to execute an innovative research and development project under the guidance of INST faculty

ACADEMIC PROGRAMMES

Total Students Strength in 2023-24



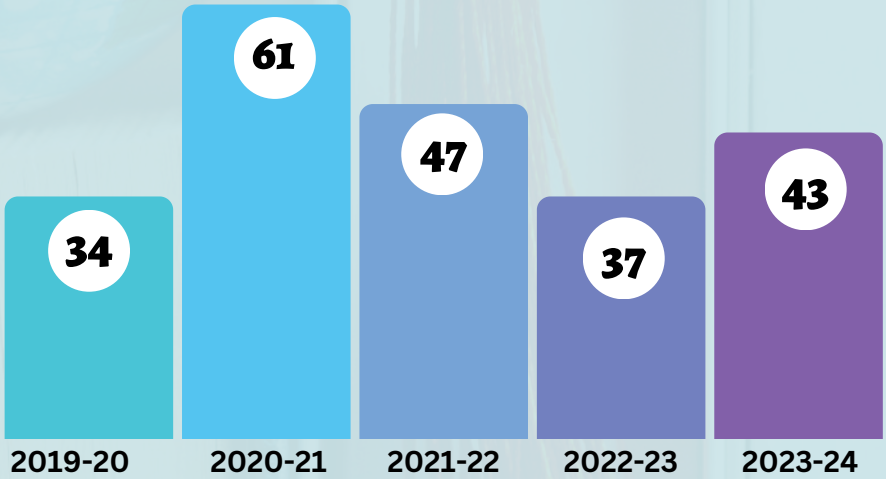
81 **CBU**
Chemical Biology Unit

53 **QMad**
Quantum Material & Device Unit

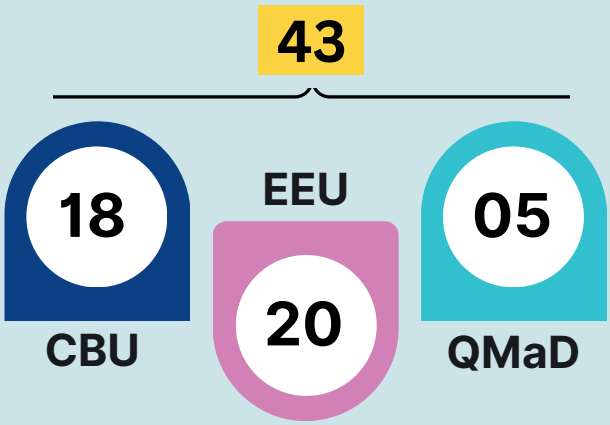
74 **EEU**
Energy and Environmnet Unit

208

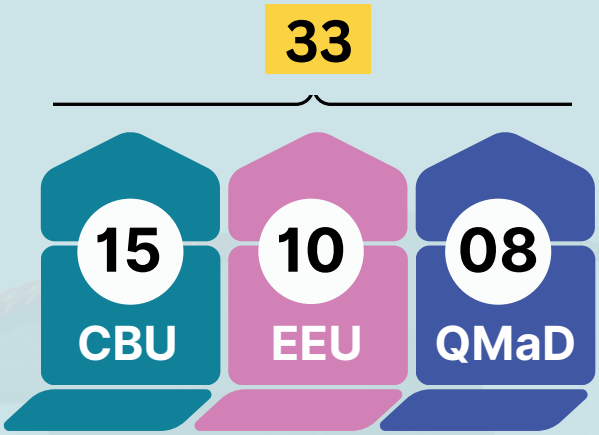
Students Registered in Last 5 Years



New Admissions in 2023-24

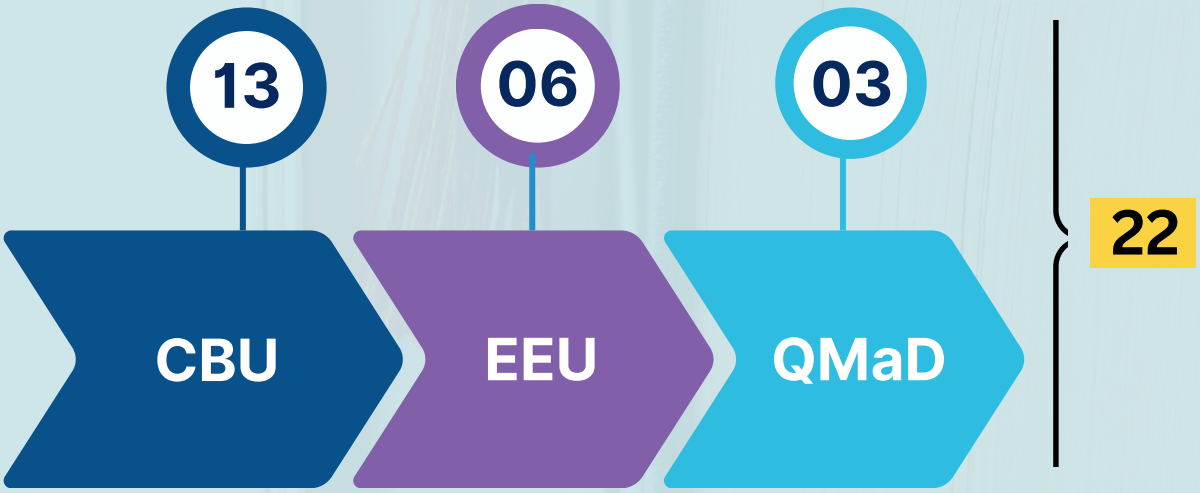


Degree awarded in 2023-24



Degree Awarded during 3 years

New Student registered in January 2024



List of Ph.D Students graduated:

Sr.	Name	Supervisor	Thesis Title
1	Ritu Rai	Dr. Vivek Bagchi	Nanostructured materials for electrocatalytic applications
2	Aditi Vijay	Dr. Sonalika Vaidya	Investigating the role of structural parameters influencing Photocatalytic and Electrocatalytic behaviour of binary and ternary Metal Oxides
3	Deepika Gupta	Prof. Asish Pal	Regulating peptide self-assembly toward precision & compartmentalization
4	Pooja Sharma	Dr. Sangita Roy	Development of Multi-component Bioactive Scaffolds for Tissue Regeneration
5	Anjana Sharma	Prof. Deepa Ghosh	Development of bioactive carbon-based nanomaterials for healthcare applications
6	Ajit Singh	Dr. Chandan Bera	Measurement of Electrical, Thermal and Photo-conductivity of Nanomaterials
7	Jijo Thomas	Prof. Deepa Ghosh	Injectable Self-healing Hydrogels for Cartilage Tissue Engineering
8	Shaifali Sartaliya	Dr. J. Govindasamy	A Study of the Design and Synthesis of Polymeric Smart Nanocarriers for Delivering Drugs
9	Vijay Kumar Pal	Dr. Sangita Roy	Designing Biomolecular Hydrogel Scaffolds for Healthcare Applications
10	Atikur Rahman	Dr. Prakash P. Neelakandan	Modulating Photophysical Properties of Dye-loaded Gold Nanoparticles through Plasmon-Molecule Coupling
11	Manish Kumar Mohanta	Prof. Abir De Sarkar	Ab-initio Insights into Applied 2D Materials for Energy Harvesting and Next Generation Devices
12	Sardoiwala Nadim	Dr. S. R. Choudhury	Epigenetic regulation mediated nanotherapy for prevention of Parkinson's disease
13	Neha	Dr. K. Kailasam	Designing of Heptazine and Triazine based Porous Organic Polymeric Networks and their applications
14	Vianni Chopra	Prof. Deepa Ghosh	Functionalized carbon biomaterials for bone tissue engineering
15	Gaurav Kumar	Dr. Sharmistha Sinha	Functional Attributes and Self-Assembly Behaviour of a Shell Protein from the 1,2-Propanediol Utilization Prokaryotic Metabolosome
16	Aakriti Singh	Dr. Shyam Lal	Surface functionalized biocompatible lipid nanocarriers as an oral anti-leishmanial therapy
17	Manju Sharma	Dr Jiban Jyoti Panda	
18	Mujeeb Alam	Dr Debabrata Patra	Autonomous Fluid-Flow on Supramolecular Interfaces: A Step towards Powerless Microfluidic Device
19	Deepak Chauhan	Prof. K. Kailasam	Solar-fuels and valorized organic products from biomass-based precursors: Boosting bio- chemical economy through carbon nitride based photocatalytic systems

20	Navpreet	Dr. Ramendra Sundar Dey	Modulation of graphene and its hybrid nanostructures toward the development of hybrid energy storage devices
21	Kamaljit Kaur	Dr. P.S Vijayakumar	Optically active nanomaterials in food and agriculture applications
22	MD. Rejaul Karim	Dr. Indranil Sarkar	Development of low dimensional cobalt-iron based Heusler alloy systems for magnetic and magneto-optical applications
23	Mr. Raihan Ahammed	Prof. Abir De Sarkar	First-principles Quantum Mechanical Insights into Emerging 2D Materials for Futuristic Electronics and Energy
24	Manish	Prof. Suvankar Chakraverty	Measurement of Electrical, Magnetic and Optical properties at EuO-KTaO3 Conducting Interface
25	Soni Jignesh Mohanbai	Prof. Surajit Karmakar	Development of a melatonin mediated therapeutic approach in the treatment of inflammatory bowel disease
26	Rishu Khurana	Md. Ehesan Ali	Ab Initio Modelling of Molecular Magnets
27	Ankush	Dr. Menaka Jha	Nanostructured phosphorus-based compounds and their application towards electrochemical hydrogen generation
28	Rakesh Kumar Mishra	Dr. Rehan Khan	Biocompatible nanocarrier-mediated drug delivery for the management of disease severity of Experimental colitis
29	Ashima	Md. Ehesan Ali	Spin Polarized Electron Transport through Organic Magnetic Molecules
30	Gurpreet Kaur	Prof. Deepa Ghosh	Tracking the ultrafast photophysical events in all-inorganic metal halide perovskites through transient absorption spectroscopy
31	Tanmay Goswami	Prof. Deepa Ghosh	Spectroscopic Investigation of Ultrafast Photo-physical Processes in Chalcogenide Based Two-Dimensional (2D) Materials
32	Sonali Kakkar	Dr. Chandan Bera	First-principles studies of transition metal chalcogenides and oxide heterostructures for spintronic applications
33	Asish Gaur	Dr. Vivek Bagchi	Nanostructured Materials for Energy Application

RESEARCH AND DEVELOPMENT

INST, Mohali has an interdisciplinary team of scientists working at the cross section of biomaterials, inorganic chemistry, supramolecular chemistry and quantum materials.

INST focuses on electrochemical devices for Energy Conversion and Storage, Smart materials for packaging, Ultrafast Spectroscopy and its Applications, Topological materials for future devices, Nanotechnology based technology in Agricultural and Food processing, Nanotoxicology, Biomechanics for understanding human disease and development of smart biomaterials, Theranostics for point of care and Nanomaterials from natural sources

INST has developed a state of the arts facility for physico-chemical characterization of nanomaterials under one roof and this facility is open to the external investigators through a central facility.
The following section describes about the various research activities being pursued by three Research Unit ; Energy and Environment Unit (EEU), Quantum Materials and Device Unit (QMaD) and Chemical Biology Unit(CBU).

KEY R&D FACILITIES

SYNTHESIS LAB

TISSUE CULTURE LAB

FACS FACILITY

SPECTROSCOPY LAB

ADVANCED MATERIAL CHARACTERIZATION FACILITY

BIO-PROCESSING LAB

DEVICE ASSEMBLY AND TESTING FACILITY

THIN FILM COATING LAB

CLASS 10000 CLEAN ROOM

NANOFABRICATION PROCESS FLOW FACILITY

LITHOGRAPHY FACILITY

SEMICONDUCTOR CHARACTERIZATION FACILITY

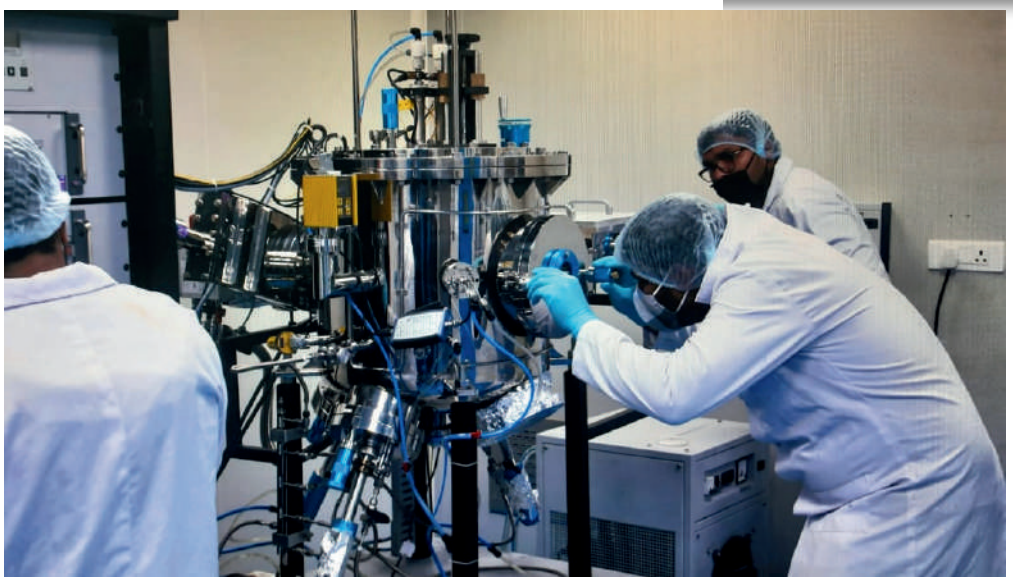
ADVANCE LASER PROCESSING AND 3D PRINTING FACILITY

ADVANCED MICROSCOPY FACILITY

CIF (CENTRAL INSTRUMENT FACILITY)

Caters to INST and External samples across the country

- Spectroscopy Facility
- Microscopy Facility
- Scattering Facility
- Chromatography Facility
- Surface Characterization Facility
- Advance Material Characterization Facility
- Advanced Biological Characterization Facility



ENERGY & ENVIRONMENT UNIT

FACULTY MEMBERS

Dr. Akashdeep
Scientist 'G'

Dr. Kamalakannan Kailasam
Scientist 'G'

Dr. Debabrata Patra
(Head of UNIT)
Scientist 'F'

Dr. Prakash P. Neelakandan
Scientist 'F'

Dr. Jayamurugan Govindasamy
Scientist 'F'

Dr. Sonalika Vaidya
Scientist 'E'

Dr. Tapasi Sen
Scientist 'E'

Dr. Vivek Bagchi
Scientist 'E'

Dr. Ramendra Sundar Dey
Scientist 'D'

Dr. Menaka Jha
Scientist 'D'

Dr. Sanyasinaidu Boddu
Scientist 'D'

Dr. Monika Singh
Scientist 'D'

Dr. Amit Kumar Mondal
Scientist 'B'

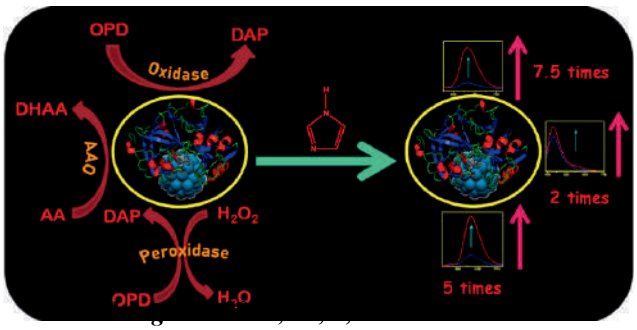
Prof. Amitava Patra, Director, INST

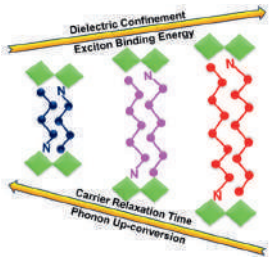
Research Activities/Highlights:

Our research focuses on understanding the ultrafast carrier dynamics of two-dimensional (2D) semiconductor nanoplatelets (NPLs), metal clusters, perovskite nanocrystals, and polymeric nanoparticles for designing efficient light-harvesting systems.

Significant Research achievements:

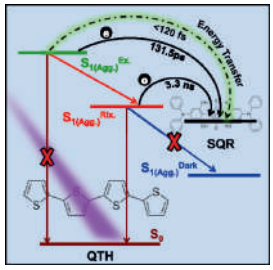
Artificial nanoenzymes based on metal nanoclusters have received great attention for multienzyme activities. This work describes the different enzymatic activities of the NCs, paving a new way for artificial nanoenzymes to have enhanced activities. Here, pepsin-capped copper NCs (Cu-Pep NCs) are used as oxidase, ascorbic acid oxidase (AAO), and peroxidase mimics, and their activities are enhanced by imidazole. The oxidase activity increased almost 7.5-fold, while 5-fold and 2-fold increases were observed for the peroxidase and AAO-like activity, respectively. The enhanced radical formation in the presence of imidazole moieties facilitates the enzymatic activity of the Cu-Pep-NCs/Imid system.





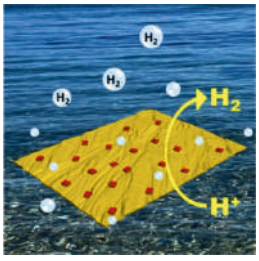
This work highlights the significance of dielectric confinements and exciton binding energy of hybrid layered perovskites (LPs) in controlling the carrier relaxation dynamics of LPs. Here, we have varied the alkyl-ammonium chain length in the LPs to change the dielectric confinement, and the first-principles calculations reveal that the long-chain organic spacer experiences stronger dielectric confinement in comparison to short-chain organic spacer cation-based LPs. The much softer phonon modes are responsible for the higher up-conversion of acoustic modes to optical modes, which leads to slower carrier relaxation dynamics in n- n-butylamine (BA) based LPs.

J. Phys. Chem. Lett. 2023, 14, 49, 10900–10909



Photoinduced energy transfer, charge transfer, and generation of sufficiently long-lived charge-separated (CS) states in the aggregated oligothiophenes are always challenging. Herein, we have coupled quaterthiophene (QTH) with a squaraine (SQR) dye in hybrid aggregates. A detailed time-resolved investigation using transient absorption spectroscopy and global target analyses revealed ultrafast photoinduced energy and electron transfer from QTH aggregates to SQR aggregates, forming a long-lived CS state in these hybrids. They were extracted to the SQR aggregates, leading to their successful utilization toward light-harvesting applications.

J. Phys. Chem. C 2023, 127, 20, 9735–9744



Heterostructured materials are emerging to improve the performance of hydrogen evolution reaction (HER) catalysts by controlling the interfacial charge-transfer process. Here, we report the synthesis of two-dimensional (2D) CdSe/CdS core/shell nanoplatelets (NPLs) with a 2D MoS2 nanosheet heterostructured electrocatalyst for hydrogen generation. A promising electrocatalytic activity with an onset overpotential of 171 mV and a Tafel slope of 122 mV dec–1 has been obtained in 2D NPLs-based heterostructured electrocatalysts in an acidic medium. Theoretical calculations reveal the creation of a sulfur defect during the HER on heterostructures, leading to excellent activity due to the optimum adsorption of the H* intermediate in the hydrogen-evolving reaction.

ACS Appl. Energy Mater. 2023, 6, 22, 11745–11753

Selected Publications:

- Devi, A.; Minhas, H.; Sahoo, L, Rashi., G. Saniya.; Das, A.; Mandal, S.; Pathak, B.; Patra, A. Insights of the Efficient Hydrogen Evolution Reaction Performance in Bimetallic Au4Cu2 Nanoclusters, Nanoscale, 2024, 16, 1758-1769.
- Marjit, K.; Francis, A. G.; Pati, S. K.; Patra, A.* Impacts of Exciton Binding Energy and Dielectric Confinement of Layered Lead Halide Perovskites on Carrier Relaxation and Exciton Phonon Interactions J. Phys. Chem. Lett. 2023, 14, 10900–10909.
- Rashi, Kaur, V.; Devi, A.; Bain, D.; Sen, T.; Patra, A.*, Probing the Fluorescence Intermittency of Bimetallic Nanoclusters using Single-Molecule Fluorescence Spectroscopy, J. Phys. Chem. Lett. 2023, 14, 45, 10166–10172

No of PhD Students- 02

Dr. Akash Deep, Scientist-G

Research Activities/Highlights:

- Applications of Carbon based nanomaterials and metal-organic frameworks for energy storage applications.
- Optical biosensors for detection of environmental pollutants and food quality parameters.
- Biosensors for clinical parameters.
- Development of 2D materials based electrochemical interfaces for sensor applications.
- Recycling of electronic waste for the recovery of high purity nanoproducts.

Significant Research achievements:

Different nanomaterials and their composites have been explored for the energy and environmental applications. The 2D materials like MOFs and MXenes have been explored as electrochemical and optical interfaces for the development of sensors and biosensors for analytes like Ferritin, Immunoglobins, circulating cancer cells, heavy metals, food toxins, pathogens, etc. These sensors offer high sensitivities and specificity in simple fluorescence, electrochemical or surface plasmon resonance formats. The materials have also been demonstrated for removal of pollutants and pathogens from environmental samples.

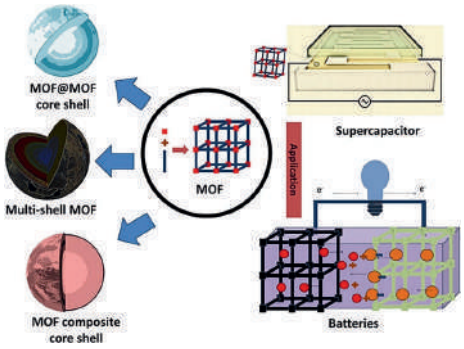


Fig. 1. Metal-organic frameworks based structures being explored for energy storage applications

The applications of MOFs and other nanomaterials have also been established in energy storage applications, e.g., supercapacitors. Many of such materials have been recovered from environmental and electronic wastes, primarily using the hydrometallurgical processes. The recovery of reusable materials, particularly from electronic waste, has also been tested on large scale in collaboration with the industry.

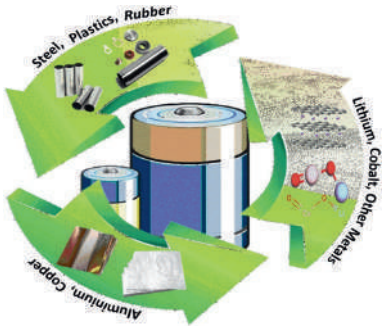


Fig. 2. Different technologies being developed for the recycling of waste lithium batteries

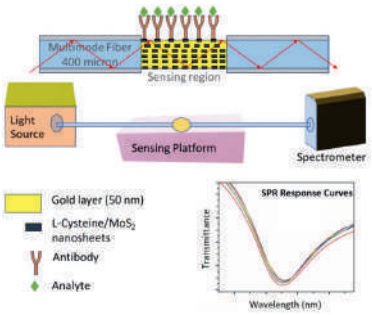


Fig. 3. Optical fiber based SPR sensor systems for the detection of biomolecules

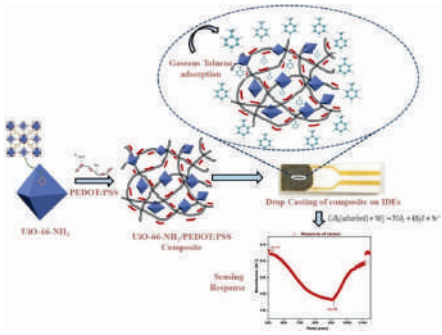


Fig. 4. Metal-organic frameworks based electrochemical platforms for detection of gases

Selected Publications:

- Thawany, P.; Khanna, A.; Tiwari, U. K.; Deep, A. L-cysteine/MoS2 modified robust surface plasmon resonance optical fiber sensor for sensing of Ferritin and IgG. Scientific Reports, 2023, 13 (1), 5297.
- Shrivastav, V.; Dubey, P.; Sundriyal, S.; Tiwari, U. K.; Deep, A. Recent advances on core-shell metal-organic frameworks for energy storage applications: Controlled assemblies and design strategies. Coordination Chemistry Reviews, 2024, 499, 215497.
- Sharma, S.; Kaur, G.; Nayak, M. K.; Deep, A. Development of core@ shell magnetic framework composite for immunoselective detection and capture of Salmonella typhimurium. Environmental Science: Nano, 2023, 10 (9), 2473-2488.

No of PhD Students- 02

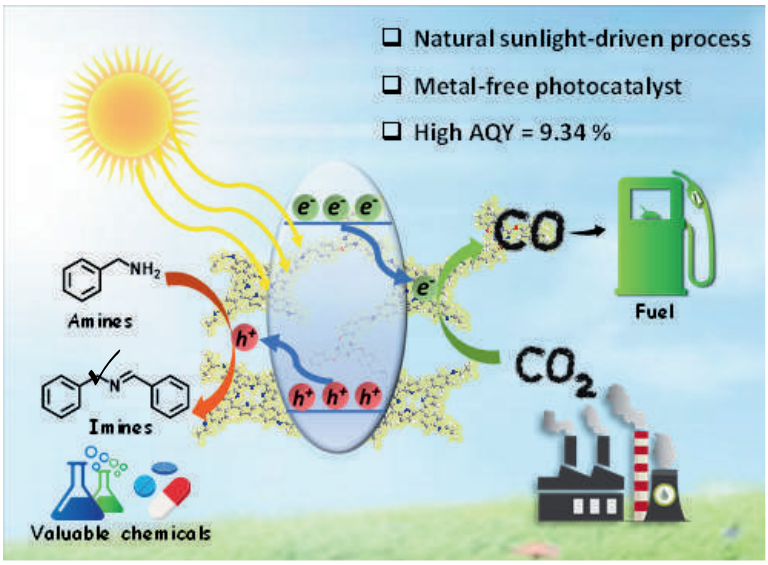
Dr. Kamalakannan Kailasam, Scientist-G

Research Activities/Highlights:

Advanced Functional Nanomaterials for Energy and Environmental Applications like photocatalytic water splitting, CO2 photoreduction and biomass valorization to fine chemical synthesis, CO2 conversion, gas storage and sensing using Heptazine based Carbon Nitride Polymers and Metal Oxide Nanostructures.

"Coalescing solar-to-chemical and carbon circular economy: Mediated by metal-free porphyrin and triazine-based porous organic polymer under natural sunlight" N. Saini, N. Sharma, D. K. Chauhan, R. Khurana, Md. E. Ali and K. Kailasam*. Journal of Materials Chemistry A, 2023, 11, 25743-25755.

- A novel metal-free photocatalyst, composed of porphyrin and a triazine-based porous organic polymeric network (TPT-prop) for the photocatalytic reduction of CO2 coupled with oxidative benzylamine homocoupling under natural sunlight for the first time.
- A remarkably high AQY of 9.34% (at λ = 430 nm) and solar-to-fuel conversion of 0.24 % was attained for CO production.



Metal-free porous organic polymeric network for synergistic CO2 reduction and amine oxidation under natural sunlight.

Significant Research achievements:

- Our group has been working on technological project with BPCL (Bharat Petroleum Corporation Ltd) on Photocatalytic H2 production and thermo-catalytic CO_2 conversion to organic carbonates.
- Among few attempts worldwide, our group is successful towards synergistic photoredox catalysis to obtain solar fuels (H_2 and CO generation) and fine chemicals from biomass based substrates.
- Utilizing the undesirable oxidation of Lead-free hybrid halide perovskite nanosheets for solar-driven photocatalytic C(sp3)-H activation for the first time.

Selected Publications:

- Rawat, B.; Battula, V. R.; Nayak, P.; Ghosh, D.; Kailasam, K. Utilizing the undesirable oxidation of Lead-free hybrid halide perovskite nanosheets for solar-driven photocatalytic C(sp3) H activation: Unraveling the serendipity. ACS. Appl. Mater. Interface, 2023, 15, 53604.
- Chauhan, D. K.; Verma, A.; Jain, A.; Saini, N.; Prajapati, P. K.; Bera, C.; Kailasam, K. Unifying CO2-to-fuel and biomass valorization over metal-free 2D carbon nitride-fullerene heterostructure: a solar-driven chemical circular economy. J. Mater. Chem. A, 2023, 11, 18672.
- Saini, N.; Sharma, N.; Chauhan, D. K.; Khurana, R.; Ali, Md. E.; Kailasam, K. Coalescing solar-to-chemical and carbon circular economy: Mediated by metal-free porphyrin and triazine-based porous organic polymer under natural sunlight. J. Mater. Chem. A, 2023, 11, 25743.

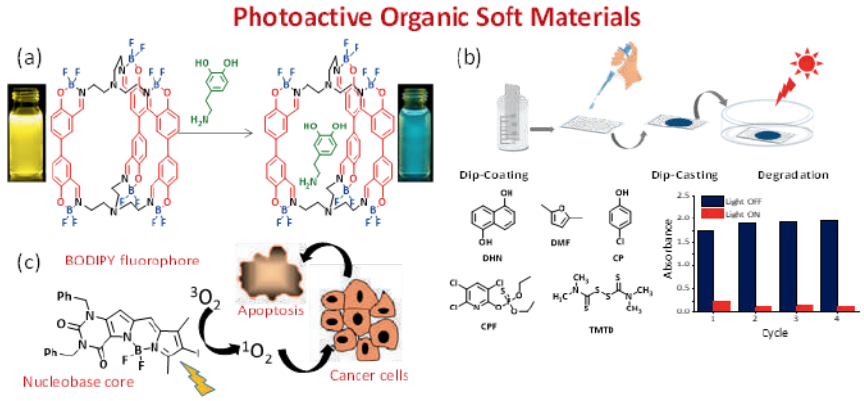
No of PhD Students-07, Postdoc 01

Dr. Prakash P. Neelakandan, Scientist-F

Research Activities/Highlights:

- **Plasmon-molecule coupled nanoparticles:** Metal nanoparticles decorated with BODIPY dyes form hybrid excited states via strong electronic coupling between nanoparticles and dyes. Further, organic dyes helped in self-assembling metal nanomaterials and these hybrid nanoparticles were demonstrated to have applications in photobiology and catalysis.

- **Schiff bases and their boron complexes:** Several Schiff bases and their boron complexes were synthesized and were observed to yield flexible single crystals. The mechanical and optical properties of these crystals was tuned using external physical and chemical stimuli which were employed for developing sensors, anti-counterfeiting materials and triboelectric nanogenerators.



- **Nucleic Acid Analogues:** Artificial nucleobase analogues were synthesised by modifying natural nucleobases. For example, uracil was fused to a BODIPY core and evaluation of its photophysical and photopbiological properties revealed its anti-tumour properties.

Schematic representation of (a) detection of dopamine using a molecular capsule, (b) degradation of water pollutants using plasmon-molecule coupled nanoparticles, and (c) photodynamic therapy using an uracil appended BODIPY.

Significant Research achievements:

Pollutants such as salicylic acid, ibuprofen, naproxen, diclofenac, atenolol, tri(2-chloroethyl) phosphate, tri(chloropropyl) phosphate and diethylhexyl phosphate are found in wastewater treatment plant effluents. Sulfonylureas and organophosphates are the two major classes of pesticides, and they have a high level of toxicity and are harmful to humans if ingested, inhaled, or absorbed topically. Decontaminating industrial and domestic wastewater is thus of primary importance for ensuring clean drinking water. Plasmonic nanoparticles are superior photocatalysts as they are stable and allow usage of both the UV and visible light thereby significantly improving the efficiency of the photo-degradation process. We have shown that plasmon-molecule coupling in gold-BODIPY nanocomposites results in enhanced singlet oxygen generation. We developed heterogeneous thin films incorporating plasmon-molecule coupled nanocomposites with excellent thermal and photochemical stability. These thin films were demonstrated to generate singlet oxygen efficiently and these thin films functioned as a heterogeneous and reusable photocatalyst for the degradation of dissolved water contaminants and pesticides.

Selected Publications:

- Nagpal, A., Tyagi, N.; Neelakandan, P. P.*; BODIPY-fused Uracil: Synthesis, Photophysical Properties, and Applications; Photochem. Photobiol. Sci., 2024, 23, 365-376.
- Kumar, P. P. P.; Bajaj, A.; Samadder, P.; Ali, M. E.; Neelakandan, P. P.*; Selective Naked-eye Detection of Dopamine Using an Imino-Boron Molecular Capsule; New J. Chem., 2023, 47, 19183-19190.
- Hemant, Rahman, A.; Neelakandan, P. P.*; Photocatalytic Degradation of Water Pollutants and Pesticides Using Plasmon-Molecule Coupled Gold-BODIPY Nanoparticles; ChemNanoMat, 2023, 9, e202300236.

No of PhD Students-5, Project/intern students-3

Dr. Jayamurugan Govindasamy, Scientist-F

Research Activities/Highlights:

Polymer chemistry, Catalysis, Functional organic (nano) materials for optoelectronics, sensing, drug delivery, health and environmental applications.

The research in my group is centred on synthetic organic chemistry to explore nanoporous and nanomaterials for various applications. Thus, it is highly interdisciplinary.

- The development of luminescent 1,1,4,4-tetracyanobuta-1,3-dienes is an active research area, with a quantum yield (Φ) of 7.8% achieved in cyclohexane. We pioneered using urea as a donor to turn non-emissive chromophores into weakly emissive ones (Φ = 2.3% in CH3CN). Using nanotechnology, we reformulated this into highly emissive aggregates with Φ = 7.9% in water, without fluorophore conjugation for photodynamic therapy application.
- To counter the harmful effects of excess nitric oxide (NO) through its inactivation, we developed urea-functionalized push-pull chromophores having TCBD/TCNQ as acceptor moieties. The inhibition of neovascularization in a corneal injury model suggested that Urea-TCNQ was effective in preventing pathological conditions.
- Further, in health, a new type of polymeric biocide wherein 100% drug units were developed for antimicrobials coating of sutures which was further made more biocompatible by carbonising partially and to develop antimicrobial nanomat for therapeutic applications.

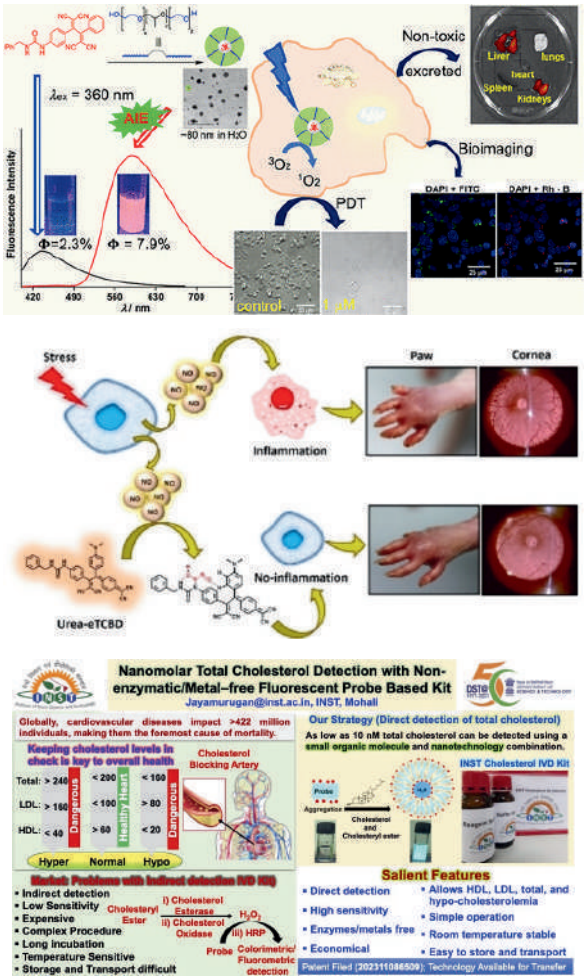


Figure 1. Transforming weakly emissive chromophores into emissive and its use as sensitizer for photodynamic therapy, New urea based receptor for NO scavenging for preventing pathological conditions, Small organic molecule fluorescent probe for detecting hypo- and hyper-cholesterolemia.

Significant Research achievements:

Developed a non-enzymatic/metal-free small fluorescence probe for total cholesterol detection blood serum samples in collaboration with doctors from PGI, Chandigarh.

Selected Publications:

- Sartaliya, S.; Sharma, R.; Sharma, A.; Chopra, V.; Ghosh, D.; Jayamurugan, G.* Biocidal polymer derived near white light-emitting carbonized polymeric dots for antibacterial and bioimaging applications. Photochem. Photobiol. 2024, DOI: https://doi.org/10.1111/php.139122024.
- Dhiman, S.; Solanki, A. K.; Nag, K.; Jayamurugan, G.* Perspectives on dual-purpose functional nanomaterials for detecting and removing fluoride ion from environmental water. ChemNanoMat 2023, e202300369.
- Roy, H. S.; Neethu, K. M.; Rajput, S.; Sadhukhan, S.; Gowri, V.; Dar, A. H.; Monga, M.; Salaria, N.; Guha, R.; Chattopadhyay, N.; Jayamurugan G.;* Ghosh, D.* Efficient Nitric Oxide Scavenging by Urea-Functionalized Push-Pull Chromophore Modulates NO-Mediated Diseases. Chem. Eur. J. 2023, e202301748.

No of PhD Students-06/Postdoc-1, Project/intern students-4

Dr. Debabrata Patra, Scientist-F

Research Activities/Highlights:

Regulating macroscopic fluid flow by catalytic harnessing of chemical energy could potentially provide a solution for powerless microfluidic devices. Earlier reports have shown that the surface anchored enzymes can actuate surrounding fluid in the presence of respective substrate in a concentration dependent manner. It is also crucial to have control over the flow speed of a self-powered enzyme micropump in various applications where controlled dosing and mixing is required. However, modulating the flow speed independent of fuel concentration remains a significant challenge. In quest to regulate the fluid flow in such system, a supramolecular approach has been adopted where reversible regulation of enzyme activity was achieved by a two-faced synthetic receptor bearing sulfonamide and adamantane groups. The bovine carbonic anhydrase (BCA) enzyme contains a single binding site favourable to sulfonamide group was used as model enzyme and the enzyme activity was inhibited in presence of two-faced inhibitor. The same effect was reflected when immobilized enzyme was used as an engine to actuate the fluid flow. The flow velocity was reduced up to 53% in presence of 100 µM of inhibitor. Later, upon addition of a supramolecular "host" CB[7], the inhibitor was sequestered from enzyme due to higher binding affinity of CB[7] with the adamantane functionality of the inhibitor. As a result, the flow velocity was restored to ~ 72%, thus providing successful supramolecular control over a self-powered enzyme micropump.

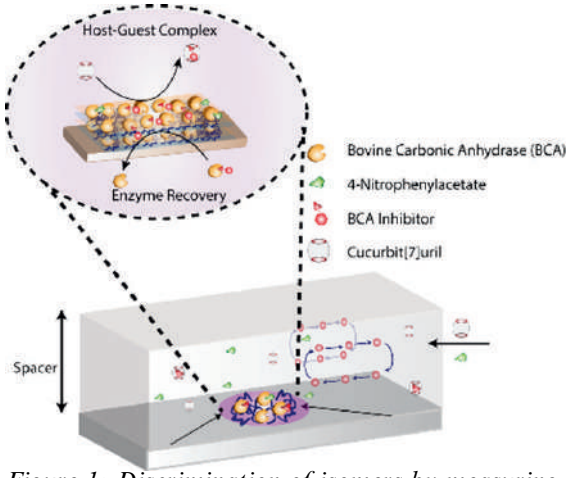


Figure 1: Discrimination of isomers by measuring self-generated fluid flow.

Significant Research achievements:

The jammed liquid-liquid interface offers an elegant approach to achieve non-equilibrium shapes of liquids. The interfacial jamming subsequently brings about formation of 2D "solid-like" assembly. In this work, biphasic reaction between a perylenediimide based luminogen benzoperylenediimide monoanhydride (Bp(Im)2MA) and diamines are demonstrated that rendered amide bond formation and in turn amide nanoconjugates across the oil-water interface. Amide nanoconjugates formed with different diamines showed diamine alkyl chain length dependent varied interfacial properties and sizes. Jamming of the interface is judiciously utilized to induce aggregation of amide nanoconjugates which successfully established macroscopic Aggregation Induced Emission-switching (AIE-switching) behavior. Further, the versatility of this approach is extended to analyze the reactivity of chiral amino acids. The reaction between the Bp(Im)2MA luminogen and chiral amino acids exhibits macroscopic enantioselectivity at jammed interface via diverse surface coverage of the amino acids-based amide nanoconjugates. The formation of discrete nanoscopic amide interfacial assembly for each of the L- and D- amino acids isomers is corroborated with Atomic Force Microscopy (AFM) images. This study extends a fascinating pathway to aid in understanding and fabrication of structurally diverse jammed interfaces and aggregation of organic molecules across an oil-water interface.

Figure 2: The biphasic reaction between between a fluorescent probe and diamines

Selected Publications:

- Alam, M.; Sangwan, R.; Agashe, C.; Gill, A. K.; & Patra, D. "Autonomous macroscopic signal deciphering the geometric self-sorting of pillar [n] arenes". Chem. Common., 2023 59, 6016-6019.
- Agashe, C.; Roy, R.; Koner, A. L.; & Patra, D. "AIE-Switching and Enantioselective Reactivity at Jammed Liquid-Liquid Interface" Adv. Opt. Mater. 2023, 2303034.
- Agashe, C.; Saroha, A.; Agasti, S. S.; & Patra, D. "Supramolecular Modulation of Fluid Flow in a Self-Powered Enzyme Micropump" Langmuir 2024. 40, 6933-6939.

No of PhD Students-07

Dr. Sonalika Vaidya, Scientist-E

Research Activities/Highlights:

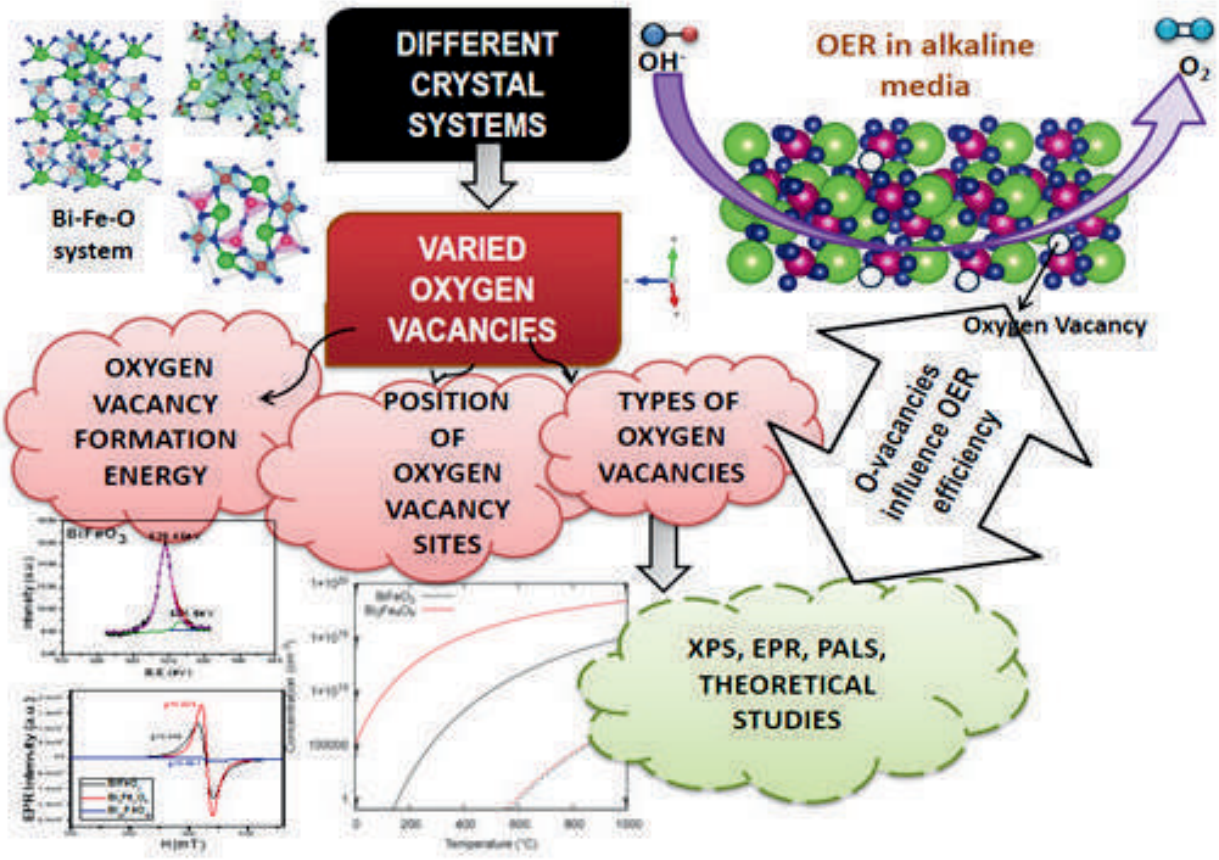


Fig : The nature and relative concentration of oxygen vacancies influenced by the crystal structure and stoichiometry of the elements in Bi-Fe-O system affect their behavior towards OER.

We have tried to understand the influence of oxygen vacancies in the Bi-Fe-O systems having different crystal structure and stoichiometry on their electrocatalytic Oxygen Evolution Reaction (OER) behaviour.

Selected Publications:

- Kumari, A.; Vaidya S. Influence of Structural Parameters of a Catalyst on its Photocatalytic Activity In ACS Symposium Series volume Towards Scalable Production of Green Hydrogen through Photocatalysis.(Accepted February 2024)
- Kumari, A.; Jyoti, S.; Vaidya S. Nanostructured Metal Oxides for Photocatalytic Water Splitting In Nanomaterials for Energy and Sensors Applications, CRC Press, 2023, 209.
- Verma, R.; Vaidya S. Basics of Nanoemulsions: Synthesis and Characterization In Micro and Nano Technologies, Industrial Applications of Nanoemulsions, Elsevier, 2024, 1.

No of PhD Students-3, intern students: 1

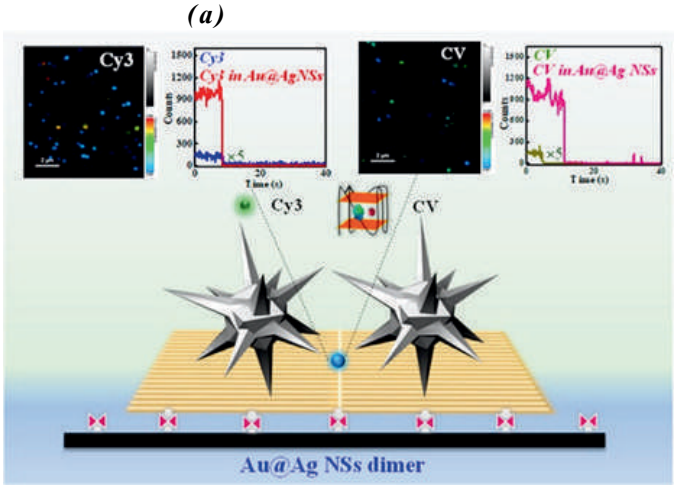
Dr. Tapasi Sen, Scientist-E

Research Activities/Highlights:

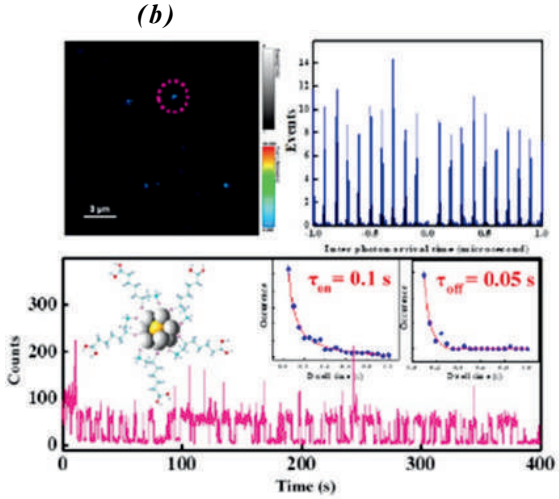
- Development of metallic nanostructures.
- NIR active SiO2@Au NSs were employed for SERS enhancement and Photothermal killing of breast cancer.
- Bimetallic Au@Ag nanostars were site specifically arranged using DNA origami for fluorescence enhancement.
- Photostability of bimetallic AuAg28 and monometallic Ag 29 nanoclusters was monitored using single-molecule spectroscopy.

Significant Research achievements:

Our group studied single molecule fluorescence enhancement of Cy3 dye positioned at the junction of the Au@Ag NSs dimer with an interparticle gap of 5 nm using DNA origami. Further, the fluorescence enhancement of a small biologically relevant molecule was explored using CV dye as a probe, attaining a maximum of 42 Fold enhancement. Additionally, our team discovered that bimetallic AuAg28 nanoclusters have superior photostability compared to monometallic Ag29 nanoclusters using single-molecule spectroscopy. The statistical analysis was performed depicting 5- fold enhancement in intensity on Au doping in Ag29 nanocluster.



(a) Fluorescence enhancement was observed in the presence of Au@Ag NSs which was confirmed from FLIM Images and intensity time traces



(b) Au@Ag NSs were site-specifically constructed in dimer shape using DNA origami nanofabrication and used as a probe for ultra-sensitive ATP detection using crystal violet CV dye and to increase the single-molecule fluorescence of Cy3 dye.

Selected Publications:

- Kaur, V., Kaur, C. and Sen, T., Single-Molecule Fluorescence Enhancement Based Detection of ATP Using DNA Origami-Assembled Au@ Ag Nanostar Optical Antennas. J. Phys. Chem. C, 2023, 127, 15, 7308-7318.
- Kaur, G., Kaur, V., Kaur, N., Kaur, C., Sood, K., Shanavas, A., Sen, T. Design of Silica@ Au Hybrid Nanostars for Enhanced SERS and Photothermal Effect. ChemPhysChem, 2023, 24, 22, e202200809.
- Rashi, Kaur, V., Devi, A., Bain, D., Sen, T., Patra, A. Probing the Fluorescence Intermittency of Bimetallic Nanoclusters using Single-Molecule Fluorescence Spectroscopy. J. Phys. Chem. Lett., 2023,14, 45, 10166-10172.

No of PhD Students-6

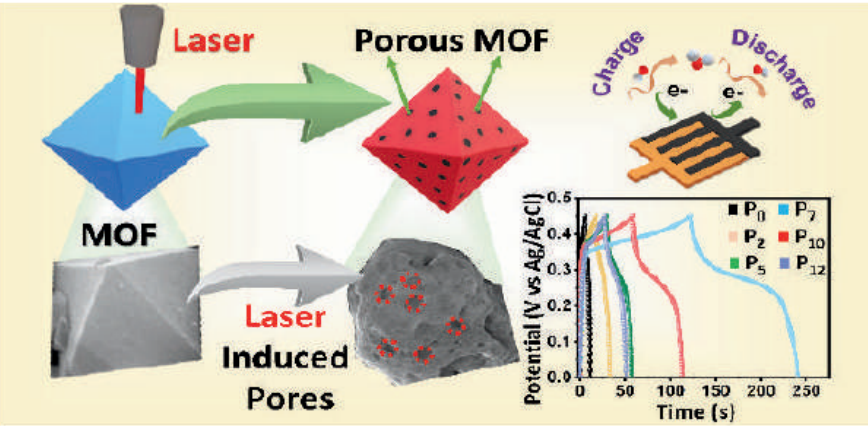
Dr. Vivek Bagchi, Scientist-E

Research Activities/Highlights:

Electrocatalysts are critical to increase reaction rates and control selectivity in many electrochemical fuel production and consumption reactions. In Energy and Environment Research Laboratory (EERL), we develop new electrocatalyst materials for processes including hydrogen evolution and oxidation, oxygen evolution and reduction, nitrogen reduction reaction, carbon dioxide reduction etc. We also design materials for energy storage and environmental remediation.

Energy Conversions:

- Hydrogen generation
- Oxygen Evolution
- Oxygen Reduction
- Nitrate Reduction Reaction
- Carbon-di-Oxide Reduction and Capture
- Conversion: Electrochemical carbon dioxide conversion
- Utilization Energy Storage
- Supercapacitors
- Metal-ion Batteries
- Environmental Remediation
- Material Development for Air/Water Purification Catalysis
- Artificial and Biomimetic Catalysis
- C-H Bond Activation and Functionalization



Schematic illustration of treatment of CuZn-MOF with laser at various laser powers.

In one of our study, we synthesized CuZn-MOF-Px by meticulously adjusting laser power during fabrication. This precise tuning substantially enhanced controlled defects and porosity, enhancing the electrode's surface area and specific capacitance. This work's significance lies in the innovative use of laser irradiated approach for improving the performance of MOF-based materials for energy storage devices.

Selected Publications:

- Aashi; Rani,R; Alagar,S; Sharma, J; Arun k, and Bagchi, V*, Laser-Induced Crafting of Modulated Structural Defects in MOF-Based Supercapacitor for Energy Storage Application, ACS Materials Lett., **2024**, 6,5,1769-1778.
- Krishankant; Aashi; Jain, A; Sharma, J; Rani,R; Bera, C; and Bagchi, V*, Unfolding the Electrocatalytic Efficiency of Ultrastable CoFeLDH Nanorods by Creating Oxygen Vacancies for OER, ACS Appl. Energy Mater. **2024**, 7, 3, 1027–1036.
- Gaur, A; Aashi; Mathew, J; Pundir, V; Kaur, R; Sharma, J; Gupta, K; Bera C, and Bagchi, V, Electronic Redistribution Through the Interface of MnCo2O4-Ni3N Nano-Urchins Prompted Rapid In-Situ Phase Transformation for Enhanced Oxygen Evolution Reaction, Nanoscale, **2024.**

No of PhD Students -9, Project/intern students: 03

Dr. Monika Singh, Scientist-D

Research Activities/Highlights:

Ultrathin 2D metal-organic frameworks (MOFs) exhibit a myriad of unparalleled properties, rendering them extensively applicable across various fields. Despite this, developing a 2D MOF sensor for detecting hazardous amines in water remains a formidable challenge. To address this, we synthesized Ni-btc MOF ultrathin nanosheets with a thickness of approximately 4.15 nm for the detection of amines in water. These nanosheets demonstrated a notable "turn-on" fluorescence response in the presence of ammonia and aliphatic amines. The detection limit for aliphatic amines ranged from 297 to 424 nM, while for ammonia, it reached an impressive low limit of around 42 nM, which is an excellent value, hitherto, compared to the other reported MOFs for ammonia sensing in water. Density functional theory calculations elucidated the mechanism underlying fluorescence enhancement. Additionally, a mixed matrix membrane based on MOF nanosheets was fabricated for real-time sensing that exhibits an immediate color change in the presence of ammonia and aliphatic amines.

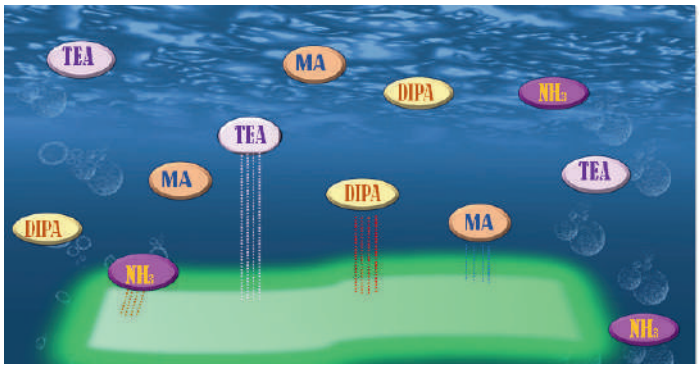


Figure 1. "Turn-on" fluorescence sensing by Metal-Organic Frameworks

Significant Research achievements:

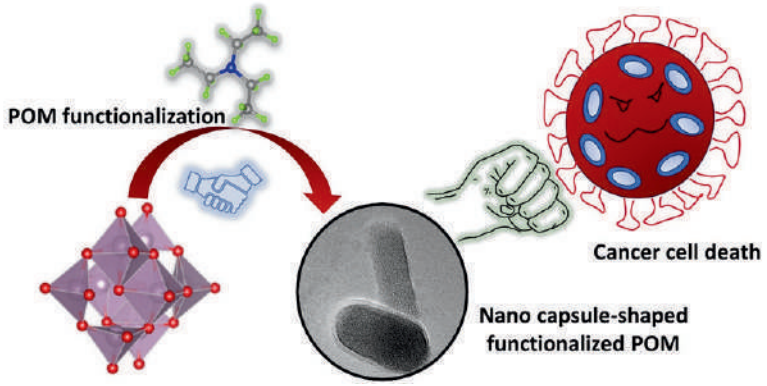


Figure 2. Polyoxometalates as anti-tumoral agents

Polyoxometalates (POMs) are versatile anionic clusters which has attracted a lot of attention in biomedical investigations. A polyoxomolybdate (POMo) based organic-inorganic hybrid solid (C6H16N)(C6H15N)2[Mo8O26].3H2O, has been synthesized and its antitumoral activities have been investigated against three cancer cell lines namely, A549 (Lung cancer), HepG2 (Liver cancer), and MCF-7 (Breast cancer) with IC50 values 56.2 µmol/L, 57.3 µmol/L, 55.2 µmol/L respectively. This material was stable in physiological pH as evident from UV-Vis spectroscopy making it a suitable candidate for biological applications. We have also made an attempt to understand the mechanistic pathway of anti-tumoreffect followed by any {Mo8O26}4- type cluster-based hybrid solid. It was found to interact with calf-thymus DNA leaning to the fact that DNA binding can be said to be the most likely mechanism for cancer cell death. In addition to that, DNA fragmentation assays were carried out to verify the cell death by DNA binding mechanism and revealed that the DNA was damaged upon addition of this material, further demonstrating that DNA binding is the most probable mechanism for the anti-tumor activity displayed by polyoxometalate-based inorganic-organic hybrid solid. This paves the path for exploring octamolybdate based hybrid POMs with bioorganic ligand as potent anti-tumor agent.

Selected Publications:

- Ladhi, R.; Dhillon, A. K.; Singh, M. Ultrathin MOF nanosheets and their mixed-matrix membranes for ammonia and aliphatic amine sensing in water, Nanoscale, 2024, doi.org/10.1039/D4NR00546E.
- Joshi, A.; Acharya, S.; Devi, N.; Gupta, R.; Sharma D.; Singh, M. Polyoxomolybdate-based hybrid nanocapsule as an antineoplastic agent, Nanoscale Advances, 2023, 22, 6045-52. (This article featured in special collection "Celebrating International Women's Day: Women in Nanoscience" published by RSC on the occasion of Women's Day 2024)
- Sood, P.; Krishankant, Bagdwal, H.; Joshi, A.; Yadav, K. K.; Bera, C.; Singh, M. Polyoxometalate-Derived Cu-MoO2 Nanosheets as Electrocatalysts for Enhanced Acidic Water Oxidation, ACS Applied Nano Materials, 2023, 1, 69-76.

No of PhD Students-4, Project/intern students:02

Dr. Sanyasinaidu Boddu, Scientist-D

Research Activities/Highlights:

- **Lanthanide-doped nanomaterials for Anti-counterfeiting:** Lanthanide-doped Sr2BiF7 nanomaterials with excitation-dependent luminescent properties are synthesized by a simple co-precipitation method and applied for multimode encrypted anti-counterfeiting.
- **Luminescent nanomaterials for Temperature sensing:** Downshifting and upconversion photoluminescence properties of Ba2V2O7 nanosheets doped with Er3+ are investigated. Temperature-dependent luminescence intensity ratios of thermally coupled as well as non-thermally coupled levels are used for temperature sensing in the range of 275-650 K
- **Semiconductor nanomaterials for photocatalytic water splitting:** A simple is applied for photocatalytic H2 evolution activity enhancement through surface engineering of CaTiO3 without disturbing its phase, and morphology of the material. The selective leaching of Ca(II) ions from the CTO surface results in oxygen vacancy as well as (III) and (IV) oxidation states of Ti along with a rough surface in CaTiO3. This helps in the enhancement of the photocatalytic hydrogen evolution rate from 8.7 µmol.g-1.h-1 (pristine CaTiO3) to 58.1 µmol.g-1.h-1 (CaTiO3-treated with 5M HNO3), which is approximately 6 times higher.

Significant Research achievements:

Ba2V2O7:Er3+ nanosheets were synthesized using a sol-gel method aided by citric acid. The luminescence properties of these samples, including up-conversion and down-conversion, were investigated using both ultraviolet and 980 nm LASER stimulation. When subjected to ultraviolet light, the sample exhibits a distinct broadband emission that appears pale green. This emission is a distinguishing property of the sample and is attributed to the presence of V2O72- ions. Upon being stimulated by a 980 nm LASER, the sample exhibits standard green up-conversion

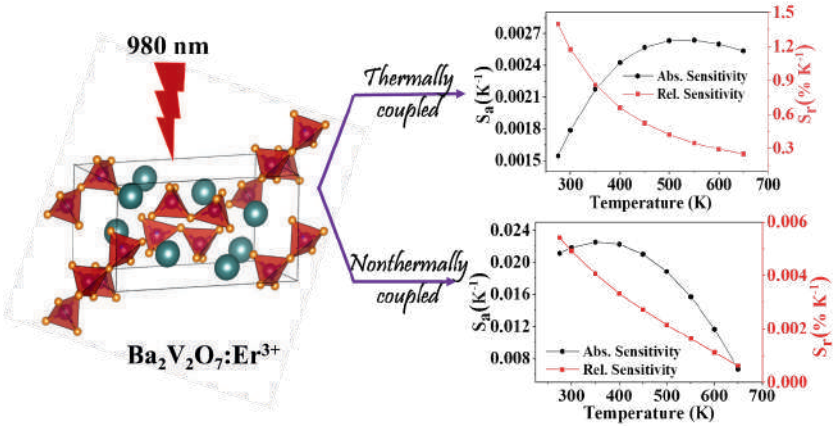


Figure: Absolute and relative temperature sensitivities obtained in the range of 275-650K through TCELs and NTCELs of Ba2V2O7:Er3+ nanosheets.

Er3+ emission bands. Concurrently, an assessment was conducted on the phosphor's ability to measure temperature by analysing the luminescence intensity ratio between the thermally coupled 2H11/2, 4S3/2 energy levels (TCELs) and the non-thermally coupled 2H11/2, 4F9/2 energy levels (NTCELs) of the Er3+ ion. The corresponding highest sensitivity of temperature for TCELs and NTCELs is 1.40%K-1 and 0.54%K-1, respectively and it can position Ba2V2O7:Er3+ nanosheets as a capable option for materials utilized in temperature sensing applications.

Selected Publications:

- Yadav, P.; Anil, C.A.; Kunchala, R.K.; Samal, S.K.; Naidu, B.S. Surface-engineering of CaTiO3 for photocatalytic hydrogen evolution reaction through enhanced oxygen vacancy, Int. J. Hydrog. Energy, 2024, 64, 407-416.
- Samal, S.K.; Kulkarni, S.; Yadav, J.; Naidu, B.S. Er3+-activated Ba2V2O7 upconversion nanosheets for dual-mode temperature sensing, Nanoscale, 2024, 16, 7443 – 7452.
- Kunchala, R.K.; Bhatt, D.; Kalia, R.; Samal, S.K.; Yadav, J.; Naidu, B.S. Effect of mixed-valence of manganese on water oxidation activity of La1-xCaxMnO3 (0≤x≤ 1) solid solutions, Int. J. Hydrog. Energy, 2023, 48 (40), 15092-15104.

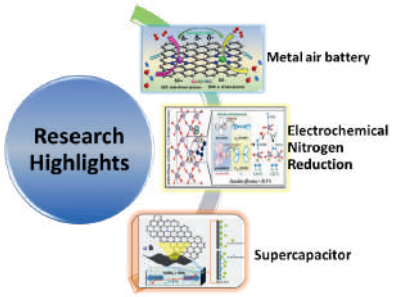
No of PhD Students-6, Project/intern students-4

Dr. Ramendra Sundar Dey, Scientist-D

Research Activities/Highlights:

The research activities of the group focuses on electrochemistry of nanomaterials, including electrochemical ammonia synthesis, metal-air battery, and energy storage devices. Mentioned below are the highlights of overall research activities.

Oxygen vacancy engineering is a new technique that can induce a charging effect in materials for different applications. This study focuses on the synthesis of oxygen vacancy-engineered SnO2 with a gradual structural transformation from in-plane to bridge-type oxygen vacancy density. This transformation enables the NRR process at a lower overpotential and determines the binding strength of the intermediates on the active site. In situ ATR-IR studies helped identify the stable reaction intermediates. A restricted hydrogen evolution reaction Faradaic on the Sn-site resulted in a Faradaic efficiency of 48.5%, which is better than that reported in all the literature reports. This study uncovers insights into the electronic structural alteration of SnO2 and the effect of active sites on the rate kinetics of the NRR (Mater. Horizons 2024).

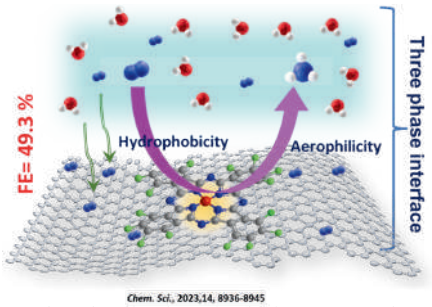


Recent research has shown that aqueous supercapacitors made with carbon-based nanomaterials are gaining popularity due to their low-cost synthesis, environmental compatibility, and safety. In particular Dr Dey and his team developed laser-irradiated boron-doped graphene (LI-BG) electrodes paired with a water-in-bisalt (WIBS) electrolyte consisting of 12m NaNO3 and 0.1m KNO3 that have demonstrated excellent cycling stability over 8000 cycles. The high energy density and power density of the B-doped electrode immersed in the electrolyte also make it a promising candidate for improving the performance of aqueous supercapacitor systems. Throughout the cycling, it has shown nearly 100% Coulombic efficiency and around 90% capacitance retention up to 6000 cycles. This study highlights the potential of LI-BG electrodes with WIBS electrolytes in enhancing the energy density and overall performance of aqueous supercapacitor systems. (ACS Sustain. Chem. Eng. 2024).

We synthesized a cobalt-imidazole-tetracarboxylate metal–organic framework and modified it with graphene to create a conducting electrocatalyst. This catalyst successfully catalyzes the oxygen reduction reaction (ORR) and oxygen evolution reaction (OER) in alkaline media. The electrocatalyst has a half-wave potential of 0.78 V vs. RHE for the ORR and an overpotential of 302 mV vs. RHE for the OER. Dey et al., also used in situ Fourier transform infrared (FT-IR) spectroscopy with electrochemical techniques to analyze the intermediates formed during the reactions. Overall, the approach has allowed them to create sustainable, low-cost, and user-friendly catalysts that could be a good alternative for future electronic applications, particularly for Zn-air batteries. (J. Mater. Chem. A 2023).

Significant Research achievements:

Engineering hydrophobic-aerophilic interfaces to boost N2 diffusion and reduction through functionalization of fluorine in second coordination spheres (Bhardwaj, S.; Das, S. K.; Biswas, A.; Kapse, S.; Thapa, R.; Dey, R. S. Engineering Hydrophobic–Aerophilic Interfaces to Boost N2 Diffusion and Reduction through Functionalization of Fluorine in Second Coordination Spheres. Chem. Sci. 2023, 14 (33), 8936–8945.)



Ammonia is an essential component of nitrogen-containing fertilizers and hydrogen energy carriers. A sustainable and less energy-intensive alternative to the traditional Haber-Bosch method is electrochemical ammonia synthesis.However, the electrochemical nitrogen reduction reaction (eNRR) is slow due to N2 diffusion, leading to the competing hydrogen evolution reaction (HER).

To address this, Dr Ramendra Sundar Dey and team developed a hybrid electrocatalyst, F-CuPc-G, by grafting fluorinated copper phthalocyanine (F-CuPc) to graphene, which had both hydrophobic and aerophilic properties. The NRR process follows an alternating pathway, and the catalyst's hydrophobic layer fosters N2 molecule diffusion while its aerophilic characteristic aids N2 adsorption, suppressing the HER. At -0.3 V vs. RHE, the F-CuPc-G catalyst achieved a high faradaic efficiency (FE) of 49.3% for NRR.

Selected Publications:

- Bhardwaj, S.; Das, S. K.; Biswas, A.; Kapse, S.; Thapa, R.; Dey, R. S. Engineering Hydrophobic–Aerophilic Interfaces to Boost N2 Diffusion and Reduction through Functionalization of Fluorine in Second Coordination Spheres. *Chem. Sci.* 2023, *14* (33), 8936–8945.
- Biswas, A.; Barman, N.; Nambron, A.; Thapa, R.; Sudarshan, K.; Dey, R. S. Deciphering the Bridge Oxygen Vacancy-Induced Cascading Charge Effect for Electrochemical Ammonia Synthesis. *Mater. Horizons* 2024.
- Kumar, G.; Das, S. K.; Nayak, C.; Dey, R. S. Pd "Kills Two Birds with One Stone" for the Synthesis of Catalyst: Dual Active Sites of Pd Triggers the Kinetics of O2 Electrocatalysis. *Small* 2024, *20* (9), 2307110.

No of PhD Students-7, Intern students: 01

Dr. Menaka Jha, Scientist-D

Research Activities/Highlights:

- The utilization of urea during electrolysis presents an appealing option for anodic oxidation, offering environmental benefits by converting waste into energy. The present work focuses on synthesizing mixed transition metal oxide (MMO) nanostructures composed of nickel rich nickel cobaltite electrode materials. Interesting, cobalt rich nickel cobaltite have been widely studied; however, the nickel-rich nickel cobaltite remains relatively unexplored. For stabilization of nickel rich nickel cobaltite, we have designed a process for synthesizing three-dimensional (3D) Ni-Co oxalate as a precursor via the coprecipitation method using diammonium oxalate monohydrate as a precipitating agent. This work provides detailed insights into designing MMOs with high porosity, increased exposed active sites, and unique structural features that enhance electrocatalytic activity (Figure 1a).
- The demand for display devices increased very rapidly, and out of various display techniques, field emission-based display technology has huge potential to make next-generation display devices. A conventional field emitter uses single materials, which offer high quantum resistance between the emitter materials and substrate; thus, the heterostructure formation can be used for the reduction of quantum resistance by increasing the density of state near the Fermi level. Therefore, in the present work, black phosphorus (BP)/dysprosium hexaboride (DyB6) heterostructures were used for field emission study(Figure 1b).
- Designing efficient electrocatalysts for hydrogen generation is desirable for electrochemical water splitting and fuel cells as they are a part of clean and sustainable energy system. Here, we are reporting the utilization of clean method for the production of platinum deposited chromium disulphide (CrS2) particles and their application for hydrogen generation via photo-assisted electrochemical water splitting. Photoelectrochemical studies of CrS2 show a close to zero onset potential, ultralow overpotential (8.3 mV), small Tafel slope (54 mV/decade), and low impedance (1.8 Ω) in acidic media (figure 1c).

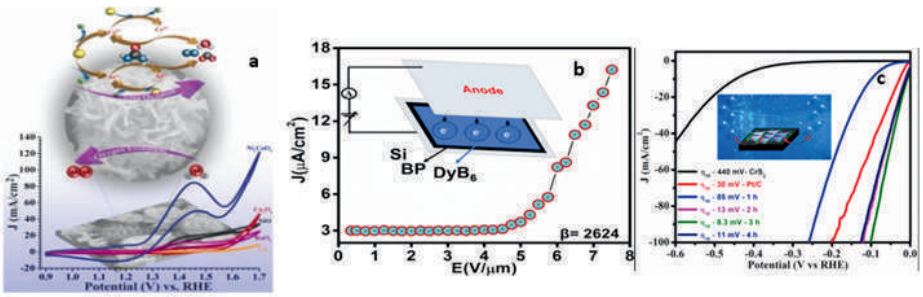
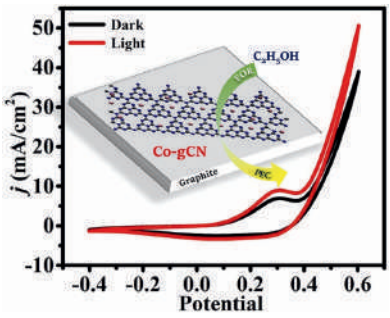


Figure: Absolute and relative temperature sensitivities obtained in the range of 275-650K through TCELs and NTCELs of Ba2V2O7:Er3+ nanosheets.

Significant Research achievements:

- Energy conversion devices based on liquid fuels have gained considerable attention in recent times to meet the increasing global demand for energy. In this work, graphitic carbon nitride (gCN) nanosheets have been synthesized by pyrolysis of urea and Co has been decorated in different molar ratios over its surface by the solution phase method. The prepared catalysts have been utilized for photo electrooxidation of ethanol, an anodic half-cell reaction in direct ethanol fuel cells. Electrochemical studies show that the catalyst containing 3 mol % of Co shows the best activity with a peak current density of 6.91 mA/cm2 obtained at a peak potential of 0.28 V with maximum current density of 40 mA/cm2. The effect of light on the catalytic activity has also been studied. On illuminating the surface of the electrode with light, an increment of 85% in current density is observed which indicates higher charge transfer that enhanced the photoactivity of the catalyst.



- This study confirms the practical applicability of the non-expensive carbonaceous material Co–C3N4 utilization as a photoanode in future energy systems (Figure 2).

Selected Publications:

- Wadhwa, Ritika, Krishna K. Yadav, Supriya Rana, and Menaka Jha. "Cobalt decorated graphitic carbon nitride photoanode for electrochemical ethanol oxidation: A sustainable way towards clean energy." International Journal of Hydrogen Energy 48, no. 77 (2023): 29982-29995.
- Khan, Nausad, Krishna K. Yadav, Ritika Wadhwa, and Menaka Jha. "Realizing ultralow overpotential during electrochemical hydrogen generation through photoexcitation of chromium disulphide." International Journal of Hydrogen Energy 56 (2024): 1294-1300.
- Yadav, Krishna K., Sunaina, Shubham Saini, Ritika Wadhwa, Sapna Devi, Santanu Ghosh, and Menaka Jha. "Black Phosphorus/Dysprosium Hexaboride-Based Heterostructured Films for Field Emission Technologies." ACS Applied Nano Materials (2024).

No of PhD Students- 07

Dr. Amit Kumar Mondal, Scientist-B

Research Activities/Highlights:

Our research activities involve in understanding the importance of chiral molecules and magnetic materials for next-generation spintronic devices. As we know that all biological molecules such as proteins, amino acids, DNA and sugars appear basically in one of their enantiomeric forms that mean they are homo-chiral. The origin of homo chirality is still an open question for all of us, i.e. "why evolution preserves the chirality?" The goal of our research is to explore why chirality is indeed essential for real spintronic applications and why this "topological" property has been used by nature in physiological processes

- Study 'chiral-induced spin selectivity (CISS) effect' in various chiral supramolecular and polymeric structures.
- Fabrication of some new spin-based devices with the idea of CISS effect which essentially would be of great interest to the scientific and industrial community for real applications.
- Investigation of the role of CISS effect in biomolecules.

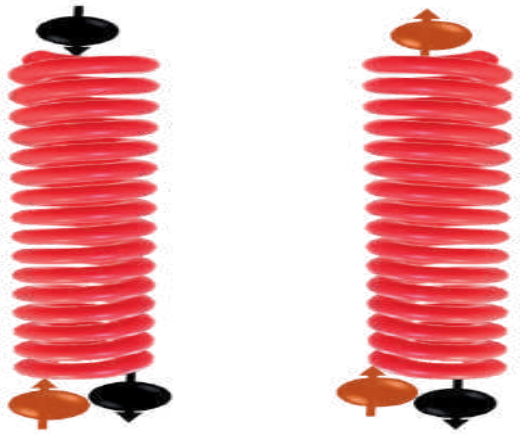


Figure: Representing the Chiral Induced Spin Selectivity (CISS) effect; Spin selectivity in electron transport through chiral molecules.

Significant Research achievements:

Recently, chiral molecules have garnered renewed attention due to their potential as highly efficient spin filters through the chiral-induced spin selectivity (CISS) effect. However, the potential of asymmetric building blocks based on chiral perylene diimides (PDIs) self-assembled materials to generate spin-polarized current is still not widely acknowledged. We have explored that nanofibers derived from "asymmetric PDIs" molecules have been found to exhibit promising spin-filtering property and spin-amplification effect at room temperature. During a multistage process, spin filtering occurs with the involvement of multiple molecules or more than one nanofiber in conduction process. The chiral amplification process can further control the high spin polarization. Additionally, the study shows that the spin alignment does not experience spin dephasing or spin-flipping phenomena during the transport process, indicating self-assembled nanofiber materials' highly durable functionality as spin filters. These findings underscore the significance of self-assembled materials in the realm of spintronics, as they offer fascinating platforms with evolving structure-property relationship.

Selected Publications:

- Das, T. K.; Mondal, A. K.; Tiwari, O. S.; Makam, P.; Gazit, E.; Claudio, F.; Naaman. R. Spin-induced electron transmission through metal–organic chiral crystals. Phys. Chem. Chem. Phys, 2023, 25, 22124.

No of PhD Students-02, Postdoc-01

CHEMICAL BIOLOGY UNIT

FACULTY MEMBERS

Dr. Deepa Ghosh
Scientist 'G'

Dr. Surajit Karmakar
Scientist 'G'

Dr. Asish Pal
Scientist 'F'

Dr. Sharmistha Sinha
Scientist 'F'

Dr. Rahul K Verma
(Head of UNIT)
Scientist 'E'

Dr. Sangita Roy
Scientist 'E'

Dr. P.S. Vijayakumar
Scientist 'E'

Dr. Jiban Jyoti Panda
Scientist 'E'

Dr. Asifkhan Shanavas
Scientist 'D'

Dr. Deepika Sharma
Scientist 'D'

Dr. Manish Singh
Scientist 'D'

Dr. Rehan Khan
Scientist 'D'

Dr. Shyam Lal M ★
Scientist 'D'

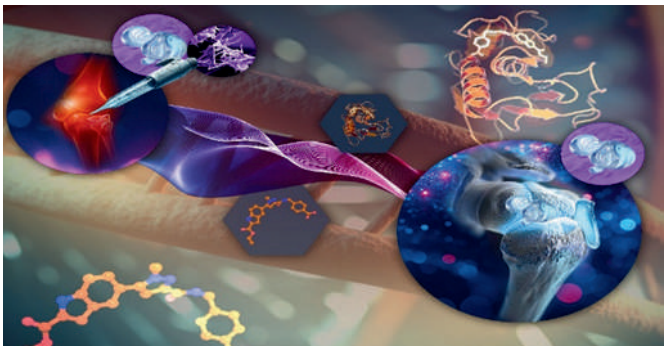
Dr. Subhasree Roy Choudhury
Scientist 'D'

★ *(Till nov 2023)*

Dr. Deepa Ghosh, Scientist-G

Research Activities/Highlights:

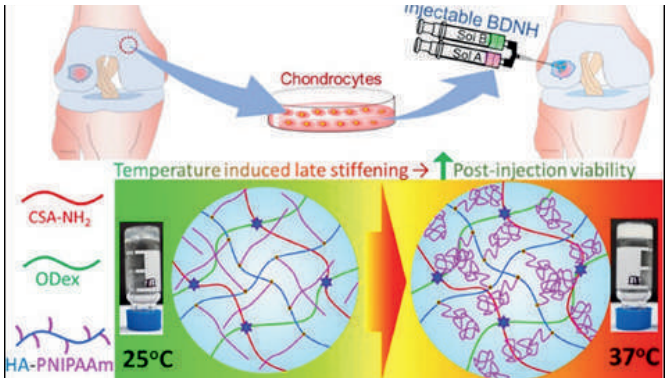
- Development of a new approach for the treatment of challenging wounds like non-healing diabetic foot ulcers
- Development of new therapeutic approaches for the treatment of Osteoarthritis
- Addressing the challenges of environmental pollution caused by the commonly used laboratory dye, Haematoxylin.
- On-demand release of a selective MMP-13 blocker from an enzyme-responsive injectable hydrogel protects cartilage from degenerative progression in osteoarthritis



Schematic illustration of a MMP-13 antagonist, released from an injectable hydrogel in protecting cartilage degeneration J. Mater. Chem. B, 2024 (10.1039/D3TB02871B)

- Post-Implantation Stiffening by a Bioinspired, Double-Network, Self-Healing Hydrogel Facilitates Minimally Invasive Cell Delivery for Cartilage Regeneration

Schematic illustration of an injectable hydrogel that serves as a scaffold for chondrocytes delivery in the treatment of Osteoarthritis.



Selected Publications:

- Vineeta Panwar, Anjana Sharma, Preethi Murugesan, Navita Salaria, Deepa Ghosh* Free-flowing, self-crosslinking, carboxymethyl starch and carboxymethyl cellulose microgels, as smart hydrogel dressings for wound repair. Int. J. Bio. Macro. 246, 125735 (2023)
- HS Roy, P Murugesan, C Kulkarni, M Arora, GK Nagar, R Guha,Naibedya Chattopadhyay and Deepa Ghosh* On-demand release of a selective MMP-13 blocker from an enzyme-responsive injectable hydrogel protects cartilage from degenerative progression in osteoarthritis. J. Mat.Chem. B 10.1039/D3TB02871B (2024)
- Jijo Thomas, Vianni Chopra, Swati Rajput, Rajdeep Guha, Naibedya Chattopadhyay and Deepa Ghosh* Post-Implantation Stiffening by a Bioinspired, Double-Network, Self-Healing Hydrogel Facilitates Minimally Invasive Cell Delivery for Cartilage Regeneration. ACS Biomacromolecules 2023, 24, 7, 3313–3326

No of PhD students-3, Postdoc-2, Project/intern students:2

Dr. Surajit Karmakar, Scientist-G

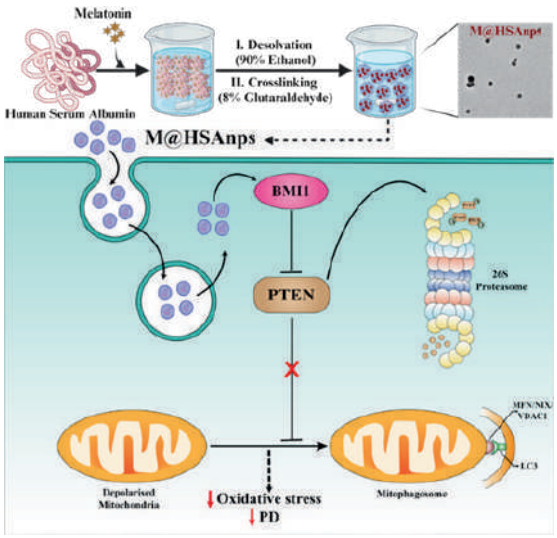
Research Activities/Highlights:

We are working for the development of nano-therapeutics including nanoparticle based drug delivery, siRNA delivery and photodynamic treatment for cancer therapy by targeting mitochondrial metabolism;

- Understanding the molecular mechanisms of inflammatory bowel disease, diabetic retinopathy and their prevention by nanotherapy. Nanotherapy against neurodegenerative diseases.
- Nanomaterials for tumour imaging, chemo-photo combination therapy and immunotherapy for cancers. To overcome resistance to chemotherapy, target validation, signal transduction in membrane proteins and nanoparticles endocytotic cascade.
- Receptor and ion channel regulation on cell membrane organization, endosomal function and escape. Environment, Food and probiotic Nanobiotechnology.

Significant Research achievements:

In this study, we have used a biocompatible protein (HSA) nanocarrier for the delivery of melatonin to the brain. This nanomelatonin showed better antioxidative and neuroprotective properties, and it not only improves mitophagy to remove unhealthy mitochondria but also improves mitochondrial biogenesis to counteract rotenone-induced toxicity in an in vitro PD model. We also showed BMI1, a member of the PRC1 complex that regulates mitophagy, whose protein expression was enhanced after nanomelatonin dosage. These effects were translated to a rodent model, where nanomelatonin improves the TH+ve neuron population in SNPC and protects against rotenone-mediated toxicity. Our findings highlight the significantly better in vitro and in vivo neuroprotective effect of nanomelatonin as well as the molecular/cellular dynamics it influences to regulate mitophagy as a measure of the potential therapeutic candidate for PD. ACS Appl. Mater. Interfaces 2024, 16, 7, 8417–8429.



Scheme elucidates human serum albumin nanoformulation of melatonin enhances mitophagy to alleviate PD.

Selected Publications:

- Biswal, L.; Sardoiwala, M.N.; Kushwaha, A.C.; Mukherjee, S.; Karmakar S. Melatonin-Loaded Nanoparticles Augment Mitophagy to Retard Parkinson's disease. ACS Appl. Mater. Interfaces, 2024, 16, 8417.
- Sardoiwala, M.N.; Biswal, L.; Sahu, V.K.; Boddu, M.; Roy Choudhury, S.; Karmakar S. Melatonin-Polydopamine Nanoformulation Prevents Retinal Neurodegeneration in a Preclinical Model of Diabetic Retinopathy. ACS Appl. Nano Mater, 2024, 7, 6983.
- Sardoiwala, M.N.; Nagpal, S.; Bhatt, B.; Roy Choudhury, S.; Karmakar S. Improved Melatonin Delivery by a Size-Controlled Polydopamine Nanoformulation Attenuates Preclinical Diabetic Retinopathy. Mol Pharm, 2023, 20, 2899.

No of PhD students-6, Postdoc-2, Project/intern students: 06

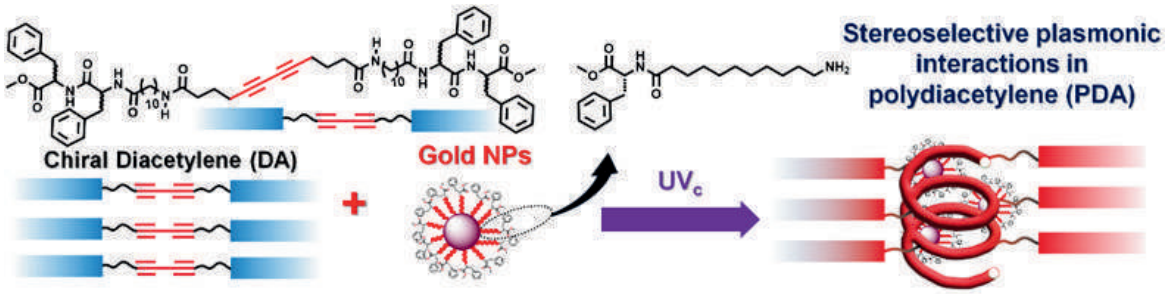
Dr. Asish Pal, Scientist-F

Research Activities/Highlights:

We are interested in a number of interdisciplinary research areas with fundamental understanding and exciting applications as follows:

- Stimuli-responsive collapse of Single Chain Polymer to form Nanoparticles: We employ a number external stimuli for polymer collapse to make materials, that have applications in self-healing coating, catalytic nanoreactors, drug delivery across blood brain barriers.
- Pathway complexity in self-assembly of peptide materials: We explores strategies including living supramolecular polymerization, self-sorting to control shape and size of nanostructures in amyloid like peptide fibers to render catalytic functions.
- Hydrogel materials: Peptide, polymer hydrogels and stimuli-responsive behavior for targeted drug delivery and 3-dimensional scaffold for tissue engineering.

Chiroptical materials: Ordered macroscopic assemblies of chiral conjugated polymers for many futuristic applications in sensing and photonics. Peptide-tethered diacetylene monomers exhibit efficient topochemical photopolymerization to furnish chiral polydiacetylene with desired control over chiroptical properties. We incorporated achiral and chiral gold nanoparticles in the chiral polymers and investigated the stereo-selective plasmonic interactions manifest in the modifications of the circular dichroism spectra, with the ultimate goal of designing next-generation organic-inorganic hybrid materials with large chiroptic effects



Significant Research achievements:

Recently, we have developed an elegant strategy to create injectable hydrogel networks with nonlinear mechanical properties, resembling natural biopolymers by covalently cross-linking supramolecular peptide nanostructures with a thermo-responsive aldehyde-functionalized polymer for muscle cell proliferation.

Also, we demonstrated the first example of selective chiral amplification mediated by stereo-structural matching of the polymer-plasmonic AuNP hybrid pairs. Such ordered self-assembly aided by topochemical polymerization in peptide-tethered PDA provides a smart strategy to produce soft responsive materials for applications in chiral photonics.

Selected Publications:

- Joseph, J. P.; Miglani, C.; Maulik, A.; Abraham, S. R.; Dutta, A.; Baev, A. Prasad, P. N.;* Pal, A*. Stereoselective Plasmonic Interaction in Peptide-tethered Photopolymerizable Diacetylenes Doped with Chiral Gold Nanoparticles. Angew. Chem. Int. Ed. 2023, 62, e2023067.
- Miglani, C.; Banoo, M.; Nath, D.; Ralhan, J.; Sil, S.; Joseph, J. P. Pal, S.; Gautam, U.; Pal, A.* Orthogonal Chain Collapse in Stimuli-responsive Di-block Polymers leading to Self-sorted Nanostructures. Chem. Comm. 2023, 59, 13195-13198.
- Nath, D.; Ralhan, J.; Joseph, J. P.; Miglani, C.; Pal, A.* Thermo-responsive Injectable Hydrogel to Mimic the Heat- and Strain-stiffening Behaviour of Biopolymers towards Muscle Cells Subsistence. Biomacromolecule, 2024, 25, 853-863.

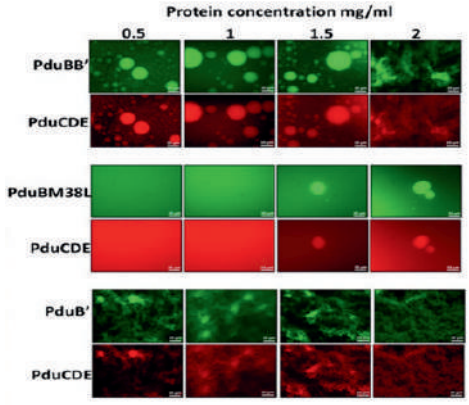
No of PhD students-7, Postdoc-3, intern students-2

Dr. Sharmistha Sinha, Scientist-F

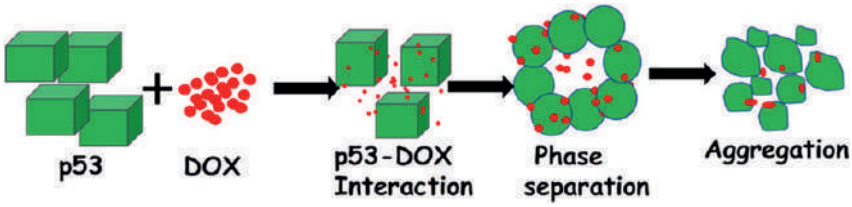
Research Activities/Highlights:

One of the major shell protein of PduBMC, PduBB′ has higher LLPS propensity than enzyme PduCDE and shows the time dependent recruitment of Texas red-labelled PduCDE within Alexa-488 labelled phase separated PduBB′. PduBB' imparts its property to one of the enzyme PduCDE and on phase separating of these two proteins together enhanced the specific activity and better stress tolerancce of the enzyme on comparison with free enzyme.

We explored the phenomenon of liquid–liquid phase separation as a method of confinement in prokaryotic and eukaryotic cells taking two different paradigms of organelle formation and disease respectively .A classic example of prokaryotic confinement is bacterial microcompartment that confines enzymes in a small volume enveloped by an outer protein shell to metabolize specific organic molecules, allowing bacteria to survive in restricted nutrient environments. A combination of shell protein and enzyme along with free enzymes were subjected to activity assays, spectroscopic techniques, binding assays, and computational analysis followed by liquid-liquid phase separation showed that the shell protein is protecting the enzyme from harsh conditions.



Significant Research achievements:



The image represent how doxorubicin can form complex with p53 leading to liquid liquid phase separation and aggregation of p53 thus highlighting the dual nature of chemotherapeutics.

The interplay between cellular physiology and exogenous stimuli is critical for understanding disease intervention mechanisms. Our investigation focused on the influence of doxorubicin, a chemotherapeutic agent, on the self-assembly of p53 and its implications in cancer chemo-resistance. Through biophysical and imaging techniques, we discovered that doxorubicin interacts with wild-type p53 (WTp53) and its variants, inducing liquid-liquid phase separation and protein aggregation. Doxorubicin's sequestration within p53 mutant droplets suggests a decrease in drug concentration at target sites, echoing recent studies on drug partitioning within cellular condensates. These insights emphasize the need for targeted therapeutic strategies to mitigate such unintended consequences of widely used chemotherapeutic agents.

Selected Publications:

- Garg, A.; Kumar, G.; Singh, V.; Sinha, S. Doxorubicin catalyses self-assembly of p53 by phase separation. Current Research in Structural Biology 2024, 7, 100133.
- Kumar, G.; Hazra, J. P.; Sinha, S. Disordered regions endow structural flexibility to shell proteins and function towards shell–enzyme interactions in 1,2-propanediol utilization microcompartment. Journal of Biomolecular Structure and Dynamics/Journal of Biomolecular Structure & Dynamics 2022, 41 (18), 8891–8901.
- Kumar, G.; Sinha, S. Self-assembly of shell protein and native enzyme in a crowded environment leads to catalytically active phase condensates. Biochemical Journal 2023, 480 (8), 539–553.

No of PhD students-8, Postdoc-01, Project/intern students-4

Dr. Jiban Jyoti Panda, Scientist-E

Research Activities/Highlights:

- Dr Panda's research group extends their realms across developing theranostic agents for neurodegenerative disorders, cancer, and bone regeneration.
- Recently, an acoustic stimuli-responsive polymer-amino acid nano system was developed in our lab for treating AD effectively. Our nano system demonstrated superior efficacy in both cellular models as well as AD induced animal models. Also, organic nanodots were synthesized comprising of amino acids and catecholamine moieties which were loaded with a neural growth factor protein for neuro-regeneration.
- The utilization of photo-responsive drug delivery systems is major area of interest. The research revolves around development of upconversion nanoparticles, azo-based nanoparticles. These nano systems were then loaded with anti-cancer drugs and RNA for inducing anti-cancer effect.
- Furthermore, we report successful development of a peptide nanocarrier system encapsulating bone growth factors, synthesized through nanobowl fabrication techniques.

Significant Research achievements:

Degeneration of neurons due to the accumulation of misfolded amyloid aggregates in the CNS is a fundamental neuropathology of Alzheimer's disease (AD). Here, we explored biocompatible polydopamine-coated piezoelectric polyvinylidene fluoride (DPVDF) nanospheres as acoustic stimulus-triggered anti-fibrillating and anti-amyloid agents. The nanospheres were tested against two model amyloidogenic peptides, including the reductionist model-based amyloidogenic dipeptide, diphenylalanine, and the amyloid polypeptide, amyloid beta (Aβ42). Our results revealed that DPVDF nanospheres could effectively disassemble the model peptide-derived amyloid fibrils under suitable acoustic stimulation. In vitro studies also showed that the stimulus-activated DPVDF nanospheres could efficiently alleviate the neurotoxicity of FF fibrils, as exemplified in neuroblastoma and SHSY5Y cells. Studies carried out in animal models further validated that the nanospheres could dislodge amyloid aggregates in vivo and also help the animals regain their cognitive behavior. Thus, these acoustic stimuli-activated nanospheres could serve as a novel class of disease-modifying nanomaterials for non-invasive electro-chemotherapy of AD.

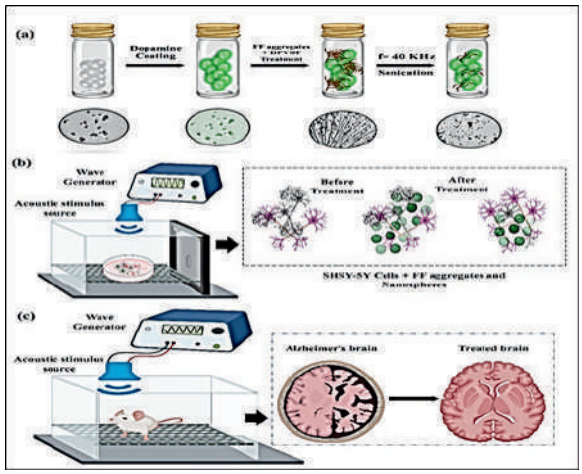


Figure: (a) Overall schematic representation showing the formation of polydopamine-coated PVDF nanospheres. (b) Amyloid fibril disaggregation ability and neuroprotective effects exhibited by acoustic stimulus activated DPVDF nanospheres in neural cells. (c) In vivo studies have demonstrated a notable reduction in Aβ 42 plaques following exposure to acoustic stimulus in the presence of DPVDF nanospheres offering a non-invasive therapeutic intervention for Alzheimer's disease (figure made using Biorender.com).

Selected Publications:

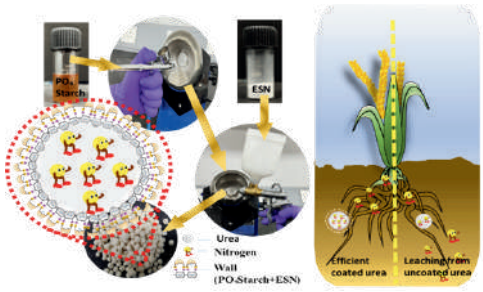
- Sharma, M.; Choudhury, S.; Babu, A.; Gupta, V.; Sengupta, D.; Ali, S. A.; Dhokne, M. D.; Datusalia, A. K.; Mandal, D.; Panda, J. J. Futuristic Alzheimer's Therapy: Acoustic-Stimulated Piezoelectric Nanospheres for Amyloid Reduction. Biomaterials Science 2024, 12 (7), 1801–1821.
- Kour, A.; Himanshu Sekhar Panda; Imocha Rajkumar Singh; Kumar, A.; Jiban Jyoti Panda. Peptide-Metal Nanohybrids (PMN): Promising Entities for Combating Neurological Maladies. Advances in colloid and interface science 2023, 318.

No of PhD students-9, Postdoc-1, Project/intern students-6

Dr. P.S.VijayaKumar, Scientist-E

Research Activities/Highlights:

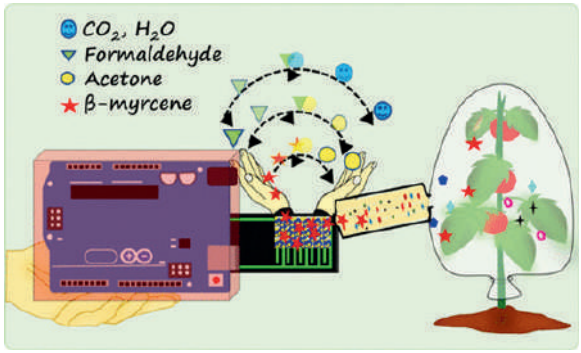
Starch wall of urea



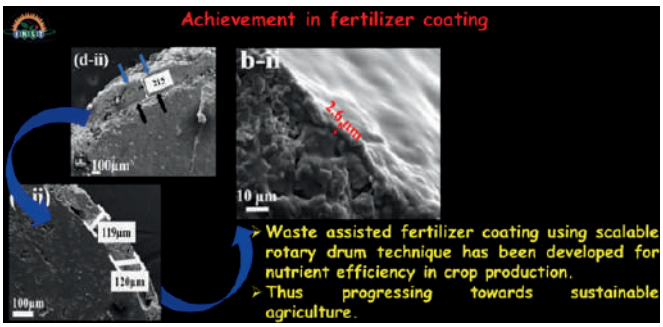
- The earth abundant starch has been coated on the urea to give controlled release and improvement in the nutrient use efficiency.
- The starch has been phosphorylated and blended with the egg shell nanoparticles that gave mechanical strength as well as calcium to bind the phosphate ends in the starch, which resulted in a stable water resistant coating.
- This composite gave tunable thickness in the drum rotar coater.
- The efficiency of the coted urea has been tested for the crop production with the rice.
- Ref. (Carbohydrate Polymers 317, 2023, 121042)

Handheld Crop Pest Sensor

- Using Binary Catalyst-Loaded Nano-SnO2 Particles for Oxidative Signal Amplification a chemoresistive sensor has been developed for the detection of the signature volatile released from the crop on the incidence of pest.
- This sensor has been validated with the tomato crop infested with the pest in closed atmospheric container.
- Ref. (ACS Sens. 2024, 9, 81−91)



Significant Research achievements:



Recently in agriculture nanotechnology, we are trying different coating for the urea using the waste biopolymer and nano reinforcement agent. In this context we tried jute, starch, chitosan etc.,

In this journey we are optimising the coating that can give thin but stable coating to control the fertilizer loss.

Our recent work shows a stable coating with the starch and egg shell nanoparticles, which are biodegradable, but stay for about 50-60 days for the slow release.

Selected Publications:

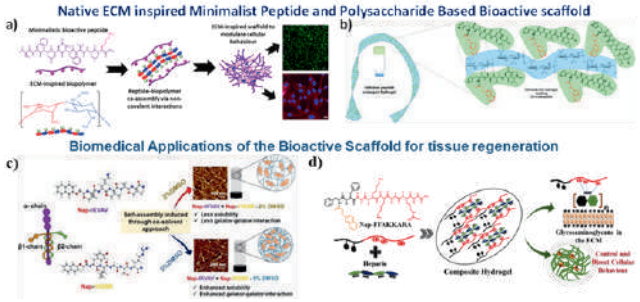
- S. Kataria, M. Chandel, P. Kumar, M. Palanisami, N. Moun, S. Kanagarajan and Vijayakumar S.* Irrigation-friendly sensor to manage drought in crops Sens & Actuators B: Chem 2023, 134975.
- K. Swami, B. K. Sahu, M. Nagargade, K. Kaur, A. D. Pathak, S K Shukla, T Stobdan, V Shanmugam.* Starch wall of urea. Carbohydr. Polym. 2023 317 121042.
- Kumar, P.; Chandel, M.; Kataria, S.; Swami, K.; Kaur, K.; Sahu, B.; Dadhich, A.; Urkude, Rajashri ; Subaharan, K.; Koratkar, N.; Vijayakumar S.* Hand-Held crop pest sensor using binary catalyst. ACS sensor 2024, 9, 1, 81–91.

No of PhD students-11, Project/intern students-4.

Dr. Sangita Roy, Scientist-E

Research Activities/Highlights:

- Understanding the design principles of the native ECM inspired essential small molecular self-assembly to create next-generation biomaterials
- Exploration of minimalist peptide nanotechnology for development of novel biomimetic scaffolds as synthetic extracellular matrix (ECM)
- Designing the ultra-short peptide sequence to form bioactive hydrogel scaffolds based on structural and functional proteins of ECM, such as, Laminin, Collagen, Fibronectin, Elastin as well as junctional proteins, like, Entactin, Perlecan etc.
- Post-assembly modification with the natural biopolymers, like, cellulose, heparin, chondroitin sulphate etc. to create a composite scaffold with advanced functions
- Studies on differential interactions of cells with these designer scaffolds under 2D and 3D culture conditions
- Use of non-equilibrium self-assembly to control physicochemical properties of these bioactive scaffolds and create an ideal microenvironment for cellular growth
- 3D bioprinting of these bioactive scaffolds for tissue regeneration and studying differential disease models



(a, b) Schematic representation of the fabrication development of native ECM derived minimalist bioactive peptide and biopolymer based advanced bioactive scaffold for controlling cellular response (c, d) Applications of composite peptide-based bioactive scaffolds for tissue regeneration

Significant Research achievements:

Our group explored a minimalistic approach to fabricate novel biomimetic functional scaffolds using self-assembling bioactive peptide sequences for designing an extracellular matrix (ECM) mimic for tissue engineering applications. To construct an ideal mimic of the hierarchical complex structure of natural ECM, we developed the conjugate gels from structural and functional proteins of ECM, as well as junctional proteins in the intercellular spaces, which show excellent promise for applications in cellular adhesion, proliferation, and migration.The resulting new materials are further modified with specific carbohydrate-based biopolymers, like, cellulose, heparin etc. to fabricate peptide-polysaccharide conjugates as an advanced tissue mimic.

In a recent study, we demonstrated for the first time the potential of the shortest molecular pentapeptide domain inspired from collagen toward mineralizing hydroxyapatite on peptide fibers to develop bone-filling material. Our simplistic approach adapted an easy and facile route of introducing the metal ions onto the peptide nanofibers, which displayed adsorbed glutamate onto the surface to induce the nucleation of the crystalline growth of hydroxyapatite. Interestingly, nucleation and growth of the hydroxyapatite crystals lead to the formation of a self-supporting hydrogel to construct a suitable interface for cellular interactions.

In a collaborative project, our group has demonstrated fabrication of a mechanically stable and flame-retardant cellulose aerogel based thermal insulator by the incorporation of inorganic material within the organic domain. Interestingly, in these organic-inorganic nanohybrids, the functional attributes like mechanical strength and flammability were improved to a great extent and thus overcoming the limitations of the commercially available thermal insulating materials, like, polyurethane (PU) foams in terms of biocompatibility, mechanically stability, durability and environment friendliness.

Selected Publications:

- Sen, S.; Singh, A.; Kailasam, K.; Bera, C.; Roy, S. Facile synthesis of cellulose and fly-ash based sustainable nanohybrids for thermal insulation applications, Cellulose, 2023, 30 (14), 9127-9145.
- Sen, S.; Sharma, P.; Pal, V. K.; Roy, S. Designing Cardin-Motif Peptide and Heparin-Based Multicomponent Advanced Bioactive Hydrogel Scaffolds to Control Cellular Behavior, Biomacromolecules, 2023, 24 (11), 4923-4938.
- Kashyap, S.; Pal, V. K.; Mohanty, S.; Roy, S. Exploring a Solvent Dependent Strategy to Control Self-Assembling Behavior and Cellular Interaction in Laminin-Mimetic Short Peptide based Supramolecular Hydrogels, ChemBioChem, 2023, 25, e202300835.

No of PhD students-8, Project/intern students-3

Dr. Rahul Kumar Verma, Scientist-E

Research Activities/Highlights:

- Patients with rheumatoid arthritis (RA) often have one or more painful joints despite adequate medicine. To improve the therapeutic efficacy, it is essential to ensure that a drug is only released from the formulation when it is needed. In this work, we developed an intelligent "Self-actuating" drug delivery system where Disease-modifying anti-rheumatic Drug (DMARD) methotrexate is incorporated within a matrix intended to be injected directly into joints. This formulation has the property to sense the need and release medication only when joints are inflamed in response to inflammation (Fig.1).

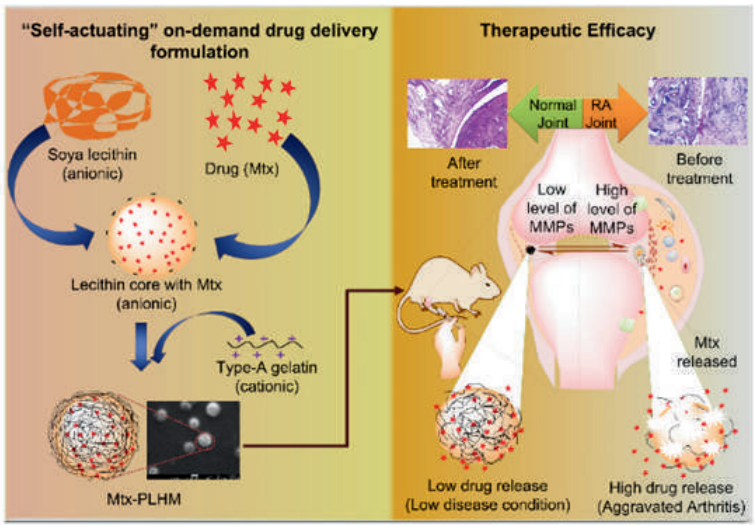


Figure.1 Self actuating on demand drug delivery system for Rheumatoid Arthritis

Significant Research achievements:

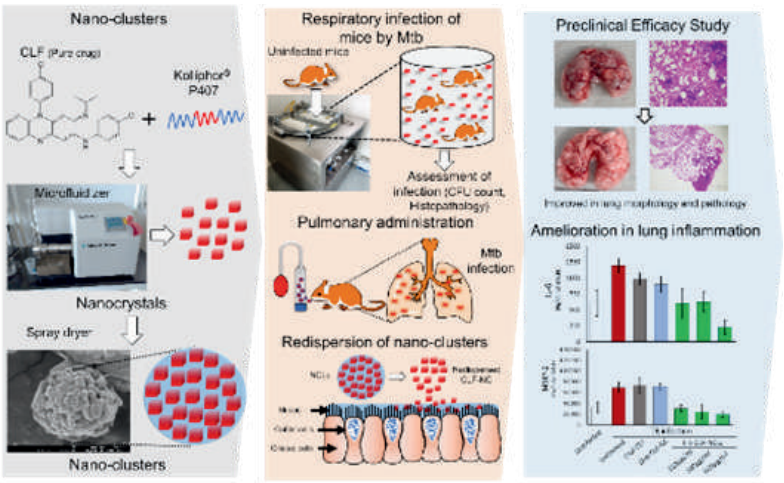


Figure.2 CIofazimine Nano-Crystals for TB therapy

- The rise of tuberculosis (TB) superbugs has impeded efforts to control this infectious ailment, and new treatment options are few. To unravel these issues, Nano-crystals of CLF (CLF-NC) were prepared using a microfluidizer® technology, which were further processed into micro sized drug nano-clusters (CLF-NCLs) by spray drying technique. These pre-clinical data suggests inhalable clofazimine nanoclusters are well tolerated, show significant anti-TB activity and apparently able to tackle the challenge of paradoxal chronic lung inflammation in murine TB model. (Fig.2).

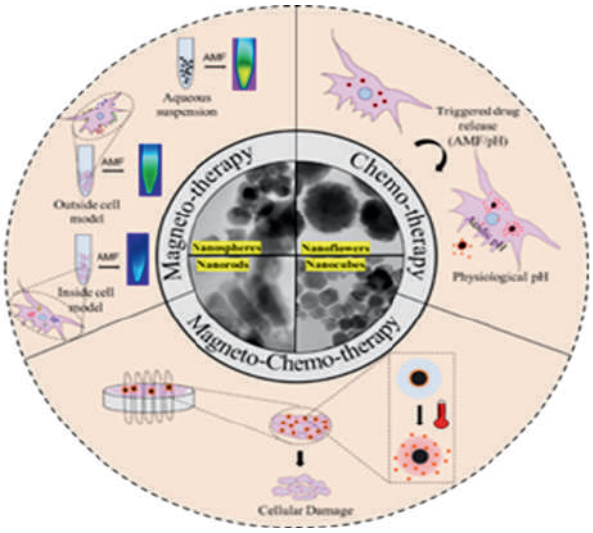
Selected Publications:

- Jadhav, K.; Jhilta, A.; Singh, R.; Ray, E.; Sharma, N.; Shukla, R.; Singh, A. K.; Verma, R. K., Clofazimine nanoclusters show high efficacy in experimental TB with amelioration in paradoxical lung inflammation. Biomaterials advances 2023,154, 213594.
- Kole, E.; Jadhav, K.; Singh, R.; Mandpe, S.; Abhang, A.; Verma, R. K.; Naik, J., Recent Developments in Tyrosine Kinase Inhibitor-based Nanotherapeutics for EGFR-resistant Non-small Cell Lung Cancer. Current drug delivery 2024.
- Singh, R.; Jadhav, K.; Kamboj, R.; Malhotra, H.; Ray, E.; Jhilta, A.; Dhir, V.; Verma, R. K., Self-actuating inflammation responsive hydrogel microsphere formulation for controlled drug release in rheumatoid arthritis (RA): Animal trials and study in human fibroblast like synoviocytes (hFLS) of RA patients. Biomaterials advances 2024, 160, 213853.

No of PhD students-4

Dr. Deepika Sharma, Scientist- D

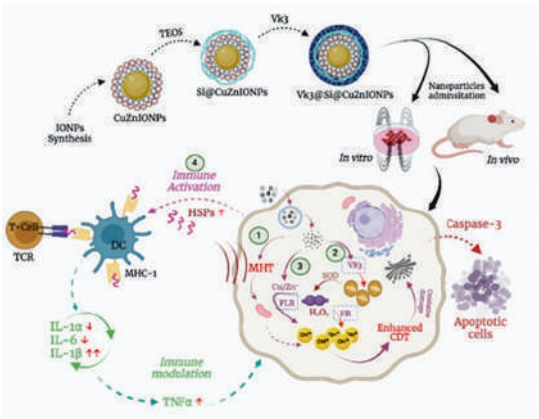
Research Activities/Highlights:



The shape-dependent hyperthermic and chemotherapeutic potential of nanomaterials has not been extensively explored. This study presents various morphological designs of magnetic nanoparticles (MNPs), including spherical, clusters, rods, and cubic shapes, to compare their properties for biomedical applications like drug delivery, cellular uptake, and heat generation. An extensive comparison was made of the morpho-structural characteristics, size distributions, chemical composition, surface area, and magnetic properties of these MNPs.Under biosafety limits (Hergt's limit: H*f value < 5 × 10^9 Am^-1 s^-1), cuboidal MNPs showed the highest heating efficiency due to magnetosome-like chain formation and a sustained drug release profile. The cancer cell death mechanism via magneto-chemotherapy was found to be oxidative stress-mediated apoptosis. These findings suggest the potential of combinatorial therapy to overcome clinical limitations for advanced glioblastoma thermotherapy. Differentiation therapy, aimed at converting malignant phenotypes to benign ones, has been successful in treating acute myeloid leukemia but not other cancers. Hyperthermia therapy (HT) exploits heat-induced cellular changes to aid cancer therapy.

More Info - Tewari AB, Saini A, Sharma D. Extirpating cancer stem cell hydra: Clinical and Experimental Medicine. 2023.

Significant Research achievements:



Magnetic hyperthermia therapy (MHT) using magnetic nanoparticles (MNPs) under an alternating magnetic field (AMF) can cause tumor regression via reactive oxygen species (ROS) generation. However, its effectiveness is limited in hypoxic tumor environments due to low ROS levels. To address this, a magnetothermodynamic (MTD) therapy was developed, combining ROS generation and heat-related immunological effects. Vitamin K3-loaded copper zinc ferrite nanoparticles (Vk3@Si@CuZnIONPs) were used as MTD agents. In vitro studies showed enhanced ROS production under AMF, leading to a strong anticancer response. In vivo tests on A549 lung adenocarcinoma models showed a 69% tumor inhibition rate within 20 days and complete tumor eradication within 30 days.

This response was marked by significant apoptosis and increased levels of heat shock proteins and proinflammatory cytokines, suggesting an activated immune response. The dual ROS and heat-mediated effects of this therapy could significantly enhance the efficiency of future cancer treatments

Selected Publications:

- Gupta R, Kaur T, Chauhan A, Kumar R, Kuanr BK, Sharma D. Tailoring nanoparticles design for enhanced heating efficiency and improved magneto-chemo therapy for glioblastoma. Biomaterials Advances. 2022;139:213021.
- Gupta R, Chauhan A, Kaur T, Kuanr BK, Sharma D. Transmigration of magnetite nanoparticles across the blood–brain barrier in a rodent model: influence of external and alternating magnetic fields. Nanoscale. 2022;14(47):17589-606.
- Tewari AB, Saini A, Sharma D. Extirpating the cancer stem cell hydra: Differentiation therapy and Hyperthermia therapy for targeting the cancer stem cell hierarchy. Clinical and Experimental Medicine. 2023.

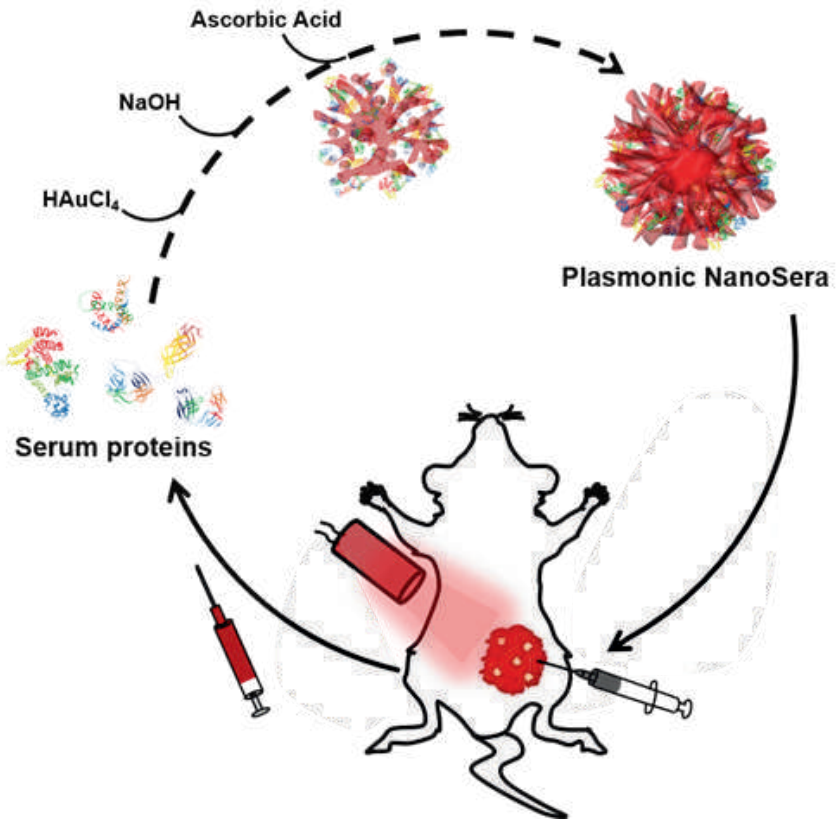
No of PhD students-4

Dr. Asifkhan Shanavas, Scientist-D

Research Activities/Highlights:

Green synthesis of gold nanodendrites involving autologous serum proteins as both a template and stabilizer is reported. The nanodendrites, also termed as 'Plasmonic NanoSera' (PNS), with size 150 nm, possess anisotropic dense branches with a broad extinction cross section across the visible-near infrared (I & II) regions. The PNS, with a photothermal conversion efficiency of 58%, demonstrated significant phototoxicity in cancer cells associated with elevated intracellular reactive oxygen species.

The PNS did not cause acute toxicity with intravenous administration at 20 mg kg−1 dosage. Intra-tumoral injection of autologous mouse serum protein-derived PNS followed by 808 nm Laser irradiation generated an 78% higher localized temperature rise compared to a saline control in the 4T1 breast tumor model, thereby suppressing both the tumor growth and tumor burden-associated splenomegaly. This proof-of-concept study validates the preclinical safety and host-specific photothermal efficacy of PNS.



Selected Publications:

- Johns Paul V, Priyanka Sharma, Asifkhan Shanavas, (2024) Self-assembled nano-biomaterials for combination immunotherapy, ACS Applied Bio Materials, Accepted Manuscript
- Mimansa, Smriti Bansal,Pranjali Yadav, Asifkhan Shanavas (2023) Plasmonicnanodendrites stabilized with autologous serum proteins for sustainable host specific photothermal tumor ablation,Materials Advances, 4 (23), 6175-6182

No of PhD students-6, Postdoc-1 intern students-2

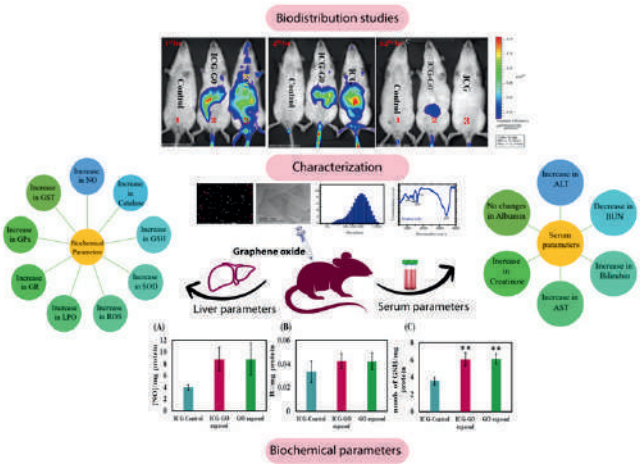
Dr Manish Singh, Scientist-D

Research Activities/Highlights:

Research activities of my group include Toxicology, Cellular and Molecular Neuroscience, In utero Exposures and CNS Development, Neuro-Behavioral Analysis, Nanoneurotoxicology, Developmental Nanotoxicology, Nano Environmental Health and Safety and Bioimaging Tools (Confocal and Electron Microscopy). We are currently working on toxicology of nanomaterials like GO with a special focus on their hazardous effects on reproductive, fetal and long term behavioural outcomes. We are also exploring the applications of nanomaterials and physical stimulation strategies for enhancement of neuritic outgrowth and neuronal regeneration.

Significant Research achievements:

Our group is mainly interested in exploring the toxicological profiles of various materials both nano and bulk. Recently we performed a study exploring the toxicological potential of a widely utilized nanomaterial Graphene Oxide. The present study aimed to elucidate the short term biodistribution of nano sized graphene oxide (GO) along with the toxicological assessment under in vivo condition. The synthesised GO was characterized using UV-Visible spectroscopy, XRD, FTIR, Raman spectroscopy, TGA and DLS. The morphological imaging was performed using SEM, TEM and AFM. With a lateral size of less than 300 nm, these nanoparticles exhibit significant organ barrier permeability of up to 20%. Upon acute exposure to 10mg/kg dose of ICG tagged GO nanoflakes through intravenous route, various organs such as kidney, spleen and liver were observed, and the nanoparticles predominantly accumulated in the liver upon 24h of exposure. Upon confirming the accumulation of these particles in liver through IVIS imaging, our next attempt was to analyse various biochemical and serum parameters. An elevation in various serum parameters such as ALT, AST, Creatinine and Bilirubin was observed. Similarly in case of biochemical parameters tested in liver homogenates, an increase in NO, Catalase, GSH, SOD, ROS, LPO, GR, GPx and GST was observed. This study highlights the potential toxicological risk associated with GO exposure which must be taken into account for any risk analysis associated with GO based consumer products and the occupational hazards.



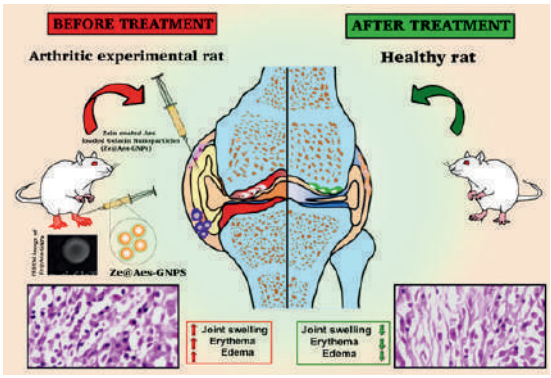
Selected Publications:

- I De, R Singh, S Kumar, S Singh, JJ Panda, K Ghosh, DP Mishra, M Singh* Short term biodistribution and in vivo toxicity assessment of intravenously injected pristine graphene oxide nanoflakes in SD rats;, Toxicology Research (2024) 13 (2).
- R Bhattacharya, P Sharma, D Bose*, M Singh*, Synergistic potential of α-Phellandrene combined with conventional antifungal agents and its mechanism against antibiotic resistant Candida albicans, CABI Agriculture and Bioscience 5 (1), 17, 2024.
- P Sharma, A Kishore, I De, S Negi, G Kumar, S Bhardwaj, M Singh, Mitigating neuroinflammation in Parkinson's disease: Exploring the role of proinflammatory cytokines and the potential of phytochemicals as natural therapeutics, Neurochemistry International, 105604,1, 2023

No of PhD students-5, Postdoc-1

Dr. Rehan Khan, Scientist-D

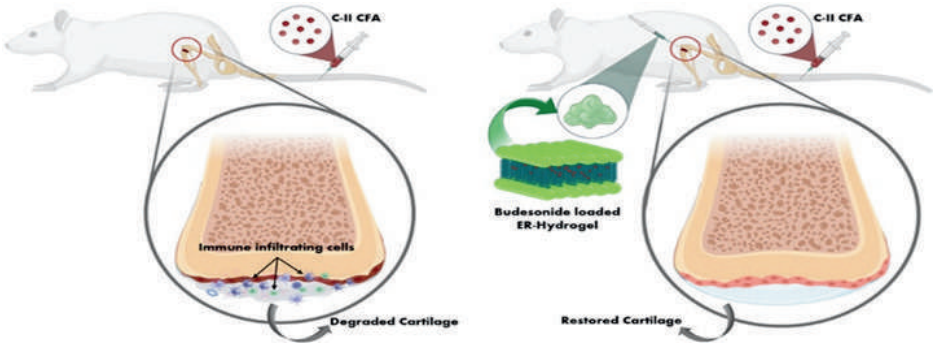
Research Activities/Highlights:



- Development of novel nanocarrier for drug/siRNA delivery.
- Toxicity assessment of engineered nanomaterials.
- Nano-Theranostics for the management of Rheumatoid arthritis and Ulcerative Colitis.
- Biomaterial-based combinatorial approach of aescin-comprised zein-coated gelatin nanoparticles alleviates synovial inflammation in arthritis

Significant Research achievements:

Rheumatoid arthritis (RA) is a chronic inflammatory disease that severely affects joints and restricts locomotion. Various treatment regimens are available for RA, providing short-term relief from pain, but long-term relief from the disease is still not available. We used budesonide as a therapeutic lead and encapsulated it into a highly biocompatible hydrogel system. The hydrogel system developed by us is enzyme-responsive and provides sustained drug release flow over an extended period of time. This hydrogel is characterized by ζ-potential analysis, field-emission scanning electron microscopy (FE-SEM), and attenuated total reflectance-Fourier transform infrared (ATR-FTIR) spectroscopy, and it is further encapsulated with budesonide (glucocorticoids) for therapeutic purposes. Evidently, Bud-loaded ER-hydrogel showed improvement in joint physiology compared to the disease group and downregulated the inflammatory markers.



Graphical representation of reversal of CIA-induced arthritis model in Wistar rats after that intraarticular treatment of Bud-loaded ER-hydrogel

Selected Publications:

- Kumar, A.; Ali, A.; Vyawahare, A.; Ahmad, A.; Mishra, R. K.; Ansari, M. M.; Nadeem, A.; Siddiqui, N.; Raza, S. S.; Khan, R. Highly Biocompatible Smart Injectable Hydrogel for the management of Rheumatoid Arthritis. ACS Biomater. Sci. Eng. 2023, 9 (9), 5312-5321.
- Jori, C.; Ansari, M. M.; Ahmad, A.; Ali, N.; Raza, S. S.; Khan, R. Biomaterial-Based Combinatorial Approach of Aescin-Comprised Zein-Coated Gelatin Nanoparticles Alleviates Synovial Inflammation in Experimental Inflammatory Arthritis. Nanoscale 2024, 16, 7965-7975.
- Vyawahare, A.; Ansari, M. M.; Kumar, A.; Ahmad, A.; Mishra, R. K.; Jori, C.; Nadeem, A.; Siddiqui, N.; Raza, S. S.; Khan, R. Enzyme Targeted Delivery of Sivelestat Loaded Nanomicelle Inhibits Arthritic Severity in Experimental Arthritis. Life Sci. 2023, 334, 122206

No of PhD students-8, intern students-1

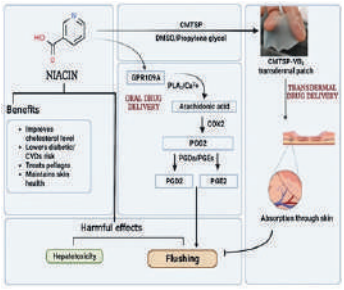
Dr. Shyam Lal M, Scientist-D *(Till nov 2023)*

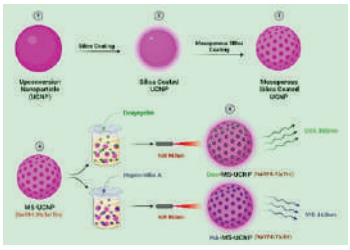
Research Activities/Highlights:

Transforming advances in nanotechnology and drug delivery into biomedical applications

- Our research thrusts is to engineering delivery systems for poorly water soluble drugs towards therapeutic clinical applications primarily, against neglected infectious diseases. We focus on the development of nanomedicines based on biological nanomaterials with considerable priority on interface between in vitro and in vivo studies and how logically designed and engineered drug delivery systems can be translated into clinically effective therapeutics.

- Also, our current team is engaged in resolving obstacles in predominant therapeutics of varicose veins, degrees of wound healing and antibiotic resistance. We aim to develop transdermal patches which could deliver active pharmaceutical ingredients (APIs) via fabricated nano carriers. The budding research would drive on microfluidic platforms specifically designed for controlled and sustained drug release. Conjointly, our group plans to unravel the effect of up-conversion nanoparticles in light sensitive medicines. Our delighted obsession is expanding the bounds of knowledge and possibilities in interdisciplinary areas of research and discoveries.





Significant Research achievements:

Oral drug delivery is the most desirable delivery route, being non-invasive, convenient, and cost-effective. Solubility is a principal aspect culpable for the low bioavailability of drugs administered orally; encapsulation in a drug delivery system that has the competence to armour a molecule's hostile physicochemical characteristics can contribute to its becoming a viable solution. We focus on the development of oral nanomedicines with considerable priority on the interface between in vitro and in vivo studies and how logically designed and engineered drug delivery systems can be translated into clinically effective therapeutic options against the most neglected tropical diseases. We have been able to develop lipid nanoparticles to improve the gastrointestinal (GI) absorption and oral bioavailability of several drugs, especially lipophilic compounds.
We adopted a systematic approach to evaluate the effect of experimentally optimised formulation variables on the properties of surface-enhanced nanocarriers and their subsequent potential implications in evading cytotoxicity. We conceptualised to elucidate the dissociable mucus inert biointeraction with mucin, uptake enhancement, and translocation across the gastrointestinal epithelium, leading to a suitable surface ligand modified nanocarrier with augmented physiochemical properties for oral delivery, giving us a detailed insight. Furthermore, we were committed to explicating the stability aspects of our formulation to subjugate the harsh and hostile gastrointestinal acidic conditions and tropical temperatures and still be stable enough to stave off any cellular metabolic disturbances with several quantitative and qualitative techniques, which we surmise to be a potential clinical oral drug delivery system. The group has been able to publish 8 articles in peer-reviewed journals (7 as a corresponding author and 1 as co-author) with a total impact factor of 49.415 and average impact factor of 6.176. I was able to secure research grants from various funding agencies

Selected Publications:

- Arora, K.; Sherilraj, P.M.; Abutwaibe K.A.; Dhruw, B.; Mudavath, S.L.*, Glycans and Biological Macromolecules: A Comprehensive review on advancing Biomedical frontiers, International Journal of Biological Macromolecules, 268, 2024, 131511.
- Karole, Archana.; Hayagreeva D. Y.; Sagar, P.; Mudavath, S.L*, Self-assembled nanomicelles for oral delivery of luteolin utilizing the intestinal lymphatic pathway to target pancreatic cancer. Nanoscale, 2024, Advance Article.
- Javaid, A.; Abutwaibe K A, Sharma, K. K.; Sherilraj P M.; Verma, A.; Mudavath, S.L*, Niacin-Loaded Liquid Crystal Nanoparticles Ameliorate Prostaglandin D2-Mediated Niacin-Induced Flushing and Hepatotoxicity. ACS Appl. Nano Mater. 2024, 7, 1, 444–454.

No of PhD students-4, Project/intern students-4

Dr. Subhasree Roy Choudhury, Scientist-D

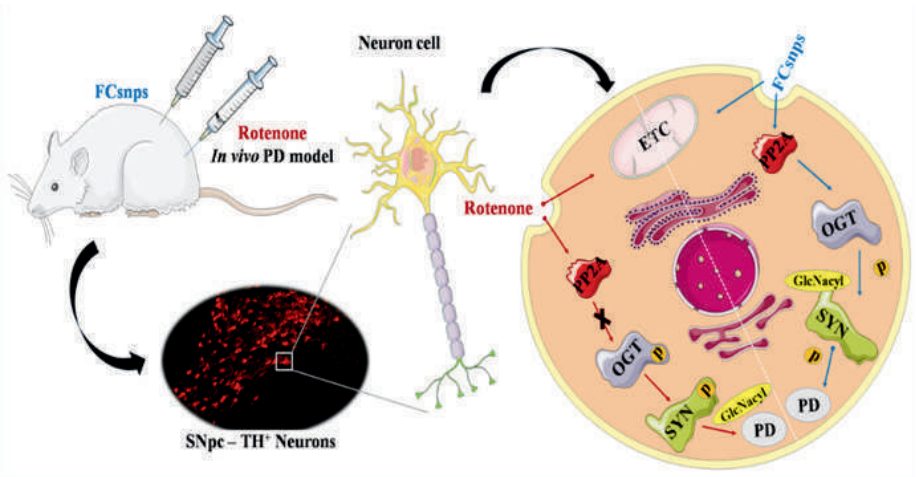
Research Activities/Highlights:

Our lab is involved in the Development of target specific nanotherapeutics for epigenetic regulation of cancer. Chemoprevention and mechanism of action of drug/siRNA loaded nanoparticle mediated therapy for leukemia, neuroblastoma, glioblastoma and neurodegenerative disorders.

- Development and application of high-throughput functional gene-based screening for cancer. Targeted Nanocarrier mediated drug/si-RNA delivery for epigenetic regulation mediated cancer inhibition.
- Nutraceutical based nanodrug delivery for antitumor activity in in vitro, 3D raft and in vivo models and their mechanism of action.
- Epigenetic regulation for neuroprotective mechanism of novel nanoformulation based drug delivery system in neurodegenerative diseases

Significant Research achievements:

The present study determines the post-translational modification and aggregation of alpha-synuclein are one of the major causes of Parkinson's disease (PD) regulation. In that, the phosphorylation and nitration of synuclein elevate the aggregation, while O-GlcNacylation prevents the aggregation of synuclein. The inhibition of synuclein aggregation directs the way toward the development of PD therapy. The endowed O-GlcNacylation of synuclein could be a promising strategy to inhibit synucleinopathy. Therefore, the neuroprotective chitosan-based FTY720 nanoformulation, PP2A (Protein phosphatase 2) activator has been employed to evaluate the PP2A role in O-GlcNacylation of synuclein in vivo PD model. The neuroprotective effect of our nanoformulation is attributed to the upregulation of tyrosine hydroxylase (TH), the PD therapeutic target with the behavioral improvement of animals against rotenone-induced PD deficits. The neuroprotective molecular insights revealed the camouflaged role of PP2A by endowing the OGT activity that induces O-GlcNacylation of synuclein in the reduction of synucleinopathy. ACS Chem. Neurosci. 2024, 15, 1, 71–77



Scheme represents FTY720 nanoformulation induces O-GlcNacylation of synuclein to alleviate synucleinopathy

Selected Publications:

- Sardoiwala, M.N.; Boddu, M.; Biswal, L.; Karmakar S; Roy Choudhury, S. FTY720 Nanoformulation Induces O- GlcNacylation of Synuclein to Alleviate Synucleinopathy. ACS Chem. Neurosci. 2024, 15, 1, 71–77.
- Sardoiwala, M.N.; Boddu, M.; Biswal, L.; Karmakar S; Roy Choudhury, S. Hytrin Nanoformulation Reduces Nitrated Synucleinopathy Through Chaperon-Mediated Autophagy. ACS Appl. Nano Mater, 2024, 7, 8, 8730–8737.
- Sardoiwala, M.N.; Nagpal, S.; Bhatt, B.; Roy Choudhury, S.; Karmakar S. Improved Melatonin Delivery by a Size-Controlled Polydopamine Nanoformulation Attenuates Preclinical Diabetic Retinopathy. Mol Pharm, 2023, 20, 2899.

No of PhD students-6, Intern students:1

QUANTUM MATERIALS & DEVICES UNIT

FACULTY MEMBERS

Dr. Abir De Sarkar
Scientist 'F'

Dr. Suvankar Chakraverty
Scientist 'F'

Dr. Indranil Sarkar
Scientist 'F'

Dr. Md. Ehesan Ali
(Head of UNIT)
Scientist 'F'

Dr. Kaushik Ghosh
Scientist 'F'

Dr. Dipankar Mandal
Scientist 'F'

Dr. Kiran Shankar Hazra
Scientist 'E'

Dr. Chandan Bera
Scientist 'D'

Dr. Bhanu Prakash
Scientist 'D'

Dr Aviru Kumar Basu
Scientist 'C'

Dr. Abir De Sarkar, Scientist-G

Research Activities/Highlights:

In the publication "Advancing intrinsic carrier mobility estimation in transition metal tri chalcogenide monolayers using DFT-BTE":

- We explored the highly anisotropic, semiconducting 2D transition metal trichalcogenide monolayers MX3 (M = Ti, Zr, Hf and X = S, Se) for their transport properties.
- The Bardeen and Shockley formalism ignores the anisotropy in all the input parameters in calculating intrinsic carrier mobility. The Takagi formalism incorporates anisotropy in effective mass. Lang et al. introduced a more accurate formalism, accounting for anisotropy in all parameters. A more pronounced improvement to the formalisms has been achieved by considering the intricate details of band dispersion.
- The Lang et al. formalism, yields electron mobility: 10800, 8350 and 6840 cm2/Vs for TiS3, HfS3 and ZrS3, respectively. While, incorporating realistic band structure and going beyond the effective mass approximation using the BTE formalism, the electron mobility reaches the values of 1420, 967 and 771 cm2/V s in TiS3, HfS3 and ZrS3, respectively.

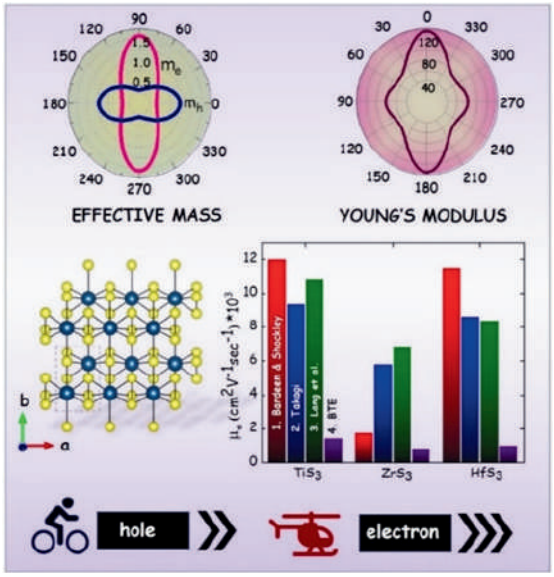


Fig. 1: Applied Physics Letters 2024, 124 (8), 082101

Significant Research achievements:

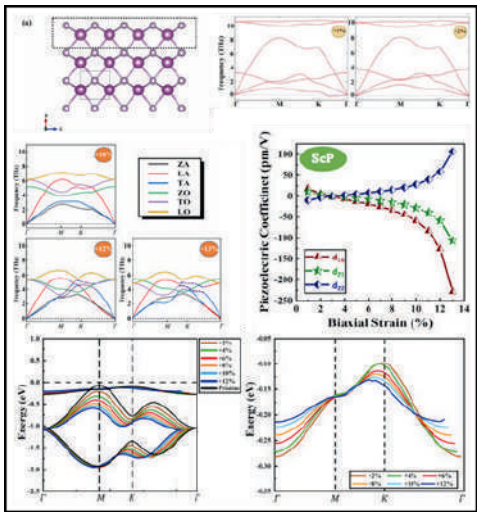


Fig. 2: Phys. Rev. B 2023, 108 (7), 075426

- In the paper "Origin of Strain Tunability in Flat Valence Band and Ultrahigh Shear Piezoelectricity in Superflexible Non-van Der Waals Graphitic ScX Monolayers (X= P, As, Sb)":
- We stabilized 1-atom-thick ScX (X = P, As, Sb) monolayers drawn from their n-vdW bulk counterpart in the wurtzite phase by applying a minimal tensile strain of 1–2%.
- The resulting high flexibility, owing to the extremely small in-plane elastic constants (6–43 N/m) and Young's modulus (6–20 N/m), suits them ideally for extensive strain engineering on a large scale.
- Complex mixing of acoustic and optic phonon modes for higher strains ensures a large shear-piezoelectric coefficient of up to d16 = −228.08, −469.87, and −397.52 pm/V for ScP, ScAs, and ScSb respectively.
- The monolayers exhibit rich band structures, including flat bands at the top-most valence band and a large spin splitting of 100 meV.

Selected Publications:

- Seksaria, H.; Kaur, A.; De Sarkar, A. Origin of Strain Tunability in Flat Valence Band and Ultrahigh Shear Piezoelectricity in Superflexible Non-van Der Waals Graphitic ScX Monolayers (X= P, As, Sb). Phys. Rev. B 2023, 108 (7), 075426. https://doi.org/10.1103/PhysRevB.108.075426.
- Tripathy, N.; De Sarkar, A. Insights into the Origin of Multiferroicity and Large In-Plane Piezoelectricity in AlXY (X= S, Se; Y= Cl, Br, I) Monolayers. Phys. Rev. B2024, 109 (12), 125414. https://doi.org/10.1103/PhysRevB.109.125414.
- Arora, A.; De Sarkar, A. Advancing Intrinsic Carrier Mobility Estimation in Transition Metal Trichalcogenide Monolayers Using DFT-BTE. Applied Physics Letters 2024, 124 (8), 082101. https://doi.org/10.1063/5.0182633.

No of PhD students-9

Dr. Ehesan Ali, Scientist-F

Research Activities/Highlights:

- **High Spin Blatter's Triradical:** Robust organic triradicals with high-spin quartet ground states provide promising applications in molecular magnets, spintronics, etc. In this context, a triradical based on Blatter's radical has been synthesized recently, having two low-lying non-degenerate doublet states with a quartet ground state. The traditional broken-symmetry (BS)-DFT computed doublet–quartet energy gaps are reported to be somewhat overestimated compared to the experimentally observed values. In this work, we have employed different ab initio methods like spin-constraint broken-symmetry (CBS)-DFT, state-averaged CASSCF, and NEVPT2 computations on this prototypical system to obtain more accurate doublet–quartet energy gaps for this triradical. Furthermore, we have proposed and modeled another two triradicals based on Blatter's radical, which are interesting for experimental synthesis and characterization.
- **GTPase domain residues T62 and S277 in yeast Dnm1:** Mitochondrial division is a highly regulated process. The master regulator of this process is the multi-domain, conserved protein called Dnm1 in yeast. In this study, we systematically analyzed two residues, T62 and S277, reported to be putatively phosphorylated in the GTPase domain of the protein. Both residues are important for the function of the protein, as evident from in vivo and in vitro analysis of the non-phosphorylatable and phosphomimetic variants. Dnm1T62A/D and Dnm1S277A/D showed differences with respect to the protein localization and puncta dynamics in vivo, albeit both were non-functional as assessed by mitochondrial morphology and GTPase activity. Overall, the secondary structure of the protein variants was unaltered, but local conformational changes were observed. Interestingly, both Dnm1T62A/D and Dnm1S277A/D exhibited dominant-negative behavior when expressed in cells containing endogenous Dnm1. To our knowledge, we report for the first time a single residue (S277) change that does not alter the localization of Dnm1 but makes it non-functional in a dominant-negative manner. Intriguingly, the two residues analyzed in this study are present in the same domain but exhibit variable effects when mutated to alanine or aspartic acid.
- **Magnetic Anisotropy in the nd-Shells of [WCp2]0 Metallocene:** Single-molecule magnets (SMMs) with a large magnetization reversal barrier are predominated by the lanthanide systems due to their strong spin–orbit coupling (SOC). However, the transition metals have also emerged as potential contenders and the largest magnetic anisotropy has been identified for a cobalt system among any d-series-based SMMs (Bunting et al. Science 2018, 362, eaat7319). In this work, we have explored the magnetic anisotropy in highly axial ligand field systems of metallocene, having different d-subshell (3d4, 4d4, and 5d4).

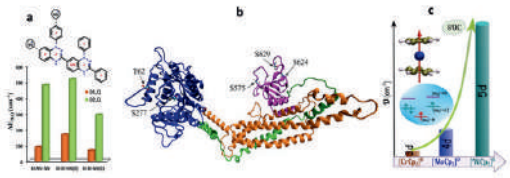
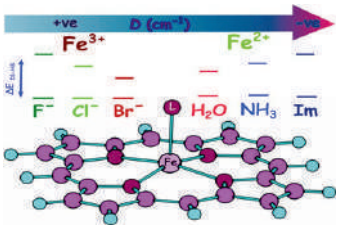


Figure 1. a) Doublet-Quartet energy gaps in high-spin Blatter's triradicals, b) Computationally modeled structure of Dnm1 protein, and c) Correlations between spin-orbit couplings (SOC) with zero-field splitting parameter (D values).

The wave function-based multireference methods including static and dynamic electron correlations ZFS) parameters. (Here, we report exceptionally large magnetic anisotropy for a 5d complex of [WCp2]0 with the highest energy barrier that is nearly twice as high as the previous record value for the Co complex. We have also observed that the axial ZFS parameter (D) is increasing down the group in the order of 3d < 4d < 5d, pertaining to a large SOC.

Significant Research achievements:



Studying magnetic properties, especially the magnetic anisotropy of iron–porphyrin complexes employing multiconfigurational methods, is quite challenging due to many strongly correlated electrons in nearly degenerate orbitals. However, a prerequisite for observing the magnetic anisotropy and slow magnetization relaxation, the zero-field splitting parameter, D, was experimentally observed decades ago for halide-based axially ligated penta-coordinate Fe(III)–porphyrins. In these complexes, the signs of D were primarily reported as positive; in a few cases, inconclusive signs of the D parameter were also mentioned. However, no ab initio calculations have been reported to shed light on this. We confirm the positive D values by deciphering the electronic structure of these penta-coordinated complexes employing the complete active space self-consistent field method and N-electron valence second-order perturbation theory. However, a negative D value is highly desired to observe the single-molecule magnet properties without an external magnetic field, which we observed in the Fe(II)–porphyrin complexes with axial imidazole ligands instead of halide ligands. The detailed analysis of the multireference wave functions unravels the role of axial ligands in determining the sign and magnitude of the D parameters.

Selected Publications:

- Khurana, R.; Bajaj, A.; Shamasundar, K. R.; Ali, Md. E. High-Spin Blatter's Triradicals J. Phys. Chem. A 2023, 127, 7802-7810. (Journal Front Cover Article)
- Ali, S.; Ali, Md. E. Broken edge spin symmetry induces a spin-polarized current ingraphene nanoribbon. J. Phys. D: Appl. Phys. 2024, 57, 215001.
- Mukhopadhyaya, A.; Ali, M. E. Can Iron–Porphyrins Behave as Single-Molecule Magnets? J Phys Chem A 2024, 128, 2339–2348.

No of PhD students-9

Dr. Kaushik Ghosh, Scientist-F

Research Activities/Highlights:

- Energy Storage and conversion via Carbon based template decorated with Metallic Phosphides
- Miniaturised Energy Storage Devices
- Non-metal-based electrode development for energy storage
- Waste Water Remediation
- 2D materials (metal chalcogenides and graphene) based devices for photodetection and sensing
- Metal oxides for Photovoltaics

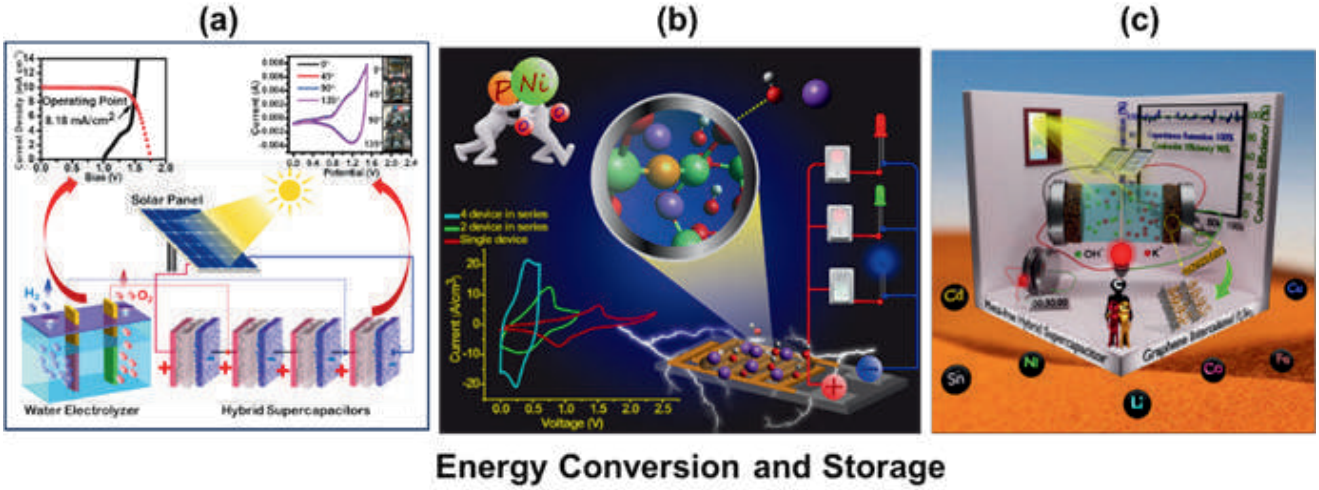


Figure 1. (a) Energy Storage and conversion via Carbon based template decorated with Metallic Phosphides (b) Metal-oxide based Micro supercapacitor for Miniaturised Energy Storage Devices (c) Non-metal-based electrode development for energy storage

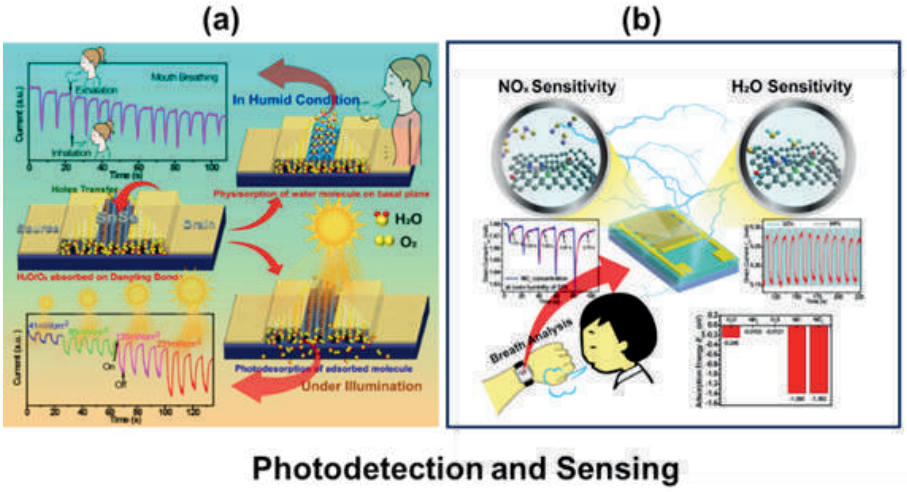


Figure 2. (a) 2D materials-metal chalcogenides based devices for photo detection and humidity sensing (b) Graphene based triboelectric self-powered sensing platform for respiratory diagnosis.

Selected Publications:

- Das, S.; Rani, S.; Kumar, N.; Ahmed Siddiqui, S.; Pahuja, M.; Moun, M.; Afshan, M.; Chaudhary, N.; Rani, D.; Ghosh, R.; Bera, C.; Ghosh, K. Self-Powered Cobalt Nanocluster Decorated Flexible Graphene Based Tribo-Sensors for Respiratory Diagnosis of Critical Asthma Patient. Chem. Eng. J. 2024, 492, 152319.
- Siddiqui, S. A.; Das, S.; Rani, S.; Afshan, M.; Pahuja, M.; Jain, A.; Rani, D.; Chaudhary, N.; Jyoti; Ghosh, R.; Riyajuddin, S.; Bera, C.; Ghosh, K. Phosphorus-Doped Nickel Oxide Micro-Supercapacitor: Unleashing the Power of Energy Storage for Miniaturized Electronic Devices. Small 2024, 20 (14), 2306756.
- Afshan, M.; Sachdeva, P. K.; Rani, D.; Das, S.; Pahuja, M.; Siddiqui, S. A.; Rani, S.; Ghosh, R.; Chaudhary, N.; Jyoti; Riyajuddin, S.; Bera, C.; Ghosh, K. Porous Carbon Template Decorated with MOF-Driven Bimetallic Phosphide: A Suitable Heterostructure for the Production of Uninterrupted Green Hydrogen via Renewable Energy Storage Device. Small 2023, 19 (50), 2304399.

No of PhD students-8, Postdoc-1, Project students-1

Dr. Suvankar Chakraverty, Scientist-F

Research Activities/Highlights:

- The growth of epitaxial thin films of LaFeO3 (LFO), LaMnO3 (LMO), and LaCoO3 (LCO) on TiO2-terminated SrTiO3 (001) substrates was reported using pulsed laser deposition.
- Although these materials exhibit anti-ferromagnetism in bulk with transition temperatures below room temperature, but for the first time, evidence of ferromagnetism in these films at room temperature is reported.
- This behaviour could be attributed to magnetic proximity, the presence of multiple valence states resulting in a double exchange reaction, as well as the influence of strain, which plays a pivotal role. Furthermore, we observe a type II band alignment at these interfaces with thin films under investigation and SrTiO3 substrate, indicative of electron-hole generation, suggesting their potential application in photovoltaic cells.
- LFO exhibits room-temperature ferromagnetism and a conducting interface, which could be advantageous for memory applications. Moreover, the possibility of spin current occurrence at the interfaces provides a viable mechanism for efficient electron-hole pair separation.

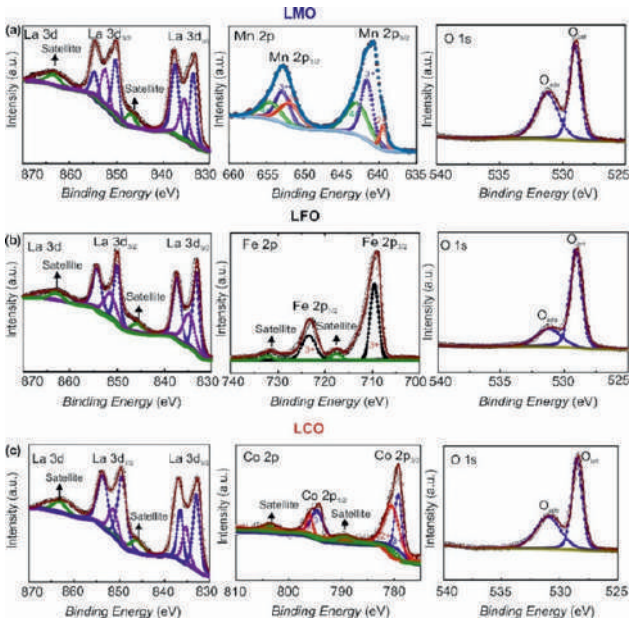


FIG. 1. High resolution XPS of La 3d, O 1s, Mn 2p, Fe 2p, and Co 2p for (a) LMO, (b) LFO, and (c) LCO

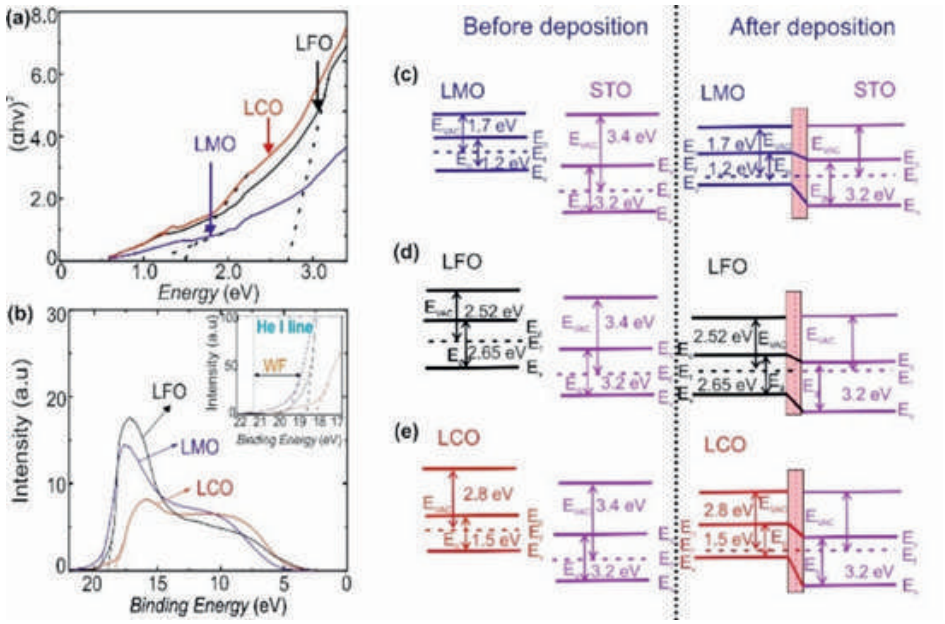


FIG. 2. (a) UV–Vis absorbance spectra of LMO, LFO, and LCO. (b) Ultraviolet photoelectron spectra of LMO, LFO, and LCO. Band alignment of the materials before and after the deposition of (c) LMO, (d) LFO, and (e) LCO, respectively.

Selected Publications:

- Satapathy, B. R.; Kaur, R.; Kumari, A.; Mishra, H. K.; Anas, Md; Vashist, A; Kumar, S; Mandal, D; Malik, V. K.; Chakraverty, S. Physical properties of LaBO3 (B = Mn, Fe, Co) thin films grown on SrTiO3 by pulsed laser deposition technique. J. Appl. Phys., 2023, 134, 145305.

No of PhD students-7, intern students-01

Dr. Dipankar Mandal, Scientist-F

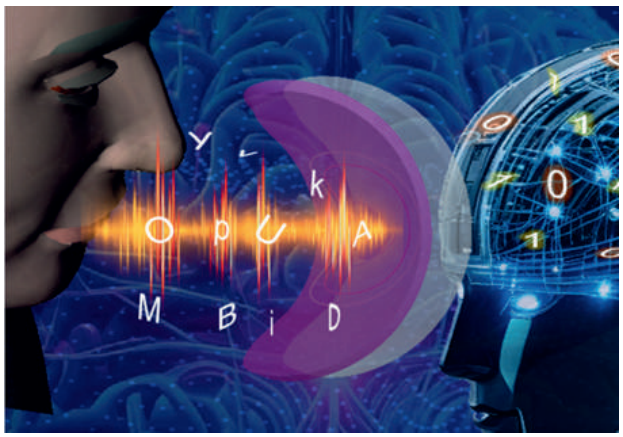
Research Activities/Highlights:

- **Development of ML integrated biomedical sensors for health care monitoring:**

Under this topic, we have proposed a protocol for solution processable biomedical sensor fabrication that give rise high degree of mechano-sensitivity (~225 mV/N) in the subtle pressure range (0.001–1 kPa), and fast responsivity (~4 ms). It is validated for assessing risk factors of cardiovascular diseases based on arterial pulse data. It is integrated with the internet of things (IoT) via machine learning (ML) system on to facilitate remote healthcare monitoring

Fig. 1: It is a representation of ML integrated biomedical sensor that can assess the risk factors of cardiovascular diseases.

- **Development of voice print biometrics:**



Owing the high sensitivity and broad frequency domain our programmable polymeric interface emerged as a breakthrough for acquiring high-fidelity voice data. By combining it with artificial intelligence (AI), an organic wearable acoustic sensor has shown its ability to quantitively sense, analyse, and recognize voice signatures as demonstrated by population classification, healthcare assessment to speaker recognition.

Fig. 2. It present a programmable polymeric interface that marks an advancement in capturing precise voiceprint descriptors. Integrated with artificial intelligence, it excels in quantitatively sensing, analysing, and recognizing voice signatures, solidifying its role as an additional tool in the existing landscape of biometrics technology.

Significant Research achievements:

A highly sensitive (~440 mV/N), confirmable and flexible wearable gadget has been introduced for addressing such complexities; moreover the gadget has been fabricated by recycling the waste material. Subsequently, it is interfaced with various deep/machine learning algorithms for classification/prediction of the different hand poses; particularly unsupervised k-means clustering is used for observing discrete classes, and different supervised algorithms such as k-nearest neighbour (KNN), support vector machine (SVM), deep neural network (DNN), and pattern recognition that provides the high degree of prediction accuracy (up to ~98%) for classification of different postures. Thus, artificial intelligence aided wearable gadget could not only offers a unique solution for autonomously tracking various body movements (Fig. 3) but also assisted in reducing the waste materials, a threat to environment.

Selected Publications:

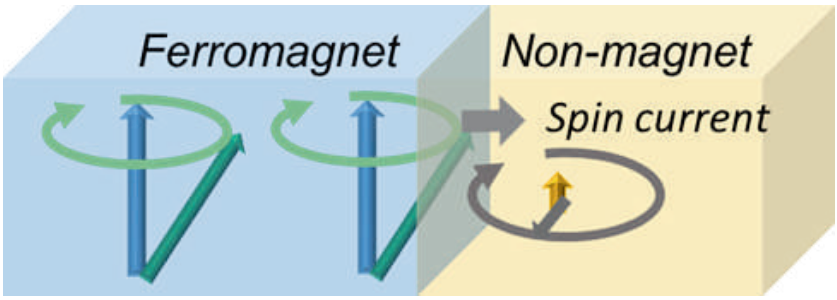
- Mondal; R. Sarkar; D. Saini; V. Gupta; T. K. Kundu; D. Mandal*, All-Electrospun, Water-Resistant, Breathable, Wearable, and Stable Metal Halide Perovskite Engineered Electroactive Polymer Textiles for Flexible Piezoelectric Nanogenerator Adv. Mater. Technol. 2023, 8, 2300614.
- A. Babu; S. Ranpariya; D. K. Sinha; A. Chatterjee; D. Mandal*, Deep Learning Enabled Perceptive Wearable Sensor: An Interactive Gadget for Tracking Movement Disorder, Adv. Mat. Tech. 2023, 8, 2300046.
- V. Gupta; A. Kumar; B. Mondal; A. Babu, S. Ranpariya; D. K. Sinha; D. Mandal*, Machine Learning Aided All-Organic Air Permeable Piezoelectric Nanogenerator, ACS Sustainable Chem. Eng. 2023, 11, 6173–6182.

No of PhD students-4, Postdoc-1 intern students-2

Dr. Indranil Sarkar, Scientist-F

Research Activities/Highlights:

Ferromagnet / Non-magnetic metal interfaces hold key to achieving ultrafast and ultralow power spintronic devices. We have been working on understanding the physical and electronic structure correlation vis-à-vis spin transfer properties across ferromagnetic/ non-magnetic metal hetero structures capable of spin torque and spin pumping.



Schematic of Ferromagnet/Non-magnetic metal interface and associated spin transfer processes

We have employed combination of X-ray scattering based structural characterization, hard X-ray photoemission based electronic structure and ferromagnetic resonance and DC magnetization based studies to improve spin transfer characteristics across FM/NM spintronic heterostructures.

Significant Research achievements:

Using hard X-ray photoemission we have for the first time revealed the hitherto unknown effect of NM underlayer with different Spin-Orbit Coupling (SOC) strength on the spin dependent electronic structure of FM/NM heterostructures of technologically relevant CoFeB/NM heterostructure (Fig. 3(a)) for spin torque applications. Through our studies we have demonstrated that the observed changes cannot be directly correlated with the conventional expectation of the dependence on the strength of SOC of the NM layer. Dichroic photoemission asymmetry measurements (Fig. 3(b)) indicate that the spin polarization of the ferromagnetic CoFeB layer is more than two-fold higher with non-magnetic Cu underlayer (weak-SOC) than that with Ta and W underlayers (strong-SOC).

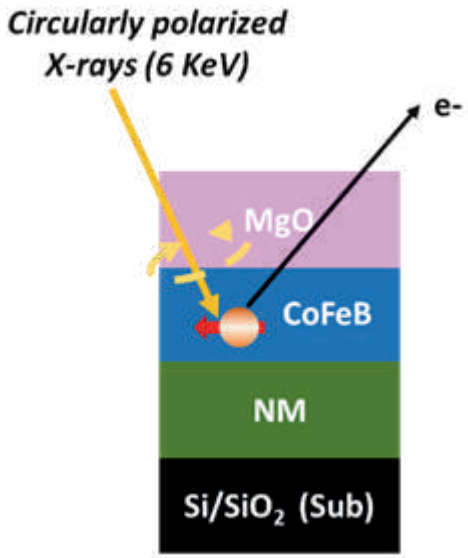


Fig. 3a: MgO/CoFeB/NM heterostructure

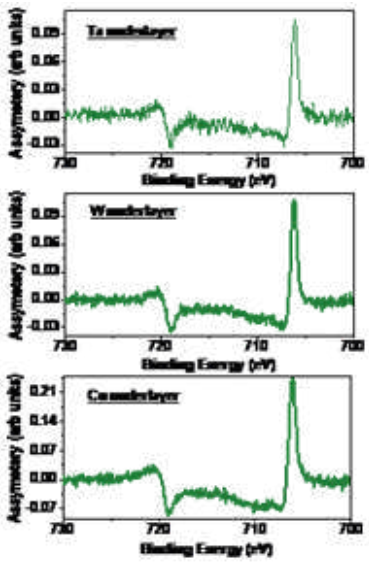


Fig.3b: Dichroic photemission asymmetry for varying NM underlayers

No of PhD students-2, intern students1

Dr. Chandan Bera, Scientist-E

Research Activities/Highlights:

Dr. Chandan Bera is working on the thermal and electron transport mechanism in nanostructured materials and developing a simple predictive model for thermal and electron transport in 2D and nanostructure materials for efficient design of thermoelectric device. His group also interested for electron and spin transport properties in hetrostructure interface and working on the electronic and spintronic properties of the interface from the atomistic calculation based on density functional theory. Another focus of his group is to predict efficient nanostructured materials for clean energy generation. With experimental collaboration his group investigate the mechanism of electrocatalysis in heterostructure materials.

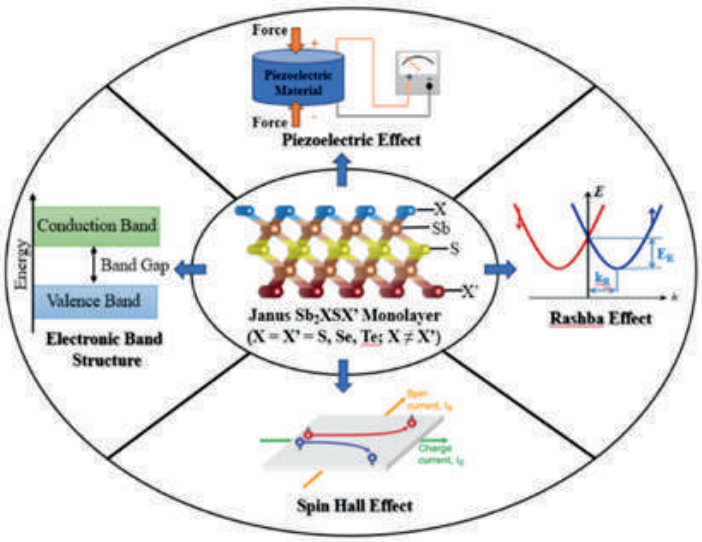


Figure: Electronic and Spintronic properties of two dimensional janus materials

Significant Research achievements:

We have developed a model to calculate pyroelectric properties of two dimensional (2D) materials using Quasi harmonic approximation and density functional theory. This model will be very efficient to predict pyroelectric coefficient and pyroelectric figure of merit in new materials. This work is recently published in Journal of Physics: Condensed Matter, 2023, 35(41), 415401.

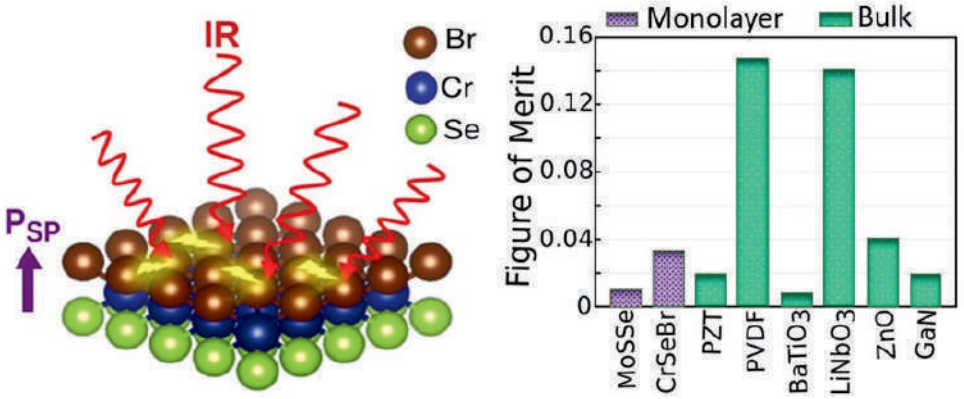


Figure: Pyroelectric properties can be useful in sensor and detector designing. Pyroelectric figure of merit calculated using Quasi harmonic approximation for 2D and bulk materials.

Selected Publications:

- Gupta, R., Bera, C. Modeling thermoelectric properties of monolayer and bilayer WS 2 by including intravalley and intervalley scattering mechanisms. Physical Review B, 2023, 108(11), 115406.
- Kumar, N., Chaudhuri, A., Arya, V., Bakli, C., Bera, C. Significantly reduced thermal conductivity and enhanced thermoelectric performance of twisted bilayer graphene. Journal of Applied Physics, 2023, 134(4), 044301.
- Jain, A., Mandal, D., Bera, C. Quasi-harmonic approach to evaluate pyroelectric properties in Janus CrSeBr monolayer. Journal of Physics: Condensed Matter, 2023, 35(41), 415401.

No of PhD students-3, intern students-2

Dr. Kiran Shankar Hazra, Scientist-E

Research Activities/Highlights:

A. Artificial edges of 2D materials and its applications:

- Currently we have shown that in 2D BP, active piezoelectric facets could be designed in pure state by creating artificial edges.
- Our research show that the optical and electrical response at the artificial edges of 2D are distinct and tunable as compared to basal planes.

B. Surface and interface properties nanostructures:

- Established a novel protocol for straightning (dewinkling) 2D flakes by using e-beam irradiation
- Opened up a new prospective of gating effect on conducting channel due to electrostatic strain induced on crystal structure.

C. SERS based biosensing:

We are working of different biomarker detection by using SERS technique and creating Raman library identifying signature peaks of the biomarkers.

Significant Research achievements:

We have demonstrate a novel way to create piezoelectric facets artificially on 2D materials by creating nanostructures using low power focused laser. Our finding also challenges traditional way of determining out of plane piezo electric coefficient using PFM technique and offers new protocol to measure those figure of merits in pure state, which may have significant impact to the scientific community.

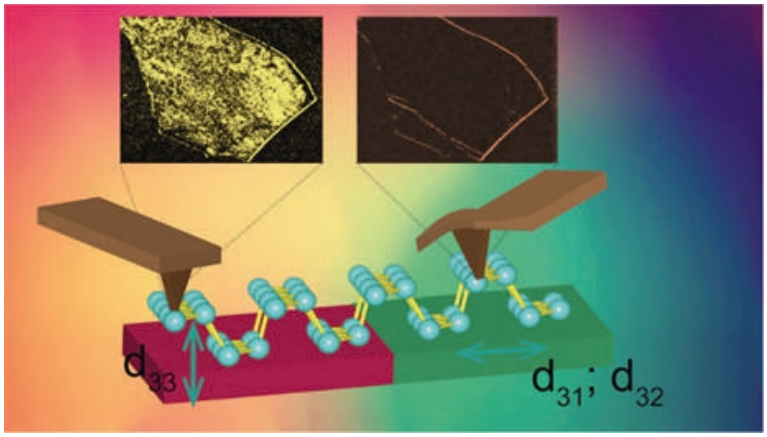


Fig 1: Selective peizoresponse along artificial edges of 2D black phosphorous

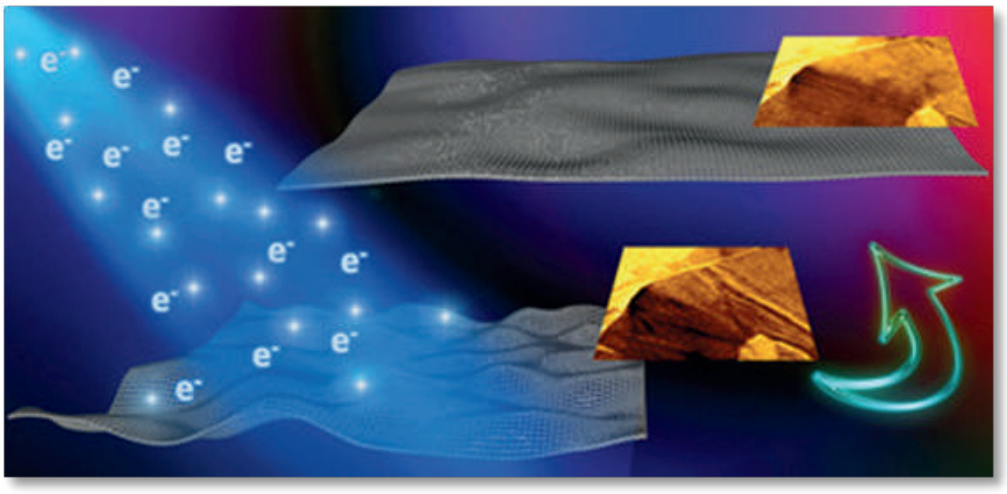


Fig 2: A new protocol to dewinkle 2D Flakes by electron beam

Selected Publications:

- Manpreet Kaur, Pradip Nandi, Mamta Raturi, Himanshu Tyagi, Jyoti Saini, Tapaswini Dash, Akash Kumar Maharana, Km Neeshu, Anirban Kundu, Abir De Sarkar, Kiran S Hazra; Facet Engineering by Sculpting Artificial Edges on 2D Black Phosphorus for Localized and Selective Piezoelectric Response. ACS Appl. Nano. Mat. 2024, 7, 6159-6168.

No of PhD students-5 Postdoc, Project intern students-1

Dr. Bhanu Prakash, Scientist-D

Research Activities/Highlights:

- Design and fabrication of microfluidic reactors for photocatalytic reduction of hexavalent chromium in wastewater. Here, we demonstrate an interplay of various microfluidic parameters such as reactor design, flowrate of the incoming precursor, channel length and different phases of titanium oxide photocatalyst.
- Design and fabrication of droplet based microfluidic reactors for synthesis of nanomaterials and polymer microspheres. A droplet-based generator was fabricated using the photolithography technique. By varying the flowrates of dispersed phases a tunability in droplet size was observed resulting in varied shapes and sized nano/microstructures. Using this approach we have successfully demonstrated the synthesis of tin oxide quantum dots and PVDF microparticles.

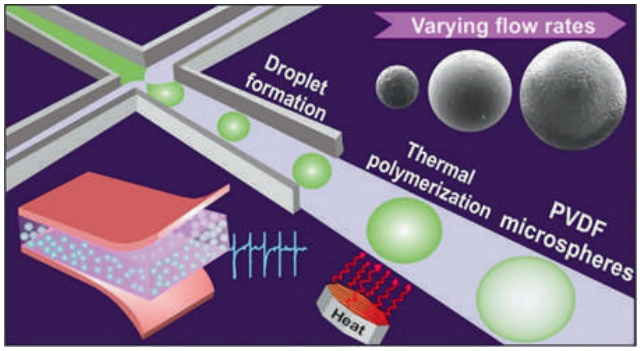


Figure 1: A microfluidic reactor equipped with a heating zone for the formation of PVDF microspheres.

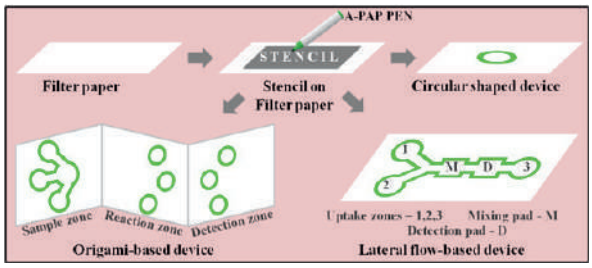


Figure 2: Schematic for formation of 2D lateral flow and 3D origami paper-based devices.

- We also demonstrate a pen-on-paper approach for chemical and biological sensing using a smartphone-enabled colometric technique. Quick, cost-effective and robust paper-based devices were fabricated using A PAP pen. The paper-based devices fabricated using A PAP pen do not require any drying or annealing step. Using this PAP pen approach, we have demonstrated the fabrication of 2D lateral flow and 3D origami paper-based devices for the detection of heavy metals and dopamine.

Significant Research achievements:

- In a work published in Chemical Engineering Journal, we have demonstrated a photoreaction of approach for conversion of toxic hexavalent form of chromium to in trivalent form. A conversion efficiency of 95 % was reported at a flow rate of 50 µl/min using serpentine microreactor. Enhanced conversion efficiency was also reported for TiO2 in the anatase phase than in the rutile phase.
- We employed a microfluidic flow focussing device (MFFD) with thermal initiated off-chip polymerization to process PVDF microspheres. Optimization of reaction temperature (Toil) significantly enhances the EA phase, reaching 82.05% at Toil = 60°C. A flexible piezoelectric device made from PVDF microspheres, demonstrating an open circuit voltage of 23.5 V in response to finger and foot tapping movements, showcases potential for self-powered wearable sensors and devices.
- We also reported for the first time a novel and cost-effective technique for fabricating paper-based devices using an Advanced PAP (A-PAP) pen, which is capable of withstanding typical aqueous solutions, organic solvents do not require any sophisticated instrumentation or a heating step, making it a promising technology for resource-limited settings. Using an A-PAP pen, we have fabricated two-dimensional (2D) paper-based devices and complex three-dimensional (3D) paper-based devices using a paper origami were fabricated.

Selected Publications:

- Rohal, A.; Garg, R.; Choudhury, S.; Manolata Devi, M.; Jyoti Panda, J.; Pandey, A.; Prakash, B. Exploiting Flow Manipulation to Engineer the Electroactive Phase for Improved Piezo Response in Size Tunable PVDF Microspheres via Microfluidic Technology. Chemical Engineering Journal 2024, 491, 151986.
- Vibhav Katoch; Singh, P.; Garg, R.; Partha Sarathi Das; Akash Katoch; Mayanglambam Manolata Devi; Kaushal, M.; Pandey, A.; Prakash, B. Continuous Flow Photoreduction and Validation of Cr(VI) in Wastewater Using TiO2 Nanoparticles: An Interplay between Catalyst Phase and Microfluidic Parameters. Chemical Engineering Journal 2024, 484, 149563–149563.
- Rahul Gond; Shukla, P.; Prakash, B.; Rawat, B. Vertically Aligned MoS2/ZnO Heterostructure for Highly Selective NH3 Sensing at Room Temperature. ACS applied electronic materials 2024, 6, 4, 2728–2738.

No of PhD students-5, Postdoc-1, intern students-2

Dr Aviru Kumar Basu, Scientist-C

Research Activities/Highlights:

In the said period my lab has been engaged in the waste water treatment and HER, OER through various photocatalytic methods. My PhD scholar, Sonu Sarraf, has published a paper in 'Journal of Material Sciences' during this period. Also, other PhD student, Manshu, has published a paper in 'Nanoscale' showing the dye degradation along with HER and OER application as shown in Figure 2.

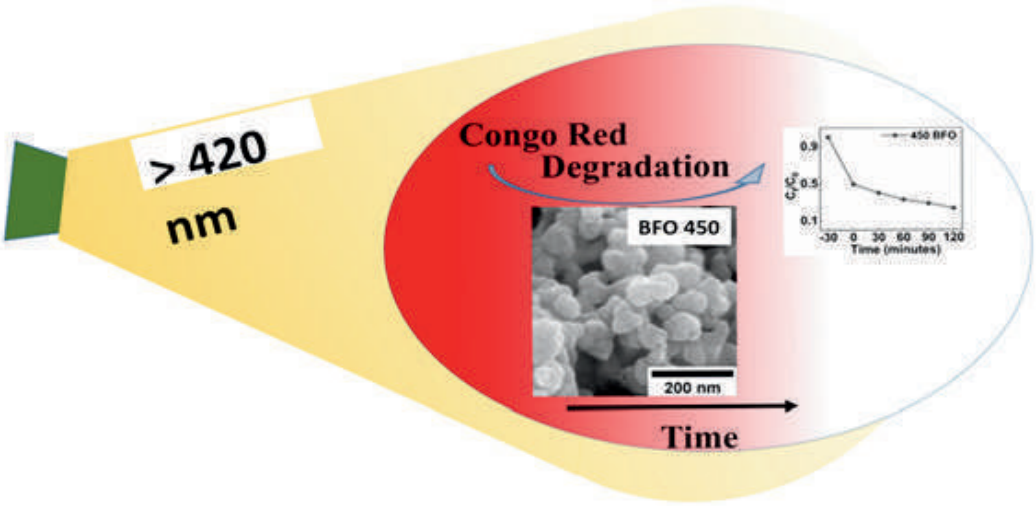


Figure 1: Photocatalytic degradation mechanism of BFO nanoparticles.

Significant Research achievements:

the significant research achievement has been the highly efficient visible light photocatalytic degradation of the CR dye. Along with this significant advancement in the ternary composite for multifacet application has been done which included applications like photocatalytic dye degradation, HER, and OER, shown in Figure 2.

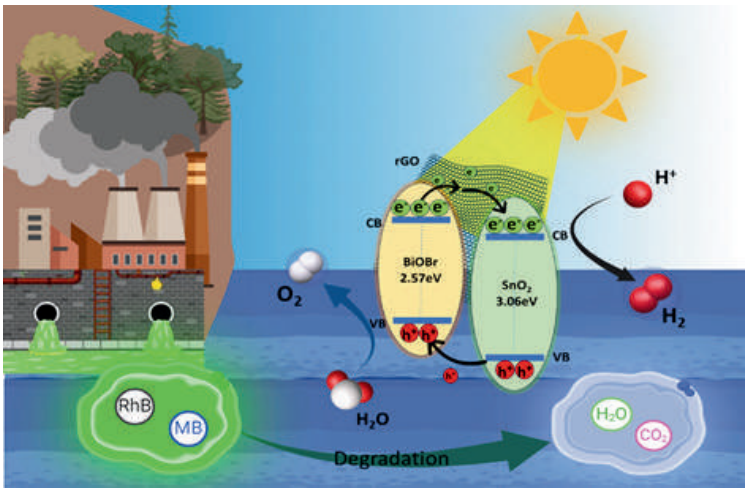


Figure 2. Novel GO hoisted SnO2-BiOBr bifunctional catalyst for the remediation of organic dyes under the illumination of visible light and electrocatalytic water splitting

Selected Publications:

- Chugh, V.; Basu, A.; Kaushik, N.K.; Kaushik, A.; Mishra, Y.K.; Basu, A.K.; Smart nanomaterials to support quantum-sensing electronics. Materials today electronics.2023 10.1016/j.mtelec.2023.100067
- Sardar, R. H.; Bera, A.; Chattopadhyay, S.; Mahato, J. C.; Sarraf, S.; Basu, A. K.; Effect of Dopants in the HTL Layer on Photovoltaic Properties in Hybrid Perovskite Solar Cells. Journal of materials science. Materials in electronics.
- Kaushal, N.; Jain, A.; Kumar, A.; Sarraf, S.; Aviru Kumar Basu; Chaaya Iyengar Raje; Saha, A.; Solvent-Free Synthesis of S,N-Doped Carbon Dots for Extended Visible-Light-Induced Oxidase-Mimicking Activities and Antimicrobial Applications.ChemPlusChem 2023. https://doi.org/10.1002/cplu.202300125.

No of PhD students-02, Intern-1

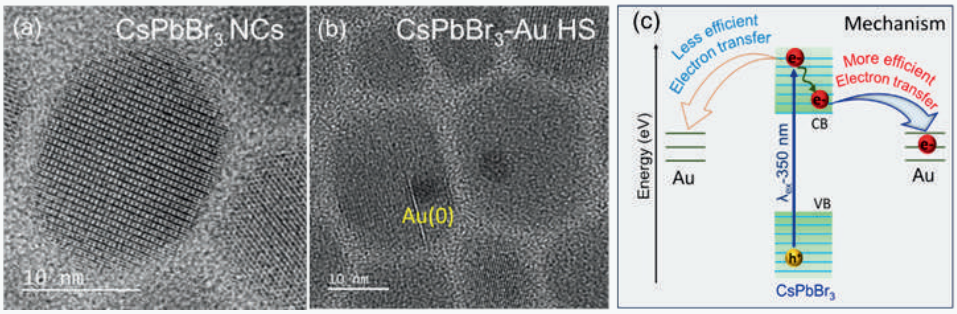
Dr. K. Justice Babu, DST Inspire Faculty Fellow

Research Activities/Highlights:

Our research is mainly focused on exploration of wet chemistry approaches to control the shape, size and composition of various nanostructures to unveil their properties. The group currently focus on the development of epitaxial heterostructures comprising of colloidal light emitting halide perovskite nanocrystals (NCs), semiconductor quantum dots (QDs) and plasmonic nanocrystals. The main goal of our research to explore the detailed understanding of light emission, charge carrier relaxation and energy/charge transfer in epitaxial heterostructures (HS) through state-of-the-art spectroscopic methods including time resolved photoluminescence spectroscopy and femtosecond transient absorption spectroscopy. In addition, these epitaxial heterostructures also explores their applications including, photovoltaics, photocatalysis and light emitting devices (LEDs).

Significant Research achievements:

Ultrafast Electron Transfer Dynamics in Epitaxial CsPbBr3/Au Heterostructure
We have successfully synthesized both dodecahedron CsPbBr3 NCs and CsPbBr3/Au epitaxial heterostructure via hot injection method. The steady state optical absorption and photoluminescence (PL) studies indicate that the excitonic properties remain retained in both CsPbBr3 and CsPbBr3/Au heterostructure. However, in the CsPbBr3/Au heterostructure, there is a notable reduction in the PL intensity at the band edge, along with faster decay of the PL lifetime. Femtosecond transient absorption spectroscopy has been utilized to understand the charge transfer dynamics of CsPbBr3/Au heterostructure. We find that distinct fast electron transfer in the CsPbBr3/Au heterostructure, which is mainly ascribed to the strong epitaxial growth and strong electronic coupling between CsPbBr3 and Au systems. The above drawn conclusions suggest a potential hetero-system for extracting charge carriers for photovoltaic applications



Selected Publications:

- Samanta, S; Justice Babu, K.; Shukla, A.; Kaur, G.; Kaur, A.; Ghosh, H. N. Unveiling the Ultrafast Electron Transfer Dynamics in Epitaxial Dodecahedron CsPbBr3/Au Heterostructure, ChemPhotoChem 2024, 8, 4, e202300242.
- Shukla, A.; Kaur, G.; Justice Babu, K.; Ghosh, H. N. Spectroscopic Investigation of Structural Perturbations in CsPbCl3 Perovskite Nanocrystals: Temperature- and Excitation-Energy-Dependent Study, ACS Photonics 2023, 10, 6, 1906–1915.
- Kaur, A.; Goswami, T.; Justice Babu, K.; Ghosh, H. N. Ultrafast Hole Migration at the p–n Heterojunction of One-Dimensional SnS Nanorods and Zero-Dimensional CdS Quantum Dots, J. Phys. Chem. Lett. 2023, 14, 33, 7483–7489

No of Project student -1

Dr. Amit Vashist, DST Inspire Faculty Fellow

Research Activities/Highlights:

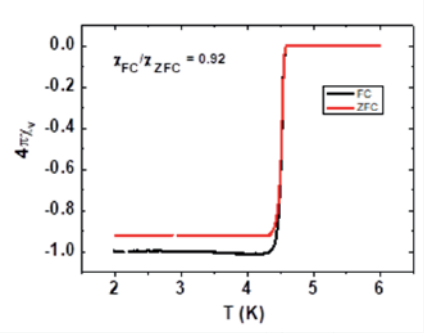


Figure: Magnetic susceptibility (χ) versus temperature (T) in both ZFC and FC modes for single crystals of PdTe. A superconducting transition is observed down to 4.6 K.

Our research is mainly focused on exploration of wet chemistry approaches to control the shape, size and composition of various nanostructures to unveil their properties. The group currently focus on the development of epitaxial heterostructures comprising of colloidal light emitting halide perovskite nanocrystals (NCs), semiconductor quantum dots (QDs) and plasmonic nanocrystals. The main goal of our research to explore the detailed understanding of light emission, charge carrier relaxation and energy/charge transfer in epitaxial heterostructures (HS) through state-of-the-art spectroscopic methods including time resolved photoluminescence spectroscopy and femtosecond transient absorption spectroscopy. In addition, these epitaxial heterostructures also explores their applications including, photovoltaics, photocatalysis and light emitting devices (LEDs).

Significant Research achievements:

We have successfully published a paper titled "Physical properties of LaBO3 (B =Mn, Fe, Co) thin films grown on SrTiO3 by pulsed laser deposition technique", in the Journal of Applied Physics (2023). Additionally, we have submitted two more papers for review in different journals.

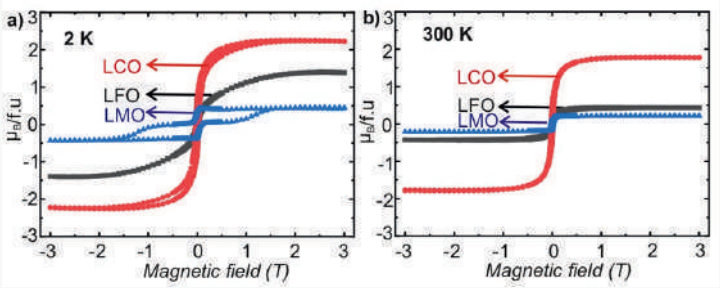


Figure: Hysteresis loop of LMnO3 (LMO), LaFeO3 (LFO) and LaCoO3 (LCO) a) 2 K b) 300 K.

Selected Publications:

- Satapathy, B.R., Kaur, R., Kumari, A., Mishra, H.K., Anas, M., Vashist, A., Kumar, S., Mandal, D., Malik, V.K. and Chakraverty, S., Physical properties of LaBO3 (B= Mn, Fe, Co) thin films grown on SrTiO3 by pulsed laser deposition technique. Journal of Applied Physics, 2023,134(14).

Dr. Neha Bhardwaj; DST-INSPIRE Faculty

Research Activities/Highlights:

Smartphone-assisted colorimetric detection of glutathione in food and pharmaceutical samples using MIL-88A(Fe)

In this work, an intrinsic-oxidase activity of MIL-88A(Fe) was employed to develop a new colorimetric sensor for the detection of GSH. The oxidase activity of MOF was utilized for the detection of GSH using UV-vis spectroscopy and the naked eye. The developed sensor has a good linear relationship with GSH concentrations ranging from 0–100 µM with a detection limit of 150 nM. Additionally, the developed method was successfully used to determine GSH accurately and precisely in food and pharmaceutical samples. The sensor demonstrated satisfactory performance for smartphone-based colorimetric GSH detection on a paper-strip-based assay. This work demonstrates the rapid, inexpensive, and ultrasensitive detection of GSH, opening new avenues for additional food quality and pharmaceutical monitoring.

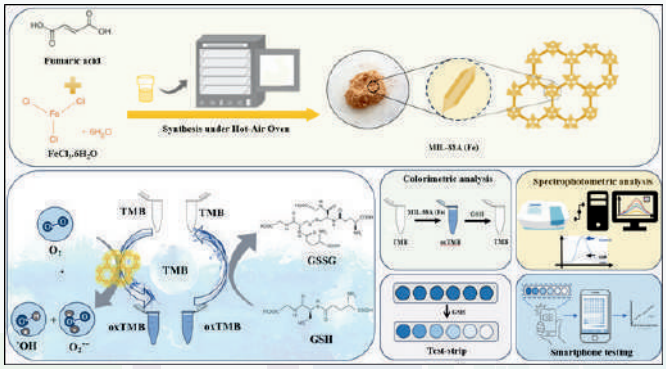


Fig. Schematic of developed GSH colorimetric nanozyme-based sensor

Selected Publications:

- Kumar, S., Deep, A., Wangoo, N., & Bhardwaj, N.Recent advancements in nanomaterials based optical detection of food additives: A review RSC Analyst, 2023, 148, 5322-5339.
- Singh, H., Thakur, B., Bhardwaj, S. K., Khatri, M., Kim, K. H., & Bhardwaj, N. Nanomaterial-based fluorescent biosensors for the detection of antibiotics in foodstuffs: A review Food Chemistry, 2023, 426, 136657

PUBLICATIONS

PUBLICATION DURING THE YEAR 2023-24

Prof Amitava Patra, Director, INST

- Devi, A.; Minhas, H.; Sahoo, L, Rashi., G. Saniya.; Das, A.; Mandal, S.; Pathak, B.; Patra, A. Insights of the Efficient Hydrogen Evolution Reaction Performance in Bimetallic Au4Cu2 Nanoclusters, Nanoscale, 2024, 16, 1758-1769
- Chakraborty, S.; Kolay, Sarita.; Maity, S.; Patra, A.* Copper Nanoclusters as Multi enzymes Mimic Activities of Oxidase and Ascorbic Acid Oxidase in the Presence of Imidazole, Langmuir 2024, 40, 1, 317–324
- Gonçalves, I. M.; Medda, A.; Jessica E. Q. Bautista, Cecília L. A. V. Campos, Ghosh, S.; Patra, A.*, Saturable Absorption and Third-Order Nonlinear Refraction Of 2D CdSe Nanoplatelets Resonant With Heavy-Hole Excitonic Transitions, Appl. Phys. Lett., 2023, 123, 251108
- Marjit, K.; Francis, A. G.; Pati, S. K.; Patra, A.* Impacts of Exciton Binding Energy and Dielectric Confinement of Layered Lead Halide Perovskites on Carrier Relaxation and Exciton Phonon Interactions, J. Phys. Chem. Lett. 2023, 14, 10900–10909
- Medda, A.; Biswas, R.; Dastider, S. G.; Ghosh S.; Mondal, K.; Haldar, K. K.; Patra, A.*, Heterostructures of 2D Core/Shell Nanoplatelets with 2D MoS2 as an Efficient Electrocatalyst for Hydrogen Evolution Reaction, ACS Appl. Energy Mater. 2023, 6, 11745–11753
- Rashi, Kaur, V.; Devi, A.; Bain, D.; Sen, T.; Patra, A.*, Probing the Fluorescence Intermittency of Bimetallic Nanoclusters using Single-Molecule Fluorescence Spectroscopy, J. Phys. Chem. Lett. 2023, 14, 45, 10166–10172
- Bain, D.; Devi, A.; Rashi, Chakraborty, S.; Kolay, S.; Patra, A.* Enhanced Luminescence in Zn+2-Induced Au14 Nanocluster Aggregates, J. Phys. Chem. C 2023, 127, 36, 18244–18251
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- Medda, A.; Ghosh, S.; Patra, A.*, Transition Metal Ions Influence the Performance of Photodetector of Two-Dimensional CdS Nanoplatelets, Chem. Eur. J. 2023, 29, e202301364
- Das, A.; Marjit, K.; Ghosh, S.; Ghosh D.; Patra, A.* Slowing Down the Hot Carrier Relaxation Dynamics of CsPbX3 Nanocrystals by the Surface Passivation Strategy, J. Phys. Chem. C 2023, 127, 31, 15385–15394
- Ghosh, Srijon.; Marjit, K.; Ghosh, G.; Ghosh D.; Patra, A.* Ultrafast Photoinduced Dynamics of Quaterthiophene-Squaraine Hybrid Aggregates, J. Phys. Chem. C 2023, 127, 9735–9744.
- Ghosh, G.; Marjit, K.; Ghosh, S.; Patra, A.*, Hot Carrier Cooling and Biexciton Dynamics of Anisotropic Shaped CsPbBr3 Perovskite Nanocrystals, J. Phys. Chem. C 2023, 127, 8670–8679.
- Ghosh, D.; Chowdhury, G, M.; Biswas, R.; Haldar, K. K.; Patra, A.* Europium Molybdate/Molybdenum Disulfide Nanostructures with Efficient Electrocatalytic Activity for Hydrogen Evolution Reaction, ACS Appl. Nano Mater. 2023, 6, 7218–7228

Dr. Akash Deep, Scientist-G

- Chauhan, G.; Malik, P.; Deep, A., Morphological, dielectric, electro-optic and photoluminescence properties of titanium oxide nanoparticles enriched polymer stabilized cholesteric liquid crystal composites, Journal of Molecular Liquids 2023, 376, 121406.
- Chauhan, G.; Malik, P.; Kaur, G.; Singh, A. K.; Deep, A.; Malik, P. Surface induced effects on the dielectric and optical properties of polymer-stabilized cholesteric liquid crystal composites. Ferroelectrics 2024, 618 (2), 421-431.
- Chauhan, G.; Malik, P.; Malik, P.; Deep, A. Improved performance of cadmium selenide quantum dots-doped polymer stabilized cholesteric liquid crystals for light shutter. Liquid Crystals 2023, 50 (15), 2540-2551.
- Chhillar, M.; Kukkar, D.; Deep, A.; Yadav, A. K.; Kim, K.-H., Zn2+/GNPs nanocomposite for highly selective colorimetric detection of creatinine in urine samples of CKD patients, Inorganic Chemistry Communications 2023, 158, 111618.
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- Sharma, S.; Kaur, G.; Deep, A.; Nayak, M. K., A multifunctional recyclable adsorbent based on engineered MIL-125 (Ti) magnetic mesoporous composite for the effective removal of pathogens. Environmental Research 2023, 233, 116496.
- Sharma, S.; Kaur, G.; Nayak, M. K.; Deep, A., Development of core@ shell magnetic framework composite for immunoselective detection and capture of Salmonella typhimurium, Environmental Science: Nano 2023, 10 (9), 2473-2488.
- Shrivastav, V.; Dubey, P.; Sundriyal, S.; Tiwari, U. K.; Deep, A., Recent advances on core-shell metal-organic frameworks for energy storage applications: Controlled assemblies and design strategies, Coordination Chemistry Reviews 2024, 499, 215497.
- Shrivastav, V.; Gupta, B.; Dubey, P.; Deep, A.; Nogala, W.; Shrivastav, V.; Sundriyal, S., Recent advances on surface mounted metal-organic frameworks for energy storage and conversion applications: Trends, challenges, and opportunities. Advances in Colloid and Interface Science 2023, 102967.
- Shrivastav, V.; Mansi; Dubey, P.; Shrivastav, V.; Kaur, A.; Hołdyński, M.; Krawczyńska, A.; Tiwari, U. K.; Deep, A.; Nogala, W., D fusion controlled electrochemical analysis of MoS2 and MOF derived metal oxide–carbon hybrids for high performance supercapacitors, Scientific Reports 2023, 13 (1), 20675.
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Dr. Kamalakannan Kailasam, Scientist-G

- Saini, N.; Sharma, N.; Chauhan, D. K.; Khurana, R.; Ali, Md. E.; Kailasam, K., Coalescing solar-to-chemical and carbon circular economy: Mediated by metal-free porphyrin and triazine-based porous organic polymer under natural sunlight, J. Mater. Chem. A, 2023, 11, 25743
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Celebration of National Technology Day

Prof. Amulya K Panda, Former Director of the National Institute of Immunology delivered a special lecture titled "Nanotechnology-based Vaccine and Immunotherapy", on the occasion of National Technology Day on 11May, 2023.

Prof. Panda during the lecture

Celebration of 3rd Research Scholars` Day (RSD-2023)

To spread scientific research and its impact on society, the Research scholar of INST had organized 3rd Research Scholars` Day (RSD-2023) on 22-23 May, 2023. It comprised a keynote lecture by a dignitary scientist followed by a series of scientific oral presentations and poster presentations by the INST scholars along with the cultural program by the INST fraternity. Prof Dulal Panda, Director, NIPER, Mohali has delivered a key note lecture having titled "Lessons from 56 years of tubulin research: Implications in human health and diseases" on this occasion.

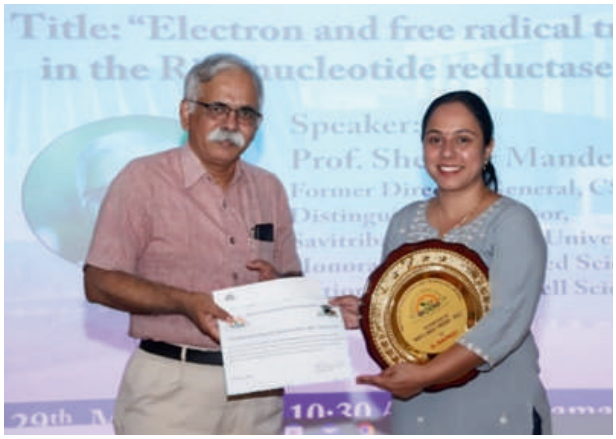
Celebration of 1st GN Ramachandran Lecture

Prof. Mande during the lecture

Prof Shekhar Chintamani Mande, Former Director General, CSIR; Distinguished Professor, Savitribai Phule Pune University, Pune & Honorary Distinguished Scientist, National Centre for Cell Science, Pune delivered 1st GN Ramachandran Lecture on 29th May, 2023.

Prof Mande also awarded best thesis recognition to Dr. Navpreet, who completed PhD under the guidance of Dr.Ramendra Sundar Dey, Sci-D, INST.

Felicitation of Prof Mande by Director, INST



Prof Mande felicitating Dr. Navpreet for best thesis award

Celebration of International Day of Yoga

INST, Mohali celebrated International Day of Yoga (IDY) on June 21, 2023. The theme of this year is "Yoga for Vasudhaiva Kutumbakam" and the domestic tagline for IDY, 2023 is "Har Aangan Yog", being propagated to bring Yoga to every household at the grassroots level. To celebrate this day, a talk and practical session by the yoga expert, Mr. Sachendra Badoni, Chandigarh, who is practising yoga and giving training session to the school & colleges in the tricity was arranged.

Participants during the YOGA celebration

Organising 2nd Bilateral Meet on Innovations in Materials for Energy and Environmental Technologies (i-MEET) on 28th June 2023

Institute of Nano Science and Technology (INST), Mohali Jointly in association with ACS-CSIO International Student Chapter, organised 2nd Bilateral Meet on Innovations in Materials for Energy and Environmental Technologies (i-MEET) on 28th June 2023.

Glimpses of 2nd Bilateral Meet on Innovations in Materials for Energy and Environmental Technologies (i-MEET)

Organising First 'Hackathon' challenge

INST organized its first 'Hackathon' challenge, an open competition among teams of research scholars, aiming to provide industry relevant solutions through nanoscience and nanotechnology on 7th July, 2023. The opening of the event was arranged at the INST's incubation center. Dr. Usha Dixit (Scientist F, AI Division, DST), an expert on entrepreneurship activities of DST, provided valuable feedback to the student teams.

Prof Patra felicitating Dr. Usha Dixit Scientist F, AI Division, DST during the event

Visit of Prof Ashutosh Sharma, Former Secretary and INSA President

A special lecture and interaction session with faculties and students of INST was arranged with Prof. Ashutosh Sharma, Chair Professor, IIT Kanpur and Former Secretary, on 1st August 2023.

Organising Second bilateral meeting of INST Mohali and CSIR - Institute Of Microbial Technology, Chandigarh

The second bilateral meeting of Institute of Nano Science and Technology, Mohali and CSIR - Institute of Microbial Technology, Chandigarh was held on 8th August 2023 at CSIR-IMTECH, Chandigarh. The meeting included talks and posters by scientists and students from both the institutes in the areas of nanotherapeutics and diagnostics, small molecule therapeutics, protein/peptide-based therapeutics and supramolecular complexes. Dr. Sanjeev Khosla, Director, Imtech and Dr. Amitava Patra, Director, INST urged the scientists to explore collaborative avenues in their research areas during the events.

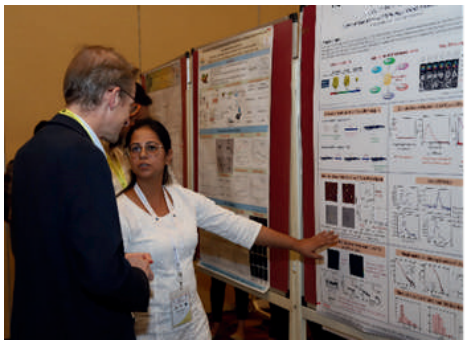

Celebration of Vigilance Awareness Week

As part of Vigilance Awareness Week, observed by Central Vigilance Commission (CVC) from 30 October to 5 November 2023, a talk on Preventive Vigilance was delivered by Shri Hari Mohan, Ex-Controller of Administration, CSIR-CSIO Chandigarh at INST, Mohali on 18 September 2023.


Organising Indo-France Seminar on Metal Nanoclusters

INST Mohali and CNRS France jointly organized an Indo-France Seminar on Metal Nanoclusters, supported by Indo French Centre for the Promotion of Advanced Research from 02-5th October, 2023. The meeting brought together eminent scientists and young researchers from both countries to discuss latest discoveries in the field of metal nanoclusters and future collaborations.






Glimpses of Indo-France Seminar on Metal Nanoclusters

Organising "Shramdaan for Swachhata

As per Hon'ble Prime Minister's "Call to Action" for 1 hour of "Shramdaan for Swachhata", a cleanliness campaign was organised on 1st, October 2023 at INST.


Celebration of 10th anniversary with an international conference on "Trends in Emerging Nano Science: Energy, Healthcare & Quantum Materials (TENS)

INST organized the International Conference on "Trends in Emerging Nano Science: Energy, Healthcare & Quantum Materials (INST-TENS 2023)" from 5th to 8th November 2023, marking a significant occasion in celebration of the 10th anniversary of INST, which comprised enthralling talks by international & national experts and high-quality scientific posters by students from across India. The conference was structured to foster in-depth discussions and the exchange of cutting-edge ideas among researchers, featuring a series of invited lectures by distinguished academicians from various parts of the world. The conference format included poster sessions organized into thematic sessions, which further facilitated engagement and collaboration among researchers, including those from INST and their global peers.

Notably, Professor D. D. Sarma from IISc Bangalore delivered the plenary lecture, which set a high academic standard and provided profound insights into the field. Additionally, the event showcased invited lectures by twenty-two renowned professors, enriching the scientific discourse with diverse perspectives and expertise.Overall, INST-TENS 2023 served as a pivotal platform for advancing research in emerging nano science, with a specific focus on energy, healthcare, and quantum materials. Beyond scientific advancement, the conference also underscored the achievements and contributions of INST over the past decade, highlighting its role as a leader in the field.

Glimpses of "Trends in Emerging Nano Science: Energy, Healthcare & Quantum Materials (TENS) conference

Celebration of Rashtriya Ekta Diwas

Institute of Nano Science and Technology, Mohali, on the occasion of the Birth Anniversary of Sardar Vallabhbhai Patel to foster and reinforce our commitment to strengthen the unity, integrity, and security of the nation, observed on 31st October 2023 as Rashtriya Ekta Diwas by organizing various activities like administering Unity Pledge and participating in Unity Run at the institute campus. Prof. Amitava Patra, Director, INST initiated the program by spreading the message of national unity and the spirit of Rashtriya Ekta. The students, scientists and staff enthusiastically participated in this event which was marked with nationalistic fervor.

Director, INST, Faculty and staff during the Pledge taking Rashtriya Ekta Diwas

Organising a national conference on "Crystals for Quantum Technology

INST organized a national conference on "Crystals for Quantum Technology" with talks by national & international experts working on thin films and crystals essential to the field of quantum technology on 11th and 12th of December 2023.

Scientists from diverse national institutions, working on thin films and crystals essential to the field of quantum technology, discussed the potential of such quantum materials to propel technological progress and pave the way for prosperous commercial ventures, at the national conference centred around "Crystals for Quantum Technology".

Prof Ajay Sood, Principal Scientific Adviser, Government of India emphasized the significance of the ongoing Quantum Mission lead by the Government of India under the visionary leadership of PM Narendra Modi. He highlighted the pivotal role of condensed matter physicists, material scientists, and electronic engineers from diverse institutes across the country and called for exploring inter-institute cooperation to synergize efforts for quantum materials and devices essential for quantum computing, communication, and sensing.

Prof Sood addressing the audience during the event

Acknowledging that the country would need more experts and facilities in the field, Prof Sood stressed that researchers and technologists from different institutes should pool their resources and facilities. This collaborative approach, he asserted, would contribute significantly to the new frontier of quantum technology on the international stage. He envisioned a future where national and international industrial companies would step forward to offer support, and new deep-tech startups would emerge, further catalyzed by initiatives like Anusandhan National Research Foundation (ANRF) launched earlier this year.

Prof. Amitava Patra, Director, INST, an autonomous institute of DST emphasized the alignment of the institute's efforts with the vision outlined by the Prime Minister, reflecting the commitment of the institute to advancing quantum technology at a national level.

He added that with expertise and state-of-the-art facilities in thin film synthesis, various photophysical techniques, and the recent establishment of a 10,000-class cleanroom facility, INST Mohali stands poised to contribute substantially to the nation's goals.

Several other National and international experts in quantum technologies along with Prof. Kamal Kishore Pant, Director, IIT Roorkee, Prof. Gowrishankar Director, IISER Mohali, Dr. Baldev Setia, Director PEC, Prof. Venu Gopal Achanta, Director NPL participated in the conference

- The eminent scientist Prof. Arindam Ghosh from IISc mentioned that this is an essential initiative towards an indigenous and self-reliant quantum technology ecosystem in India. The convenor of the conference Prof. Suvankar Chakraverty from INST asserted that the idea of this two-day conference is to bring together potential researchers in the field of thin film depositions who may contribute to the recently announced "Indian National Quantum Mission" by the Honorable Prime Minister of India.

- Dr. Ramesh Kumar Sen, Principal Director and Head, Institute of Orthopedics, Max Hospital Mohali delivered a special lecture on "Orthopaedic Window for Nanotechnology" on 21st December, 2023 at INST, Mohali.

Participation of INST, Mohali in the India International Science Festival (IISF)

INST Mohali participated in the esteemed India International Science Festival (IISF), held at THSTI, Faridabad during 17-20 January, 2024, a platform that brings together scientists, researchers and institutions from around India.

The India International Science Festival, held at Faridabad Haryana from 17th to 20th January 2024, serves as a nexus for the exchange of ideas, collaboration, and dissemination of scientific knowledge. The India International Science Festival (IISF) is a collaborative endeavor between the Ministry of Science and Technology, the Ministry of Earth Sciences, the Department of Space, and the Department of Atomic Energy in partnership with Vijnana Bharati - a science movement spearheaded by scientists of the nation with swadeshi spirit, This year's event drew participants from various scientific disciplines, creating an intellectually stimulating environment for sharing breakthroughs and advancements

INST's Contribution: INST played a pivotal role in this international gathering by presenting six posters, each highlighting the institute's groundbreaking work in the field of nanoscience and technology. The posters covered various topics, from nanomaterial synthesis to applications in diverse fields. The diverse subjects showcased INST's commitment to pushing the boundaries of scientific exploration. INST has presented six posters titled Replacing Traditional Fluorescent based diagnostics with Raman Fingerprint Technique (from Dr. Kiran Shankar Hazra), Air Purification Device for Harmful pollutant and VOC Sequestration: economical and Reusable (from Dr. Vivek Bagchi), Prototype Large-scale Reactor for Cost-effective H2 Production from Water under Natural Sunlight (from prof. Kamalakannan Kailasam), Nanotechnology for Agriculture (from Dr. Vijaya Kumar), Electrochemical nitrogen reduction reaction: A sustainable approach towards ammonia economy (from Dr. Ramendra Sundar Dey), and Amino acid /peptide-nanostructures: smart tools with multi-dimensional healthcare application (Dr. Jiban Jyoti Panda).

Interactions with Diverse Scientists: Participation in the festival gave INST a unique opportunity to engage with a diverse group of scientists, researchers, and academics. The institute's representatives actively participated in discussions and networking sessions. These interactions facilitated the exchange of ideas and also paved the way for potential collaborations and partnerships with leading minds in the scientific community.

Conclusion: Participating in the International Science Festival was a remarkable experience for the Institute of Nanoscience and Technology. The event provided a platform to showcase INST's groundbreaking research and also fostered valuable connections with scientists from diverse backgrounds. As INST continues to push the boundaries of nanoscience, such engagements play a crucial role in establishing the institute as a leader in the field.

Celebration of Cyber Jagrookta and awareness campaign

The Institute has organized a Lecture cum interactive session, as a parallel event on the Cyber Jagrookta and awareness campaign on the topic of Digitalisation and Cyber Crimes on 22/2/2024 and a lecture was delivered by Mr Harpal Singh, a Banker and IT expert.

Celebration of National Science Day

National Science Day was celebrated on 28 February, 2024, with a special lecture by Prof. Srinivasan Sampath, Department of Inorganic and Physical Chemistry, Indian Institute of Science. College students were invited for the lecture followed by their visit to the Central Instrument Facilities (CIF) of the institute.

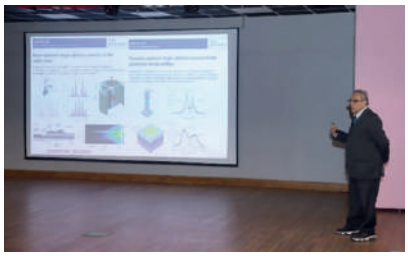
Prof. Srinivasan Sampath during the talk

Felicitation of Prof Sampath by Director, INST

Visit of students to Laboratory

Celebration of JC Bose Memorial Lecture

The JC Bose Memorial Lecture 2024 was delivered by distinguished scientist, Prof. Milan K. Sanyal, Emeritus Professor and Former Director, Saha Institute of Nuclear Physics, Kolkata on the topic "*Amazing Optical Properties of Quantum Materials*" on 04th March, 2024.



Prof Sanyal during the lecture

Felicitation of Prof Prof. Milan K. Sanyal by Director, INST

Celebration of Foundation Day

Foundation Day of INST was graced with a special endowment lecture "P C Ray Lecture" on 13 March, 2024, which was delivered by distinguished Scientist, Prof. A. Ajayaghosh, Former Director, CSIR-NIIST, Trivandrum, on the topic *"The Chemistry of Thermoresponsive Smart Windows"*. The lecture was followed by annual sports day ceremony felicitating all the participants including students, staff and faculty.

On the joyous occasion of INST Foundation Day 2024, the fraternity also came together to celebrate with a cultural program. INST's cultural team had arranged an exciting evening program to celebrate the event. During this cultural evening, Faculty/students/staff/kids had presented their skills/performances.

Prof. Ajayaghosh during the lecture

Prof. Ajayaghosh and Director, INST felicitating the winner of sports day

Performance of INST's Students, Faculty and relatives during the cultural show

Organising a 2-day IMMERSION PROGRAMME

A two-day immersion programme was held at INST from 6th to 7th March, 2024. The programme began with the introduction of the programme by Prof. Amitava Patra (Director, INST, Mohali) followed by the several sessions headed by different scientists. On the first day, the scientists described the various functional units, key national and international collaborations, and brief summary of MoUs of INST with other institutes/industries. Also, the glimpses of research and academic activities across the three INST units, discussion on the ongoing cutting edge research projects and indigenous technology development were shared by the faculties. In addition, a poster session was conducted that demonstrated the on-going works in INST having social importance. Later, the officers of DST were introduced about the INST's infrastructure, equipments and the high-end instrumental facilities.

On the second day of immersion programme, an expert talk was organised in which Mr. Satyendra Singh (Chief Executive Officer, TBI, IISER Mohali) deliberated about the incubation ecosystem, opportunities, scope, and bottlenecks associated with an incubator. The talk was followed by a discussion on the progressive aspects towards the development of INST incubation centre. Also, the case studies on developed technologies, issues in technology scale-up, scopes and challenges to the incubators were discussed by the faculties with the DST officers. Further, the industrial expectation from the incubation centers was conferred by Dr. Vishal Ahuja (CEO, VNG Medical Innovation System, Chandigarh). The scientists also discussed the challenges associated with the translation research and industry-academia collaborations, entrepreneurship promotion, industrial engagements, and outreach activities. The programme finally concluded with a panel discussion of INST faculties with the DST officers regarding the enhanced academy-industry engagements, funding opportunities, and policy implementations.

Hindi Pakhwada 2023 by Hindi Cell

Institute of Nano Science and Technology Mohali successfully organized the 14-day Hindi Pakhwada 2023. This fortnight was organized from 14 September 2023 to 27 September 2023. During this Pakhwada, a total of 06 competitions were organized for the students, faculty members and staff of the institute and 02 competitions were organized for the children of the institute members.

Hindi Fortnight 2023 started with Hindi General Knowledge Competition on 14 September 2023. After the inauguration ceremony of this Pakhwada, various competitions continued in different categories for the next 14 days in which the students, faculty members and staff of the institute not only showed their enthusiastic participation but also displayed their artistic qualities in front of everyone which were showcased during the organization of this fortnight, which was the main objective of the this Event.

The closing ceremony of this fortnight was held on 18 October 2023 in which the winners were given awards by the Honorable Director of the Institute. On this occasion, Prof. Amitava Patra congratulated all the winners. In his address, Honorable Director of the Institute, Prof. Amitava Patra, first shared his views, highlighted the importance of Hindi at the national and international level and appealed to all the members of the Institute to do more and more work in Hindi.

Staff, students and kids of faculty participating during the Hindi pakhwada

INST's research scholar presenting their paper in Official Language competition.

AWARDS & HONOUR

Awards & Honours to Faculty and Students:

Prof Amitava Patra, Director, INST

- The world's Top 2% scientist in 2022 with a global rank of 149 in Physical Chemistry (Ranking is based on C-score)
- Amitava Patra is ranked #36 in India among Best Scientists for 2024 (Research.com)
- Member of Editorial Advisory Board, The Journal of Physical Chemistry Letters (2021-2023)
- Member of Editorial Advisory Board, ChemNanoMat (2023-2026).
- Member of Editorial Advisory Board, ChemPhysChem (2019-2026).

Dr. Akash Deep, Scientist-G

- Best Presentation Award to Ms. Gurjeet Kaur (Ph.D scholar) at "IEEE 13th International Conference Nanomaterials: Applications & Properties (NAP)", during September 10-15, 2023, Bratislava, Slovakia.
- Merck Young Scientists Award-Runner up (Season-3) to Dr. Neha Bhardwaj (DST INSPIRE FACULTY) under Biological Sciences category.

Dr. Kamalakannan Kailasam, Scientist-G

- Dr. Kailasam has received "CRSI Bronze Medal-2024" by Chemical Research Society of India.
- Dr. Deepak Kumar Chauhan (RA-I) has received the RSC "Catalysis Science and Technology" best poster presentation award at the Indo-French Seminar on Catalysis for Sustainability, December 2023 held at IISER Trivandrum.
- Ms Neha Saini, a PhD student has received RSC sponsored 'Best Oral Presentation Award' at the International Conference on Advanced Nanomaterials and Nanotechnology (ICANN) 2023 held at IIT Guwahati, Assam from 29 Nov-1 Dec 2023.
- Ms Bhawna Rawat, a PhD scholar has received the 'Best Poster Presentation Award' at the 4th National Conference on Emerging Trends & Future Challenges in Chemical Sciences, ETFC-2024 organized by Kirori Mal College, University of Delhi, held on 12-13th February 2024.
- Ms Shivali Dhingra, a PhD student has received the 'Best Poster Award' at the International Conference on Emerging Trends in Photodynamics and Photochemistry (ETPP-2024) held at IISER Mohali, Punjab from 26 - 28 March 2024.

Dr. Prakash P. Neelakandan, Scientist-F

- Ms. Kiran Arora, a Ph. D. Student, won Best Poster Award at the International conference on Emerging Trends in Photodynamics and Photochemistry (ETPP-2024) held at IISER Mohali from 26th to 28th March 2024

Dr. Jayamurugan Govindasamy, Scientist-F

- Best early career researcher in the area of Nano Science and Technology: IOP Publishing journal "Nanotechnology Invited to contribute to the upcoming Emerging Leaders 2024 collection issue
- Adjunct faculty of AcSIR 2024 onwards
- Finalist for pitching at BIRAC BIG-23 call
- Adjunct faculty of IISER Mohali 2023 onwards

Dr. Ramendra Sundar Dey, Scientist-D

- Dr. Dey is selected for Nanoscale Emerging Investigator 2023 by RSC
- Dr. Dey is selected for 2023 Journal of Chemical Physics (JCP) Emerging Investigator award by AIP publishing.
- Dr. Dey is elected as Indian National Science Academy (INSA) Associate Fellow, 2023.
- Dr. Dey is selected as a Member of Indian National Young Academy of Sciences (INYAS) for 2021-2026.
- Dr. Dey is an Associates of Indian Academy of Sciences (I.A.Sc.) Bengaluru for 2020-2023.
- Dr. Navpreet, a PhD fellow awarded with "CARBON PRIZE 2023" from Carbon journal (Elsevier) for outstanding Ph.D. Thesis in carbon materials science and technology and offered for editorial board member.
- Ms. Sakshi, a PhD student has recieved Best Poster Award in TENS 2023, organized by INST Mohali on November 2023.
- Dr. Navpreet, received best Ph.D. Thesis award for national competition for research excellence in Carbon materials, presented by INSA-INYAS.
- Dr. Navpreet received best Ph.D. Thesis award from INST Mohali for the year 2023.

Dr. Vivek Bagchi, Scientist-E

- Dr Ashish Gaur, a research scholar was conferred with prestigious Brain-pool Award by the National Research Foundation of Korea.

Dr. Asish Pal, Scientist-F

- Dr. Asish Pal has been awarded "K. Kishore Memorial Award" by SPSI-Macro in appreciation to his contribution to polymer science and technology at the International Conference SPSI-Macro, 2023, December 9-13, 2023.

- Nimisha A. Mavlankar, a PhD student, secured the first position in the oral presentation at International Conference organized by Chandigarh University on January 9-10, 2024.

Dr. Sharmistha Sinha, Scientist-F

- Dr. Sharmistha Sinha was recognized as one of the 75 Women Trailblazers of Science – Vigyan Vidushi, DST.
- Dr. Sharmistha Sinha's article was added to themed collection for 'Women In Materials Science' , RSC journal
- Silky Bedi, a PhD student received JMCB- Poster Award : 'Liquid Droplets As An Effective Concentrator Of Protein Capped Nanocatalysts'
- Silky Bedi, a PhD student received FCSXIV poster award : 'Molecular Confinement Of Protein Capped Nanocatalysts Inside Liquid Droplets'
- S M Rose, a PhD student received MMT-2023 poster award :'Biomolecular condensate of hybrid nanocomposite with reaction rate tuning property'
- Harpreet Kaur, a PhD fellow, received MMT-2023 poster award: 'Intonation Of Interfacial Charge Of Gold Nanoclustersfor The Differential Detection Of Monomeric And Amyloidogenic α-Synuclein.'
- Aarcha Radhakrishnan, a PhD student, secured second prize in the poster session of Second Bilateral meeting of INST – CSIR-IMTECH: 'Probing the Role of Cargo in the Folding of Bacterial Microcompartment'.

Dr. P. S Vijayakumar, Scientist-E

- Best Oral Presentation award to Ms. Kanchan, a PhD student at RCS sponsored 8th International Conference on "Advanced Nanomaterials and Nanotechnology" (ICANN 2023) IIT Guwahati, 29th November- 1st December 2023
- Best Poster presentation award to Ms. Kanchan, a PhD student, at 2nd Bilateral Meet on Innovations in Material for Energy and Environment Technology, held at CSIR-CSIO, Chandigarh 28th June 2023
- Best Poster 3rd prize to Ms. Kanchan, a PhD student, at 2nd Bilateral meeting of INST Mohali and CSIR-IMTECH Chandigarh CSIR-IMTECH, Chandigarh on 8th August 2023.

Dr. Rehan Khan, Scientist-D

- Mr Akshay Vyawahare, a PhD scholar has won the best oral presentation award at Research Scholar Day 2023 held at Institute of Nanoscience and Technology, Mohali, Punjab on 22nd-23rd May, 2023.
- Mr Akshay Vyawahare, a PhD student, has won the best oral presentation award at International conference on "Industry Driven Pharmaceutical Education and Research: Current Trends and Future prospects" held at Chandigarh Group of Colleges (CGC), Landran, Mohali, Punjab on 27th - 28th April, 2023.
- Mr Ajay Kumar, a PhD scholar has won the best poster presentation award at Research Scholar Day 2023 held at Institute of Nanoscience and Technology, Mohali, Punjab on 22-23rd May, 2023.
- Mr Ajay Kumar, a PhD scholar 'Best oral presentation' in the conference on Drug development & Drug delivery: An international Conference, CD4-2023 held at Institute of Pharmaceutical Sciences, faculty of Engineering & Technology, University of Lucknow on 21-22nd November, 2023.
- Ms Kanika Bhutani, a PhD scholar 'Best oral presentation' at the Symposium on "Emerging Neurological Diseases and Possible therapeutics in Post-Covid Era" organized by Punjab University and Shastri Indo-Canadian Institute, New Delhi held at Punjab University, Chandigarh on 16th February, 2024.

Dr. Jiban Jyoti Panda, Scientist-E

- Fellowship to attend STI Capacity Building Programme on Female Researchers and Entrepreneurs to Promote the Bio-Circular-Green Economic (BCG) Model from 6 to 13 August 2023 in Bangkok, Thailand.
- Nidhi Aggarwal, a PhD scholar, working under the supervision of Dr Jiban Jyoti Panda has received ACS Applied Biomaterials Best Poster Presentation Award at the 3rd International Conference on Nanomaterials in Biology, 2023 held at IIT, Gandhinagar.

Dr. Abir De Sarkar, Scientist-G

- Top cited paper award 2023 by IOP
- Outstanding reviewer award by Nanoscale (RSC) & Journal of Physics: Condensed Matter (IOP)

- Best poster award won by PhD Scholar, Ms Harshita Seksaria for presenting the work "Origin of strain tunability in flat valence band and ultrahigh shear piezoelectricity in superflexible non–van der Waals graphitic ScX monolayers (X=P, As, Sb)" in the international conference: "Trends in Emerging Nano Science: Energy, Healthcare & Quantum Materials" held at INST, Mohali between 5-8th November 2023.

- Best poster award won by PhD Scholar, Ms Anu Arora for presenting her work at the 2nd bilateral meeting "Innovations in Materials for Energy and Environmental Technologies (i-MEET)" organised by CSIR-CSIO, Chandigarh and INST, Mohali held at CSIR-CSIO, Chandigarh on 28th June, 2023.

- Best poster award won by PhD Scholar, Ms Harshita Seksaria for presenting her work at the 2nd bilateral meeting "Innovations in Materials for Energy and Environmental Technologies (i-MEET)" organised by CSIR-CSIO, Chandigarh and INST, Mohali held at CSIR-CSIO, Chandigarh on 28th June, 2023.
- Best poster award won by PhD Scholar, Mr Amal Kishore for presenting his work at 3rd Research Scholar Day held at INST, Mohali between 22-23 May,2023

Dr. Kaushik Ghosh, Scientist-F

- International Researcher Award by Meijo University, Nagoya Japan 2024.
- Mohd. Afshan was awarded CSIR-SRF, CSIR-ITS, and DST, SERB-ITS.
- Ms. Seema Rani, a PhD scholar received the best poster award at ICFM-2024.

Dr. Suvankar Chakraverty, Scientist F

- Anshu Gupta, a PhD scholar was awarded with Best poster presentation award in "Quantum Matter Heterostructure 2023 conference" held on 15-17th July 2023 organised by IIT Hyderabad, India.
- Bibek Ranjan Satapathy, a PhD scholar was awarded with Best poster presentation award in "INST TENS-2023 conference" held on 5-8th November 2023 organised by INST Mohali, India.

Dr. Dipankar Mandal, Scientist-F

- 2% most influential scientist in India for 2023 (as per the Stanford University survey)
- Mr. Anand Babu, a PhD scholar has received the young researcher award from materials research society (Kolkata chapter)

Dr. Bhanu Prakash, Scientist-D

- Ms. Alisha Rohal, a PhD scholar won the 'Best Poster' award at the International Conference on Energy Materials and Devices organized by the Dept of Physics, BHU.
- Ms. Alisha Rohal, a PhD scholar won BEST POSTER sponsored by Nano-Letters at ICOM- Indian Conference on Micro Nano Fluidics held at IIT Madras.
- Mr. Vibhav Katoch, a PhD scholar received international travel support by Council of Scientific & Industrial Research, Government of India, to attend and present at Flow Chemistry Asia 2023 held in Narita, Japan on the 5th and 6th of October 2023.
- Mr. Vibhav Katoch, a PhD scholar received international travel support by Science and Engineering Research Board, Government of India, to attend and present at Physics and Chemistry of Microfluidics, Lucca, Italy from 4th to 9th June 2023.
- Mr. Vibhav Katoch, a PhD scholar received international travel support by Council of Scientific & Industrial Research, Government of India, to attend and present at 7th International Conference of Theoretical and Applied Nanoscience and Nanotechnology held in Ottawa, Canada from 1st to 3rd June 2023.

OUTREACH ACTIVITIES

Educational tour of J C Bose University, Faridabad and Chandigarh University

A total of 94 Undergraduate and Post Graduate students from J C Bose University, Faridabad and Chandigarh University visited INST's facilities on 13th April, 2023, as a part of Outreach programme. This visit was arranged as a part of the MOU signed with J C BOSE University. This educational visit had initiate academic and research collaboration between JC Bose University and INST, Mohali. Dr. Indranil Sarkar, Scientist-F welcomed the students and explained various aspect of Nano Science and recent advances in this filed.

A lab visit was also arranged for the students and were explained various high-end instruments and their working application. INST Faculty, Dr. Sonalika Vaidya, Scientist also interacted with students and delivered a talk *Amalgamation of Chemistry with Technology*.


Talk delivered by INST's Faculty Dr. Indranil Sarkar and Dr. S. Vaidya & Lab visit of visit

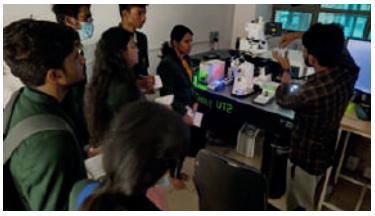
Educational tour of Chandigarh University Students

As part of the continuous Outreach program of INST to promote Nano Science and Technology, the final year BSc students of Chandigarh University visited INST on 07 March and were explained about different high-end instruments and cutting edge research in this area.


Educational tour by TNAU students

As part of the continuous Outreach program of INST to promote Nano Science and Technology, the final year BSc students of TNAU visited INST on 07 March and were explained about different high-end instruments and cutting edge research in this area.

The in-charge of Central Instrument Facility demonstrated TEM, SEM, XPS, XRD, SAXS, CONFOCAL, FACS, HPLC, GC-MS, and DSC-ITC during the lab visit. Students were really interested in nanotechnology, and introduced the basics of nanotechnology with instrument demonstrations.



Visit of TNAU students to Central Instrument Facility of INST

- Dr. Asish Pal, organised a workshop on 6th October under SSR activity “Exploring Nano Science with Quintessential Experimental Techniques” where around 75 students from College attended.

Organising SSR SERB workshop on "Nano for Sensor and Agriculture Waste Repurposing

A SSR SERB workshop on "Nano for Sensor and Agriculture Waste Repurposing" was organized on 27-28th July 2023. The workshop was mainly conducted with the aim of capacity building for nearby college faculty members and students. With 13 invited lectures from experts in the field, attendees had the opportunity to learn from esteemed professionals and researchers, benefiting from their knowledge, experiences and cutting-edge research findings.

- INST’s Faculty, Dr. Jayamurugan Govindaswamy, Sc-F interacted with more than 600 students of Arignar Anna Government Arts College, Cheyyar on 4th March 2024 and delivered a talk on the Nanotechnology and Its Applications

செய்யாறு அறிஞர் அண்ணா அரசு கலைக் கல்லூரியில்

வேதியல் துறை மன்ற துவக்க விழா

Outreach activities by Dr. Jiban Jyoti Panda

To spark curiosity and ignite the passion for science among young minds, Dr. Jiban Jyoti Panda, orchestrated a dynamic public outreach program for the school students of Om Prakash Bansal Model School in Mandi, Gobindgarh, Punjab.

The event aimed not only to introduce them to the fascinating world of nanoscience but also to inspire the next generation of innovators. The highlight of the program was a fun filled activity session where the school students participated in a poster-making and slogan-writing competitions related to modern day problems and how science and technology can be used to evade these problems.

Dr. Jiban Jyoti Panda during the outreach leacture

Other Outreach Activities

- Poster and slogan competition of around 100 students, 13/03/2024, OPBMS school, Mandi Govind Garh, Punjab, India.
- Coordinated and organised outreach program on Iconic Women scientists of India, under WINYAS flagship program Wisdom, August, 2023.
- Evaluated posters submitted by girl students under the theme Iconic women scientists of India.
- Guiding female/girl students under red dot foundation.
- ·Evaluator for INYAS-Saransh Competition 2023.
- Participated and coordinated INYAS-WINYAS flagship event, Iconic Women Scientists of India, 12th July, 2023.
- Poster evaluator, INYAS-WINYAS flagship event, Iconic Women Scientists of India.
- Evaluated student poster for North Zone Model 20 competition.
- Evaluator for INYAS-national competition for research excellence 2023.
- Coordinating member, INYAS-National competition for research excellence 2023.

Talk delivered by INST, Faculty as a part of Outreach Programme;

- Nanomedicines Enabling Drug Delivery across the Physiological Barriers in the Outreach event, Science in the community: Advancing Science Popularization in Odisha, 16th-17th November, 2023, IISER-Berhampur by Dr. Jiban Jyoti Panda
- Outreach talk, Science sparks, Nano biotechnology in everyday life, 26/02/2024; OPBMS school, Mandi Govind Garh, Punjab, by Dr. Jiban Jyoti Panda
- Indigenous advances in the field of nanoscience, 13/03/2024; RIMT University, Mandi Govind Garh, Punjab by Dr. Jiban Jyoti Panda.
- Nanotechnology for Clean Energy and Environment" on August 19, 2023 ; during the "Akshay Urja Divas-2023", organised by Boson Club, Post-Graduate Department of Physics, G.G.D.S.D. College, Chandigarh by Dr. Kamalakannan Kailasam.
- Dr. Kaushik Ghosh delivered an Outreach talk in Behala College, Behala Kolkata on 6th April 2023 to motivate Bachelor students belongs to both reserved and non-reserved category towards advanced Science and developmental progress of our country. Total student participation was 100, out of which 50 students are falling under SC/ST/weaker section.
- Dr. Kaushik Ghosh, delivered an Outreach talk in SRM University Andhra Pradesh on 6th August 2023 to motivate higher secondary and bachelor students belongs to reserved and non-reserved category towards advanced Science and developmental progress of our country. Total student participation was approximately 80, out of which 35 students are falling under SC/ST/weaker section.

Dr. Kaushik Ghosh during the Outreach lecture

Outreach by Collaboration

- INST Mohali has signed multi institutional with Rama Krishnan Mission residential college Narendrapur, Vidyamandir Belur, Vivekananda centenary college Rahara. As a part of this Outreach activities students from these college will go 2 months internship at INST, Mohali. During the tenure, 4 students Ramakrishna Mission College, Rahara have completed Internship at INST and internship Certificate were distributed by Director, INST.

Felicitation of Intern student

FALAK (Education Outreach program)

- FALAK फ़लक (FALAK - Fostering Awareness, Learning, and Knowledge), the educational outreach program, has been successfully running for more than a year now. FALAK is a visionary initiative aimed at extending learning opportunities beyond traditional classroom settings. Initially, the program was designed to benefit the children of INST workers, but it has since expanded to include the children of nearby fruit and vegetable vendors, broadening its impact within the community.
- Since its inception on November 19, 2022, more than 35 students have benefited from this transformative initiative. Our comprehensive program focuses on improving their communication skills, fostering their intellectual growth, and expanding their horizons. By doing so, we aim to nurture confidence, instill a love for learning, and equip these young minds with the tools they need to succeed both academically and personally. Through interactive sessions, creative activities, and personalized attention, we strive to create a supportive environment where each student can thrive and realize their full potential.

Activities during the FALAK outreach programme of INST

TALK DELIVERED BY THE FACULTY

Prof. Amitava Patra, Director, INST

- *Exciting Nanomaterials for Photonics and Optoelectronics*, Chief guest and invited talk at Reminisce 2023, CSIR-CSIO Chandigarh, 10th April 2023.
- *Comprehensive Growth and Achievements of INST,* Invited talk at Society for Promotion of Science & Technology in India, PSCST, NASI, INSA & INYAS, 29th April 2023.
- *Growth and Achievements of INST*, Invited talk at DST AI Conclave – 2023 on 9.5.2023.
- *Exciting Nanomaterials for Photonic and Optoelectronics*, Invited talk at Indo-French Workshop on Disruptive Nano-Photonics, CSIO-CSIR, Chandigarh, June 14-16, 2023.
- *Role of INST for Science, Technology and Society*, Invited talk at S20/G20 Outreach Event "Science, Technology and Society" PEC, Chandigarh, 01st August 2023.
- *Ultrafast Carrier Relaxation Dynamics and Aggregation-Induced Emission (AIE) of Metal Clusters*, Invited talk at Indo-France Seminar on Metal Nanoclusters, October 2-5, 2023.
- *Makers of Quantum Dots share 2023 Nobel Prize in Chemistry*, Invited talk at INST On 6.10.23.
- *Ultrafast Carrier Dynamics of Nanomaterials to Manipulate Light Harvesting*, Keynote address at 8th International Conference on Advanced Nanomaterials and Nanotechnology at Centre for Nanotechnology, IIT Guwahati on 29th November to 1st December, 2023.
- *Photo-Relaxation of Nanomaterials for Light Harvesting*, Keynote address on "Recent Trends in Applied Spectroscopy and Microscopy in Materials Research" from 01 to 05/12/2023 in online mode at NIT Hamirpur.
- *Insights of Ultrafast Carrier Dynamics of Light Harvesting Nanomaterials*, Invited lecture at 5th "Belt-and-Road" and BRICS Forum for Advanced Photonics, China 15th December 2023.
- *Insights of Ultrafast Carrier Dynamics of Light Harvesting Nanomaterials*, Invited talk at FCSXIV, 'Materials in Focus' on 15th December, 2023 – 17th December, 2023, at Koti Resorts.
- Indian Science and Its Inheritance", Keynote address at NIPER, Science Day Lecture, Mohali, 28th Feb 2024.
- *Insights of Ultrafast Carrier Dynamics of Light Harvesting Nanomaterials*, Keynote address at "Luminescent Materials: From Fundamentals to Applications (ICLMFA-2024)" Department of Chemistry, Guru Nanak Dev University, Amritsar, March 15-16, 2024

Dr. Akash Deep, Scientist-G

- *Development of Fluorescent Sensors for Environmental Pollutants*, Two-day workshop entitled Sensors for Healthcare and Environmental Applications SHEA-2024) during March 28-29, 2024 under the Scheme for Promotion of Academic and Research Collaboration (SPARC), Ministry of Education (MoE), Govt of India at Guru Jambheshwar University of Science and Technology (GJUS&T), Hisar, Haryana, March 29, 2024
- *E-Waste Recycling: Recovery of Valuable Products for Circular Economy*, 14th National Conference on "Chemistry on Sustainable Future" at Punjabi University,Patiala, Punjab, 22 February 2024
- *E-Waste Recycling for Recovery of Valuable Products*, "National Conference on Recent Advances in Theoretical and Experimental Sciences" at Bhakt Darshan Government Post Graduate College Jaiharikhal (Pauri Garhwal), Uttarakhand in collaboration with USERC and UCOST, September 29, 2023
- *Design and Applications of Different Nano Sensors for Diagnostic and Environmental Applications*, Awareness programme on design component under MSME" held at NIT Jalandhar, 21 December, 2023.
- *An overview of INST Mohali, India and Glimpses of some translational research projects.,* Institute of Materials in Electrical Engineering (IWE1), RWTH Aachen University, Aachen, Germany, October 13, 2023

Dr Kamalakannan Kailasam, Scientist-G

- *A Light(er) Approach for Sustainable Solar Fuel Production: Realising Ciamician's Dream*, Technical University Berlin, Berlin, Germany, 6th March 2024
- *Artificial Photosynthesis to Solar Fuels: Realising Ciamician's Dream*, National Conference on Emerging Trends and Future Challenges in Chemical Sciences (ETFC-24) **held at** Kirori Mal College, University of Delhi, New Delhi, 12th and 13th February 2024
- *Emergence of Heptazines: Old Wine in the New Bottle*, CRSI Bronze Medal-2024 award lecture in the "32nd CRSI National Symposium in Chemistry (CRSI-NSC-32) and 17th CRSI-RSC Joint Symposium" organized at Birla Institute of Technology (BITS), Pilani, Rajasthan, February 01-04, 2024
- *Nanoporous Heptazine based Polymeric Materials for Renewable Energy Application,* Bharat Petroleum Corporation Limited – Corporate Research and Development Centre (BPCL-CRDC), Greater Noida, Uttar Pradesh, 2**2nd** November 2023
- *A Light(er) approach for Solar Fuels and BiomassValorization to Fine Chemicals: Towards Sustainability, "4th International Conference on Recent Advances in Bio-Energy Research (ICRABR-2023)" organized by Sardar Swaran Singh National Institute of Bio-Energy (SSS-NIBE), Kapurthala, Punjab, 9th to 12th October 2023.*
- *Organophotocatalysis to Solar Fuel and Fine chemicals: Nothing to Sacrifice, "Catalysis for Energy, Environment and Sustainability (CEES-2023)" and "CO2-India Network 2nd Annual Meet" organized by Indian Institute of Technology Mandi, Himachal Pradesh, September 25 to 27, 2023*
- *Nanotechnology for Clean Energy and Environment, "Akshay Urja Divas-2023" by Boson Club Post-Graduate Department of Physics, G.G.D.S.D. College, Chandigarh, August 19, 2023.*

- *Organophotocatalysis: A light(er) approach to solar fuel and fine chemical synthesis & Polymeric carbon nitrides in biomedical applications*, Symposium on Photocatalysis and Pharmaceuticals and Departmental talk at NIPER Kolkata, West Bengal, India, April 21 & 22, 2023
- *Artificial Photosynthesis to Solar Fuels: Realising Ciamician's Dream*, IISER Kolkata, West Bengal, India, April 20, 2023
- *Organophotocatalysis for Solar Fuel and Fine chemical Synthesis: Nothing to Sacrifice*, TATA STEEL R&D, TATA STEEL Ltd, Jamshedpur, Jharkhand, India, April 18, 2023

Dr. Prakash P. Neelakandan, Scientist-F

- *Plasmon Enhanced Photosensitization in BODIPY Loaded Gold Nanoparticles*, International Conference on Emerging Trends in Photodynamics and Photochemistry, IISER Mohali, 26-28 March 2024
- *Photoactive Imino-Boron Compounds for Sensing and Flexible Optoelectronics,* 14th National Workshop on Fluorescence and Raman Spectroscopy, IISER Mohali, 12-14 December 2023
- *Plasmon-Molecule Coupling in Dye-loaded Gold Nanoparticles*, INST-IITK Bilateral Meeting, 25-26 August 2023

Dr. Debabrata Patra, Scientist-F

- *Self-powered Supramolecular Assembly: A tale of chemical powered motion.,* Lecture delivered at Chem@Nano 2022, 22.09.2023
- *Self-powered Supramolecular Assembly: A tale of chemical powered motion.,* Invited Lecture in NIT Durgapur, West Bengal, 05.06.2023

Dr. Jayamurugan Govindasamy, Scientist - F

- *Transforming Efficient Chromophores into Fluorophores Using Nanotechnology,* In ICLMFA-2024, organized by Department of Chemistry, GNDU, Amritsar, 15-16 March 2024
- *The Synergistic Use of Organic Synthesis and Nanotechnology to Create Wealth from Abundant Biomass Waste,* oral lecture at SRM Institute of Science and Technology, 29th February 2024
- *Utilizing self-assembly and nanotechnology to transform the [2+2] cycloaddition-retroelectrocyclization reaction into click chemistry and luminescent chromophores for optoelectronics,* oral lecture at University of Madras., 28th February 2024
- *The Synergistic Use of Organic Synthesis and Nanotechnology to Create Wealth from Abundant Biomass Waste,* National Conference on Current Trends in Chemical Sciences at Madurai Kamaraj University., 21-23rd February 2024

Dr. Ramendra Sundar Dey, Scientist D

- *Recent Advances in Chemical & Molecular Science,* at Faculty Development Programme (FDP), Amity University, Noida, UP, July 31st - 4th August 2023
- *Electrochemical synthesis of green ammonia: Prospects and challenges*, 34th Mid-Year Meeting of Indian Academy of Sciences (IASc), Indian Institute of Science, Bengaluru, 07 – 08 July, 2023
- *Electrochemical nitrogen fixation: A green route towards sustainable future*, Technical Symposium on Science and Technology for Sustainable Future (STSF) – 2023, Indian Institute of Technology (Indian School of Mines), Dhanbad, September 15-17, 2023
- *Electrochemical nitrogen fixation: A green route towards sustainable future*, Invited talk in Catalysis for Energy, Environment and Sustainability (CEES-2023) conference on the occasion of CO2-India Network 2nd Annual Meet, Indian Institute of Technology Mandi, 25th-27th September, 2023
- *Electrochemical Nitrogen Fixation for sustainable ammonia synthesis*, 8th International Conference on Advanced Nanomaterials and Nanotechnology (ICANN)-2023, IIT Guwahati, 29th November – 1st December
- *Developing Full Cell Electrolyzer For Electrochemical Ammonia Synthesis*, International Conference on Industry Focused Research-TEC 2023" organized at Technology Enabling Centre (TEC) - Panjab University, 12th-13th October 2023
- *Electrochemical Nitrogen Fixation for sustainable ammonia synthesis: Favouring the unflavoured,* for inducted as INSA Associate Fellow for the year 2023 during 89th Anniversary General Meeting (AGM) of Indian National Academy (INSA), at IICT and CCMB Hyderabad, 6-8th December, 2023
- *Understanding the Rules of Electrochemical Nitrogen Reduction to Ammonia*, International Conference on Materials Genome (ICMG-III), SRM University AP, Amaravati, India, February 22 to 24, 2024
- *Emerging materials for interfacial electrochemistry: A step towards sustainable and green future*, National Conference on " Recent Trends in Applied Sciences: A Special Focus on Nanoscience and Nanomaterials, Department of Basic Sciences and Social Sciences ,School of Technology at NEHU Shillong, March, 22nd-23rd, 2024

Dr. Tapasi Sen Scienctist- E

- First bilateral meeting of INST, Mohali and IIT Kanpur, 25-26th of August, 2023.
- Indo-France Workshop under CEFIPRA, 29th July, 2023 held at CSIO Chandigarh
- Indo-France Seminar under CEFIPRA, 2nd -5th Oct, 2023 held at INST, Mohali
- FCS XIV conference and workshop held at IISER Mohali jointly organized by INST, Mohali., Dec 9-16, 2023
- One-day mini-symposium in Chemistry organized by Department of Chemistry at BITS Pilani, Pilani Campus, Rajasthan, 16th March 2024.

Dr. Sanyasinaidu Boddu, Scientist-D

- *Lanthanide Ions Doped Luminescent Nanomaterials for Anti-counterfeiting Applications*, International Conference on Luminescence and Its Applications held during at IICT, Hyderabad, Telangana., 4th July 2023

Dr. Sonalika Vaidya, Scientist-E

- *Influence of structural parameters on photo- and electro-catalytic performance of metal oxides*, MRSI-AGM-2023, 34th Annual General Meeting of MRSI And 5th Indian Materials Conclave Programme, IIT-BHU, December 12-15, 2023

Dr. Amit Kumar Mandal, Scientist-B

- *Chiral Molecules as New Quantum Materials.,* Presented invited lecture in the 2nd CSIO-INST Bilateral Meet at CSIR-CSIO Chandigarh., 28th June, 2023.
- CISS effect and its Applications., Presented invited lecture in the INST-IIT Kanpur bilateral meeting., 25-26th August, 2023
- Searching for New Quantum Materials for Room Temperature Applications., Presented invited lecture in the 12th INST RAAC meeting., 24-25th January, 2024

Dr. Deepa Ghosh, Scientist-G

- *Addressing Cartilage damage using Tissue Engineering approaches,* at International Symposium on Advances in Drug Delivery Technologies, 16th Feb, 2024.

Dr. Surajit Karmakar, Scientist-G

- *Challenges in nanomedicine. Speakers and panellists.* Industry-Academia Meet, One Week One Lab in CSIR-IMTECH, 20th June 2023.
- Incubation and Innovation Centre@INST. Hackathon 1.0, INST, 7th July 2023
- *Development of Human Serum Albumin based Nanoformulation for the Treatment of Cancers.* 1st India-Japan Cancer Symposium Kanazawa University, Japan24th-25th July 2023

Dr. Asish Pal, Scientist-F

- *Supramolecular Chemistry to design Biomimetic Materials with Structure-Function Control,* Invited lecture at IIT Gandhinagar, March 19, 2024
- *New Frontiers of Supramolecular Chemistry to Design Adaptive Smart Functional Materials,* Invited lecture at MS University, Vadodara on, March 18, 2024
- *Nanotechnology as Interdisciplinary Platform for Sustainable Future,* Invited lecture at SGGS College, Sector 26 Chandigarh, February 22, 2024
- Precision Strategies toward Adaptive and Functional Supramolecular Biomaterials, Keynote lecture at ICFM-24 at IIT-KGP, January 9-11, 2024
- Precision Strategy in Supramolecular Polymers towards Strain-stiffening and Chiroptical properties, Invited lecture at Chemistry Dept, NISER Bhubaneswar, January 8, 2024

- *Functional Peptide-Polymer Conjugates towards Strain-stiffening and Chiroptical properties, K. Kishore memorial award lecture at SPSI-Macro at IIT-Ghy, December 9-13, 2023*
- *Pushing the Limit of Smart Supramolecular Nanobiomaterials for Adaptive Life-like Characteristics, Invited talk at Panjab University, Chandigarh at workshop on Biology Meets Nanotechnology, October 14, 2023*
- *New Frontiers of Supramolecular Chemistry to Design Adaptive Smart Biomaterials, Lecture at INST, Mohali at SSR workshop on, October 6, 2023*
- *Expanding Chemist's Horizon: Nano as a tool for Mimicking Nature,* Invited talk at PGGCG, Chandigarh, September 11, 2023
- *Let there be LIGHT to increase structure-functional complexity,* August 26, 2023,INST-IIT Kanpur Bilateral Meeting.
- *New Frontiers of Supramolecular Chemistry to Design Adaptive Smart Biomaterials,* Invited talk at Chandigarh University, Gharuan, July 5, 2023
- *Pushing the Limit of Smart Supramolecular Nanobiomaterials,* Invited talk at Chandigarh Group of College, Landran, July 3, 2023
- *Self-healing and Functional Nanomaterials, Bio-nanocomposite,* Invited talk at K.E.T's V. G. VAZE College, Mumbai, May 31, 2023
- *Precision Strategies toward Adaptive and Functional Supramolecular Biomaterials,* Invited talk at TU-Eindhoven, The Netherlands, May 24, 2023
- *Precision Strategies toward Adaptive and Functional Supramolecular Biomaterials,* Invited talk at Johannes Gutenberg University and Max Planck Institute Polymer, Mainz, Germany, May 22, 2023
- *Precision strategies in bottom-up self-assembly toward Adaptive Supramolecular Biomaterials,* Invited talk at IACS-Kolkata, April 20, 2023.

Dr. Sharmistha Sinha, Scientist-F

- *BMC shell protein prospects in Bio-electronic material,* FCSXIV, 2023, December,2023
- *BMC shell protein prospects in Bio-electronic material,* ICOBIN 2023, December,2023
- *Role of internal and external stimuli towards modulation of P53 structure-function activity*, INST-IIT Kanpur Bilateral Meeting, August,2023
- *Bacterial Microcompartments: Properties and Paradoxes*, INST-CSIR IMTECH Bilateral Meeting

Dr. P.S.VijayaKumar, Scientist E

- *Nanomaterials in biological research,* ICAR-NBAIR, Bangalore Meeting 2024, 15th February, 2024
- *Challenges in Translational Research and Industry-Academia Collaborations,* Immersion Program, 6 March, 2024
- Nano in agriculture sensor and fertilizer, RAAC Meeting 2024
- *Role of Nano in sustainable agriculture,* Nano science Department, TNAU, 24th January, 2024.
- *Nano-journey Towards Fertilizer Efficiency,* INST, Mohali – IIT, Kanpur Bilateral, 26th August, 2023

Dr. Jiban Jyoti Panda, Scientist-E

- *BBB Traversing Peptide/Amino acid and Metal Hybrid Nanotherapeutics for Combating Neural Disorders,* Utkal University, Bhubaneswar, July 3, 2023
- *BBB Traversing Peptide/Amino Acid-Metal hybrid Nanotherapeutics for Combating Neural Disorders,* First International, First International Cancer Meet, NIPER, Hazipur, 23/7/2023
- B*BB Traversing Peptide/Amino Acid Nanotherapeutics Targeting Neural Disorders,* An interactive International conference on Convergence of Scientific Disciplines to Advance Biotechnology, CSDAB-2023), IISER Berhampur, Permanent Campus, 21-24 November 2023.
- *BBB Traversing Peptide/Amino Acid-Metal hybrid Nanotherapeutics for Combating Neural Disorders,* 6th International Conference on Frontiers at the Chemistry Allied Sciences Interface (FCASI-2023); Central University of Rajasthan, April, 2023
- *BBB Traversing Peptide/Amino acid and Metal Hybrid Nanotherapeutics for Combating Neural Disorders,* INYAS Technical Symposium on.Science and Technology for Sustainable Future (STSF), INYAS-Mid Year Meeting, IIT-ISM-Dhanbad, September 15-17, 2023

Dr. Asifkhan Shanavas, Scientist-D

- *Nano-therapeutic approaches for metastatic breast cancer management,* 2nd Bilateral Meeting of INST Mohali and CSIR-IMTECH Chandigarh on Nanobiotechnology and Structural Biology, 4th August 2023
- *Plasmonic nanomaterials for photothermal therapy of solid tumors,* International Conference on Biological Applications of Nanoparticles (ICON-BIO 2023), 19th April 2023

Dr. Rehan Khan, Scientist-D

- *Therapeutic Nano-sized delivery systems for the Management of Experimental Arthritis,* at 3rd International Congress on Biological and Health Sciences organized by Turkey, held on 14-16 April 2023 (ICBH 2023), Online, 14-16th April, 2023
- *Nanotoxicology, Drug delivery and inflammatory diseases: A generalized view*, 21st Refresher Course in Physical Sciences & Nano Sciences organized by UGC-Human Resource Development Centre, Jawaharlal Nehru University, New Delhi, September 29, 2023
- Nanobiomaterials for the therapy of inflammatory diseases, International Conference on "Recent Advances in Biofuels and Biomaterials (ICRABB- 2023)" organised by the Department of Chemical Engineering, Dr B R Ambedkar National Institute of Technology Jalandhar, 13-14th October 2023
- Therapeutic Nanomicelles for the localized therapy of Experimental Arthritis, at 3rd International Conference on Nano-architectures for Chemical, Biological and Therapeutic Applications (NCBTA-2023) Jointly Organized by the Department of Chemistry GLA University, Mathura, UP and Jadavpur University, Kolkata, University of Zululand, South Africa and Pittsburg State University, USA, November 24-26th,2023

- *Inhibition of inflammatory arthritis using nanobiomaterials,* Invited Talk at 8th National Conference on Biopolymers & Green Composites (BPGC 2023) organized by CIPET: IPT- Kochi., 24-25th November, 2023
- *NanoBiomaterials for the Therapy of Experimental Inflammatory Arthritis,* Keynote Lecture at 2nd International Conference on Recent Trends in Materials Science & Devices 2023 (ICRTMD-2023). Research Plateau Publishers & Sat Kabir Institute of Technology and Management, Jhajjar, Haryana, 29-31 December, 2023
- *Models in Toxicology,* Invited Lecture as a Resource Person at SERB Karyashala Program at Jamia Hamdard., 27 Feb 2024
- *Basics of Nanotoxicology and Assay for Nanomaterials toxicity*, Invited Lecture as a Resource Person in One Week SNCI-STUTI Workshop on "Translational Neuroscience: Bridging Gap between Bench to Bedside", 18-25th April 2024
- *Unravelling Therapeutic and Targeting Potential of Nanoparticles for Neurological disorders,* Invited Talk at Two Days National Symposium on "Recent Advances in Neurosciences and Neurochemistry" organized by Society for Neurochemistry India (SNCI) Delhi Local Chapter at Jamia Hamdard, New Delhi., 26th-27th April 2024

Dr. Subhasree Roy Choudhury, Scientist-D

- *Epigenetic Master Regulator Polycomb Protein based Targeted Nanotherapeutics,* Second Bilateral Meeting of INST, Mohali and CSIR-IMTECH, Chandigarh at IMTECH, 8 th August, 2023

Dr. Abir De Sarkar, Scientist-G

- *DFT perspectives on valleytronics, piezoelectricity and spintronics in selected functional 2D materials*, NAMMA Psi-k Workshop at JNCASR and IISc, Bangalore, July 24 to 28, 2023
- *DFT perspectives on valleytronics and flexible piezo-spintronics in selected functional 2D materials,* Recent Progress in graphene research (RPGR) 2023, Bangalore, 20-23 November, 2023
- *DFT perspectives on valleytronics, piezoelectricity and flexible piezo-spintronics in selected functional 2D materials,* International Conference on Advances in Nanomaterials and Devices for Energy and Environment held at IIITM, Gwalior, 19, 20 December, 2023
- *DFT perpspectives on valleytronics, piezoelectricity And flexible piezo-spintronics in selected functional 2d materials,* International Conference on Atomic, Molecular, Material, Nano & Optical Physics with Applications, held in Delhi Technological University, December 20-22, 2023
- DFT perspectives on energy conversion and electronics in selected functional 2D materials, SERB sponsored High End Workshop titled "Theory and Applications of In-Silico Approach for Materials Modelling" held in Central University of Punjab, Bhatinda, 05-11 February 2024

- *DFT perspectives on valleytronics,piezoelectricity and flexiblepiezo-spintronics in selected functional 2D materials*, International Conference on Materials Genome held at SRM, Amaravati, February 22 to 24, 2024
- *DFT perspectives on valleytronics, piezoelectricity and flexible piezo-spintronics in selected functional 2D materials,* International Conference on Sustainable Nanomaterials Integration and Organization for Energy and Environment held at Shiv Nadar University, Noida, March 20 to 23, 2024

Dr. Dipankar Mandal, Scientist-F

- Invited talk on *PENG, TENG, 3D Printing, e-Skin, Nanofiber based sensors, Health-care monitoring, ferro-, piezo and pyro-electric materials (synthesis to prototype development)*, Nat. Conf. on Physics of Nano devices and quantum materials: Harnessing the power of small (PNDQM)"Amity University, Kolkata, 06-07 October, 2023
- *Piezoelectricity on 2D Materials*, Invited talk@IIT Kharagpur (Dept. of Physics), 11 Oct., 2023
- *Synthesizing Sensation: The Chemistry of Programmable Piezoelectric Wearables*, Invited talk @IISER-Kolkata (Dept. of Chemical Sciences), 10 Oct., 2023
- *Nanogenator and its Futuristic Road map*, Invited talk@JU-Kolkata (Condense Matter Physics Centre, Dept. of Physics), 29 Sept., 2023
- *Electron spun polymers and their characterization*, One Week FDP on Materials Characterization Techniques, organized by Applied Science Department, National Institute of Technical Teachers Training and Research (NITTTR) Chandigarh, 08 Dec., 2023

Dr. Md. Ehesan Ali, Scientist-F

- *Magnetization Reversal in Low-coordinated Single-Molecule Magnets through Spin-Phonon (Vibronic) Interactions*, Conference on "Intellection, Innovation and Implication in Chemistry IIIC-2023", DAV University, Jalandhar, 18-19 April 2023
- *Ab Initio Methods to Compute the Properties of Molecules and Materials,* Faculty Development Program on "Material characterization through DFT and experimental techniques", 4th-8th July, 2023
- *Antimalarial Activities of Artemisinin: In-Silico Perspectives of Biradical Mechanism and Stereo-electronic Effects*, Invited Talk for INST-IMTECH bilateral meeting, 8th August 2023
- *Magnetization Reversal in Low-coordinated Single-Molecule Magnets through Spin-Phonon Interactions,* Quantum Condensed Matter-2023 (QMAT 23), NISER, Bhubaneswar, 27-30th November, 2023
- *Role of Spin-Vibrations Interactions in Single- Molecule Magnets,* Professor Ram Chand Paul National Symposium in the Department of Chemistry, Panjab University, Chandigarh, 15th – 16th February 2024

Dr. Kaushik Ghosh, Scientist-F

- *Development of Sustainable society,* Invited talk at ICFM-2024, IIT Kharagpur, January 9-11, 2024

- *Green H2 production, The impact on Upcoming Automobile Industry, Invited talk at IMESD-2023, IIT Roorkee, December 7-10, 2023*
- *MOF based Uninterrupted Green H2 Production, Invited talk at NECSA-2024, PDPE, Amhedabad, February 21-24, 2024*
- *A Route Towards Renewable Energy Conversion Storage and Facile Application, Invited talk at IIT Mandi, December 28, 2023*
- *Porous Carbon Template Decorated with MOF-Driven Bimetallic Phosphide: A Suitable Heterostructure for the Production of Uninterrupted Green Hydrogen via Renewable Energy Storage Device*, Invited talk at ICECS-2023, Amrita Vishwa Vidyapeetham, June 21-23, 2023
- *Cost Effective Approach Towards the Production of Uninterrupted Green H2,* Invited talk at SRM University AP, August 4, 2023

Dr. Suvankar Chakraverty, Scientist-F

- *Some recent stories about conducting oxide interfaces: Nontrivial Electronic Band Structure, Nontrivial Spin Texture in Real and Momentum Space.*, "Infosys Condensed Matter seminar series" TIFR Mumbai, 2 June, 2023
- *Towards Oxide Quantronics: A possible roadmap.,* School and conference on "Quantum Technologies: Introduction, Materials and Devices" IISER Mohali., 10-14 July, 2023
- *Can Oxide play a role in "Quantronics"*?, "QMH 2023" IIT Hyderabad, 18-20 July, 2023
- *Non-Trivial spin texture: Real vs Momentum space*, "QMAT-23" NISER Bhubaneshwar, 27-30 November, 2023
- *Towards Oxide Quantronics: A possible roadmap.,* "14th APCTP-IACS-ACADEMY-JNCASR Joint activity on Novel Phases in Oxide Materials and Low Dimensional Systems" Evolve Back Resort Coorg Karnataka., 30 November- 2 December, 2023
- *Anomalous Shubnikov De Haas oscillations and Room temperature spin polarizations at oxide interfaces.,* "RTCMPQM 2024" IACS KOLKATA, 15-16 Feb, 2024
- *Anomalous Shubnikov De Haas oscillations and Room temperature spin polarizations at oxide interfaces.,* "AFMD 2024" SRM Institute of Science &Technology, 26 – 29 Feb, 2024

Dr. Bhanu Prakash, Scientist-D

- *Emerging microfluidics: nano/microfabrication and applications in energy and healthcare,* Emerging Trends and Future Challenges in Chemical Sciences (ETFC-2024), as invited speaker at Kirorimal College, University of Delhi., 12th-13th Feb 2024

LECTURES DELIVERED BY INVITED GUEST

- Prof. Tanusri Saha-Dasgupta, Director, S.N. Bose National Centre for Basic Sciences, Kolkata, *Quantum Materials by Computation: Challenges & Opportunities* on 19-04-2023
- Prof. Amulya K Panda, Former Director of the National Institute of Immunology, delivered a special lecture titled *"Nanotechnology-based Vaccine and Immunotherapy"*, on the occasion of National Technology Day on 11May, 2023
- Prof Amitava Patra, Director, INST Mohali delivered a talk which was organized by SPSTI, in association with Chandigarh Chapters of NASI, INYAS-INSA & with support from Punjab State Council for Science & Technology, which is a part of a lecture series on vision of Institutions in North-West of India in run-up to India@100 in 2047 "*On the Celebration of 10th Foundation Day of INST Mohali"* on 29/4/2023
- Prof Dulal Panda, Director, NIPER, Mohali, delivered a key note lecture having titled *"Lessons from 56 years of tubulin research: Implications in human health and diseases"* this occasion on 22-23 May, 2023
- 1st GN Ramachandran Lecture was delivered by Prof Shekhar Chintamani Mande, Former Director General, CSIR; Distinguished Professor, Savitribai Phule Pune University, Pune & Honorary Distinguished Scientist, National Centre for Cell Science, Pune on 29th May, 2023.
- A special lecture and interaction session with faculties and students of INST was arranged with Prof. Ashutosh Sharma, Chair Professor, IIT Kanpur and Former Secretary, DST on 1st August 2023.
- Prof. Venkataramanan Mahalingam, Department of Chemical Sciences, Indian Institute of Science Education and Research Kolkata delivered a talk on "*Development of Transition Metal-based Nanostructured Materials for Energy Applications*" on 25 September, 2023 at INST.
- As part of Vigilance Awareness Week observed by Central Vigilance Commission (CVC) from 30 October to 5 November 2023, a talk on Preventive Vigilance was delivered by Shri Hari Mohan, Ex-Controller of Administration, CSIR-CSIO Chandigarh at INST, Mohali on 18 September 2023.
- Prof. Arup Kumar Raychaudhuri Renowned experimental condensed matter physicist, "*Experimenting with single nanowires: Physics, Techniques.* 06/9/2023.
- Lecture delivered during Indo-France Seminar on Metal Nanoclusters, supported by Indo French Centre for the Promotion of Advanced Research from 02-5th October, 2023.

- T Pradeep, IIT Madras, Chennai, *Metal Nanoclusters: Syntheses, characterization, surface functionalization and properties* on 02nd October
- Erik Dujardin, Laboratoire Interdisciplinaire Carnot de Bourgogne, Dijon, E*mbedded photon sources for quantum plasmonics: Assets and challenges of metal nanoclusters*
- Rodolphe Antoine, Light Matter Institute CNRS and University of Lyon, *The emergence of mass spectrometry for characterizing nanomaterials. Atomically precise nanoclusters and beyond*
- Nandakumar Kalarikkal, Mahatma Gandhi University, Kottayam, Kerala, *Novel engineered nanostructured materials for tailored applications.*
- Benoit Mahler, Light Matter Institute CNRS and University of Lyon, *Adding new flavors to 2D nanocrystals: how ligands influence the synthesis, morphology and properties of semiconducting nanosheets*
- Jayasree R S, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum, *Gold quantum clusters: A potential candidate for biomedical imaging and therapy*
- K. K. Haldar, Central University of Punjab, Bathinda, *Design and Understanding of Multifunctional Nanoscale Energy Materials as Electrocatalyst.*
- Martinus H. V. Werts, Laboratoire SATIE, ENS Rennes and CNRS, *Microfluidic and optical-spectroscopic analysis of functionalized nanoparticles and nano-bio-assemblies.*
- Anisha Gokarna, Laboratory of Light, *Nanomaterials and Nanotechnologies, Troyes, Solution grown, highly crystalline multifunctional ZnO structures: From heterostructured to large-scale efficient growth.*
- Gulshan Kumar, IIT Jodhpur, *Parametric Analysis of ZnO Nanowires growth on Metal Seeded Substrates via Chemical Bath Deposition and their low-temperature sensing.*
- Anusri Medda IACS, Kolkata, *Ultrafast Electron Transfer in the Heterostructures of CdSe NPLs-Au25 Nanoclusters for Photodetector Applications.*
- Sarita KolayIACS, Kolkata, *Self-Assembly of Metal Nanoclusters: Non-covalent Interactions and Optical Properties.*
- Nikhil R. JanaIACS, Kolkata, *Nanoparticle-Based Control of Cellular Processes.*
- Amitava Patra, INST, Mohali, *Ultrafast Carrier Relaxation Dynamics and Aggregation-Induced Emission of Metal Clusters.*
- Nirmal Goswami,CSIR-IMMT, Bhubaneswar, *Harnessing Aggregation-Induced Emission in Supramolecular Assemblies of Metal Nanoclusters.*
- Xavier Le Guével, Institue for Advanced Biosciences, University Grenoble Alpes, *Theranostic agents for shortwave infrared bioimaging and cancer therapy.*
- Chayan Kanti Nandi, IIT Mandi, *Ultra long-term Super-Resolution Tracking of Lysosomes in Brain Organoids by Near- Infrared Noble Metal Nanoclusters.*
- Hans-Christian Weissker, Centre Interdisciplinaire de Nanosciences de Marseille, *Optical Spectra & Surface Plasmons in Quantum-Sized Noble-Metal Clusters and Nanoalloys from ab initio calculations.*
- Biswarup Pathak, IIT Indore, *Breaking Conventions in Nanocluster Catalysis: Investigations using DFT and Machine Learning.*

- Pierre Mignon, Light Matter Institute CNRS and University of Lyon, *Properties of 2D materials and adsorption of (bio)-organics on clay minerals through theoretical approaches.*
- Sukhendu Mandal, IISER Thiruvananthapuram, *New Advances in Atomically Precise Silver Nanoclusters.*
- Ayan Datta, IACS, Kolkata, *Buckling and Defects in Two - Dimensional Atomically Thin Monolayers.*
- Tapasi Sen, INST, Mohali: *Probing the photophysics of fluorescent single metal nanoclusters.*

- Lecture during "Trends in Emerging Nano Science: Energy, Healthcare & Quantum Materials (TENS)" conference from 5-8 November 2023.
- Plenary lecture by Prof. DD Sarma, IISc Bangalore, *Diversity of Material Properties in Low Dimensional Hybrid Halide Materials*, 7 Nov 2023
- Invited lecture by Prof. Leonard Prins, University of Padova, Italy, *Energy-driven Self-assembly of Functional Chemical Systems*
- Invited lecture by Prof. S. M. Yusuf, Bhabha *Atomic Research Centre, Novel Magnetism and Ionic Conduction in Low-Dimensional Spin Systems*
- Prof. Wojtek Chrzanowski, University of Sydney, Australia, *Extracellular Vesicles as the Next-generation Multifunctional Nanotherapeutics.*
- Prof. Sebastian Peter, Jawaharlal Nehru Centre for Advanced Scientific Research, *Carbon Recycling for Sustainable Energy: A Journey from Fundamental Chemistry to Green Technologies.*
- Prof. Chilla Malla Reddy, Indian Institute of Science Education and Research Kolkata, *Crystalline Self-healing Organic Materials.*
- Prof. Rabibrata Mukherjee, Indian Institute of Technology, Kharagpur, *Dynamics of Nano Particle Containing Polymer Thin films.*
- Prof. Suhrit Ghosh, IACS, Kolkatta, India Chain-folding Regulated *Hierarchical Assembly of Amphiphilic Polymers and Functional Nanomaterials.*
- Prof. Andrei V. Kabashin, Aix-Marseille University, France *Femtosecond Laser-ablative Synthesis of Functional Nanomaterials for Biomedicine and Energy.*
- Prof. Suparna Sanyal, Uppsala University, Sweden, *Targeting Protein Synthesis Machinery of the Human Parasite Giardia Intestinalis with Cryo-Electron Microscopy*
- Prof. Kalobaran Maiti, Tata Institute of Fundamental Research, *Behaviour of Dirac Fermions in Kondo lattice systems.*
- Prof. Philip Tinnefeld, Ludwig-Maximilians-University, Germany, *DNA Origami for Biosensing and Superresolution Microscopy.*
- Prof. Suman Kalyan Pal, Indian Institute of Technology Mandi, *Advancing Photovoltaic Technology: The Potential of Two-Dimensional (2D) Halide Perovskite Materials.*
- Prof. Anjan Barman, S. N. Bose National Centre for Basic Sciences, *Hybrid Magnonics in Nanoscale Magnets.*
- Prof. Samrat Mukhopadhyay, IISER,Mohali, *Biological Phase Transitions: Where Chemistry and Physics Meet Biology*
- Prof. Sayan Bagchi, CSIR-National Chemical Laboratory, *Probing Surface-ligand Interactions in SCN--capped Quantum Dots Using 2D IR Spectroscopy.*

- Prof. Shibdas Banerjee, IISER, Tirupati, *Specimens for Disease Diagnosis Label-free Mass Spectrometry Imaging of Surgical.*
- Prof. Swapan K Pati, JNCASR,Bangalore, *Computational Modelling of Transport Phenomena in a few Materials*
- Prof. Prabal Maiti, IIISc, Bengaluru, *Cooperative vs Sequential Melting: PNA vs DNA.*
- Prof. Biplab Sanyal, Uppsala University, Sweden, *Defect-controlled Electronic and Magnetic Properties of Organic and Inorganic, Adsorbates on Graphene.*
- Prof. Somobrata Acharya, IACS Kolkata, *Noncovalent Two-dimensional molecular Crystals for Solid State Luminescence*
- Prof. Sri Sivakumar, IIT Kanpur, *Soft Nanomaterials for Biological Applications.*
- Prof Martin Aeschlimann, University of Kaiserslautern, Germany delivered a special lecture on U*ltrafast sciences and its application to quantum materials and heterostructures* on 12th December at INST, Mohali.
- INST organized a national conference on "Crystals for Quantum Technology" with talks by national & international experts working on thin films and crystals essential to the field of quantum technology on 11th and 12th of December 2023.
- Dr. Ramesh Kumar Sen, Principal Director and Head, Institute of Orthopedics, Max Hospital Mohali delivered a special lecture on *"Orthopaedic Window for Nanotechnology"* on 21st December, 2023 at INST, Mohali.
- Prof. Sudip Batabyal, Professor, Department of Sciences, School of Physical Sciences, Amrita University, Coimbatore delivered a lecture on the tittle "*Generation of electrical energy from water evaporation: Hydrovoltaics* on 21st December, 2023.
- *"Molecular Spin Qubits for Quantum Computer and High-Density Memory Devices Based on Molecular Magnets"*, Professor Masahiro Yamashita, Emeritus Professor, Department of Chemistry, Tohoku University, Sendai, Japan, 1st February 2024
- Prof. Srinivasan Sampath, Department of Inorganic and Physical Chemistry, Indian Institute of Science.
- JC Bose Memorial Lecture 2024 was delivered by distinguished scientist Prof. Milan K. Sanyal, Emeritus Professor and Former Director, Saha Institute of Nuclear Physics, Kolkata on the topic *"Amazing Optical Properties of Quantum Materials" on 04th March, 2024.*
- Foundation Day of INST was graced with a special endowment lecture "P C Ray Lecture" on 13 March, 2024, *"The Chemistry of Thermoresponsive Smart Windows".*

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PROJECTS SANCTIONED DURING THE 2023-24

Sr.	Funding Agency	Name of Project	PI	Duration of Project	Total Cost of Project (₹)
1	**DST**	Smartphone enabled detection of cystic fibrosis using lead free perovskites based paper wearable analytical device	Dr. Bhanu Prakash	1 year 6 month	25,30,647
2	**DBT**	Biodegradable multi-unit intraruminal devices for long-term-controlled pulsatile release of nutrients supplements & deworming drugs to enhance production and reproduction in cattle	Dr. Rahul Kumar Verma	3 years	29,56,952
3	**DST**	INSPIRE Faculty Fellowship	Dr. Neha Bhardwaj	--	2,24,0743
4	**CSIR**	Development of Metal-Semiconductor based 2D Binary Periodic Ordered assemblies on Solid Substrate and test their efficacy as SERS substrate	Dr. Sonalika Vaidya	3 years	9,00,000
5	**CSIR**	Blood Brain Barrier Traversing And Lysosome Directed Dual Tau And A-Beta Protein Aggregation Targeting Catecholamine-Polydot Based Theragnostic Nanosystems For Enhanced Therapy of Alzheimer's Disease As Exemplified In A Zebra Fish Model	Dr. Jiban Jyoti Panda	3 years	18,00,000
6	**TNAU-IFFCO network**	Evaluation of uptake and assimilation of foliar nanourea	Dr. P. S. Vijaya Kumar	2 Years	30,00,000
7	**ICMR**	Development of nanostructured MoS2 based SERS and FET biosensors for ultrasensitive detection of biomarkers for Cerebral Ischemia	Dr. Rehan Khan & Dr. Kiran S. Hazra	3 years	41,88,974
8	**SERB**	Plasmonic nanostructures derived from metal organic frameworks for photo-theranostic applications	Dr. Asifkahn Shanavas	3 years	49,62,166
9	**CSiR**	Magnetic Nanoparticles Conjugated Bacteria for Chemo-thermo Application	Dr. Deepika Sharma	3 years	13,00,000
10	**DBT**	Optical Tracing and Inhibition of Metastatic Tumor With Metal Quantum Clusters	Dr. Asifkahn Shanavas	3 Years	61,54,720
11	**ICMR**	Controlling Diabetic Retinopathy (DR) through novel VEGF-targeted aptamer tethered Pazopanib nanotherapy	Dr. Surajit Karmakar	3 years	76,32,085

12	**ICMR**	Noninvasive and in situ forming peptide-polymer hydrogel containing CPP decorated nanoparticles/photo responsive agents with crystalline aggregates disaggregating propensity for potential cataract therapy	Dr. Jiban Jyoti Panda	4 years	3,25,88,912
13	**BRNS**	Electrochemical ammonia synthesis : The role of active sites of the electro catalyst for the reduction of dinitrogen	Dr. R S Dey	3 Years	37,55,250
14	**SERB**	Insight study into the photo-redox catalysis for simultaneous CO2 reduction oxidation: Boosting sustainable economy	Dr.K Kailasam	3 years	49,16,358
15	**SERB**	Computational design of 2D materials and their interfaces for a high out-of-plane piezoelectricity	Dr. Abir De Sarkar	3 years	27,26,663
16	**SERB**	Development of piezoelectric enabled nanocomposite integrated microfluidic platform for self-powered devices	Dr. Bhanu Prakash	2 years	35,31,152
17	**SERB**	Pragmatic strategies for the delivery of phytodrugs across BBB through plant derived exosomes for the management of neuro inflammatory diseases	Dr. Manish Singh	2 years	39,04,952

💰 Projects from Sponsored Agency during last 5 years

FY	DST	SERB	DBT	Other	Total	DST	SERB	DBT	Other	Total
2019-20	2	9	1	2	14	70.98	267.53	36.14	19.57	394.22
2020-21	--	4	--	1	5	91.98	171.19	17.12	12.61	292.90
2021-22	3	6	4	6	19	444.89	187.28	111.33	122.08	865.58
2022-23	5	11	-	2	18	199.41	258.43	17.66	23.65	499.15
2023-24	2	5	2	8	17	427.33	184.46	64.29	409.53	1085.61
Total	12	35	7	19	73	1234.59	1068.89	246.54	587.44	3137.46

FINANCIAL STATEMENTS

CHADHA & THUKRAL.

Chartered Accountants

H NO-144,Phase-2
MOHALI. PUNJAB
0172-2271919(O)
0172-4606719(F)
PH.9814201355,9814410501,

Independent Auditor's Report

The Board of Governors,
Institute of Nano Science and Technology
Sector-81, Knowledge City
Mohali, Punjab

Report on the Audit of the standalone Financial Statements

Management's Responsibility for the Financial Statement:

These Financial statements are the responsibility of the Institute's Management. This responsibility includes design, implementation and maintenance of internal control relevant to the preparation of financial statements that are free from material misstatement, whether due to fraud or error. It also includes the maintenance of adequate accounting records in accordance with the relevant Act for safeguarding of the assets of the organization and for preventing and detecting the frauds and irregularities, our responsibility is to express an opinion on these financial statements based on our audit.

AUDITOR'S RESPONSIBILITY FOR THE AUDIT OF THE FINANCIAL STATEMENT

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Standards of Auditing (SAs) will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

CHADHA & THUKRAL.

Chartered Accountants

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As part of an audit in accordance with SAs, we exercise professional judgement and maintain professional skepticism throughout the audit. We also:

1. Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion.

The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

2. Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances.

3. Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.

4. Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Company's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Company to cease to continue as a going concern.

5. Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

6. We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

7. We also provide those charged with governance with a statement that we have complied with relevant ethical requirements regarding independence, and to communicate with them all relationships and other matters that may reasonably be thought to bear on our independence, and where applicable, related safeguards.

CHADHA & THUKRAL.

Chartered Accountants

H NO-144,Phase-2
MOHALI. PUNJAB
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0172-4606719(F)
PH.9814201355,9814410501,

Opinion

We have examined the attached Balance Sheet of Institute of Nano Science and Technology, Mohali, Punjab as at March 31, 2024, Income and Expenditure Account & Receipt and Payment Account for the year ended March 31, 2024.

Basis for Opinion

We conducted our audit in accordance with Auditing Standards generally accepted in India. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatements. An audit includes examining on a test basis, evidence supporting the amounts and disclosures in financial statements. An audit also includes assessing the accounting principles used and significant estimates made by the management, as well as evaluating the overall financial statements presentation. We believe that our audit provides a reasonable basis for our opinion.

Report on other Legal and Regulatory Requirements

We further report that subject to following observations:

a) *No Memorandum records for the EMD and security deposits have been maintained by the Institute.*

b) *No Physical verification of assets has been undertaken by the Institute during Audit.*

We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit;

a) In our opinion proper books of accounts, as required by law, have been kept by the institute so far as appears from our examination of those books;

b) The Balance Sheet, Income and Expenditure Account and Receipt and Payment Account of the institute are in agreement with the books of account;

c) In our opinion and to the best of our information and according to the explanations given to us, the said accounts read together with and subject to the Significant accounting Policies and

CHADHA & THUKRAL.

Chartered Accountants

H NO-144,Phase-2
MOHALI. PUNJAB
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Notes to Accounts thereon, give the information in the manner so required, and present a true and fair view in conformity with the accounting principles generally accepted in India;

1. In so far as it relates to Balance Sheet, of the state of affairs of the institute as at March 31, 2024.

2. In so far as it relates to the Income.and Expenditure Account of the Excess of Expenditure over Income of the Institute for the period ended on that date.

For CHADHA & THUKRAL
CHARTERED ACCOUNTANTS
Reg. No. 022374N

(CA VIKAS THUKRAL)
(PARTNER)
M. No. 503074

Place: Mohali
Date: 22.07.2024
UDIN:

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY
KNOWLEDGE CITY, SECTOR 81, MOHALI, PUNJAB

BALANCE SHEET AS AT MARCH 31, 2024

Amount in (Rs.)

CORPUS/CAPITAL FUND AND LIABILITES	Schedules	Current Year	Previous Year
Capital Fund	1	2,35,08,27,875.70	2,54,38,36,670.90
Reserves & Surplus	2	94,54,719.26	70,25,318.86
Welfare Fund	3A	1,89,030.00	1,89,030.00
Project Account	3B	25,98,32,251.00	21,80,67,186.70
Current Liabilities & Provisions	4	3,82,02,982.64	3,89,74,708.64
TOTAL		**2,65,85,06,858.60**	**2,80,80,92,915.10**
ASSETS			
Fixed Assets - INST	5	2,09,34,14,413.81	2,28,10,81,528.55
Fixed Assets - Project	5	16,25,74,519.54	17,60,94,726.92
Fixed Assets - Consultancy	5	6,64,535.75	7,93,550.17
Current Assets, Loans & Advances	6	40,18,53,389.50	35,01,23,109.46
Miscellaneous Expenditure (to the extent not written off or adjusted)		-	-
TOTAL		**2,65,85,06,858.60**	**2,80,80,92,915.10**
Contingent Liabilities	16	5,52,00,000.00	5,52,00,000.00
Significant Accounting Policies	17		
Notes on Accounts	18		

As per our report of even date,

For Institute of Nano Science and Technology

For Chadha Thukral & Co.
Chartered Accountants

Vibha Mehta
Finance Officer

Nimesh Kaushik
Chief Finance and Administrative Officer

Partner

Prof. Amitava Patra
Director

Place: Mohali
Date : 22/7/24

UDIN:- 24503074BKFPYE4497

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY
KNOWLEDGE CITY, SECTOR 81, MOHALI, PUNJAB

INCOME AND EXPENDITURE FOR THE YEAR ENDED ON MARCH 31, 2024

Amount in (Rs.)

INCOME	Schedules	Current Year	Previous Year
Income from Sales and Services	7	39,24,776.00	29,20,771.00
Grants/subsides	8	28,46,10,711.00	23,68,99,075.00
Fees/subscriptions	9	10,12,640.00	8,55,831.00
Interest refundable to GOI	10	72,68,936.89	1,38,19,915.89
Other Misc Income/Receipts	11	54,28,620.84	39,73,780.62
TOTAL (A)		**30,22,45,684.73**	**25,84,69,373.51**
EXPENDITURE			
Establishment Expense	12	11,92,62,297.00	16,87,72,844.00
Other Expense	13	17,76,42,833.31	12,33,98,038.00
Industrial/Consultancy Project Expense	15	29,11,155.02	16,70,865.60
TOTAL (B)		**29,98,16,285.33**	**29,38,41,747.60**
Balance being excess/(shortfall) of income over Expenditure (A-B) carried forward to General Reserve		24,29,399.40	-3,53,72,374.09
Depreciation being adjusted from Capital Grant		27,09,88,288.19	28,77,46,258.76
Surplus/(Deficit) after Depreciation		**-26,85,58,888.79**	**-32,31,18,632.86**

As per our report of even date.

For Institute of Nano Science and Technology

For Chadha Thukral & Co.
Chartered Accountants

Vibha Mehta
Finance Officer

Nimesh Kaushik
Chief Finance and Administrative Officer

Partner

Prof. Amitava Patra
Director

Place: Mohali
Date : 22/7/24
UDIN:-24503074BKFPVE4497

प्रो. अमितावा पात्रा / Prof. Amitava Patra
निदेशक / Director
नैनो विज्ञान एवं प्रौद्योगिकी संस्थान
Institute of Nano Science and Technology
(विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार का एक स्वायत्त संस्थान)
(An Autonomous Institute of the Department of Science and Technology, Government of India)
नॉलेज सिटी, सेक्टर 81, एस. ए. एस. नगर, मोहाली, पंजाब 140306, भारत
Knowledge City, Sector 81, S.A.S. Nagar, Mohali (Pb.) 140306, India

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY
KNOWLEDGE CITY, SECTOR 81, MOHALI, PUNJAB

RECEIPT & PAYMENT ACCOUNT FOR THE YEAR ENDED ON MARCH 31, 2024

Amount in (Rs.)

RECEIPT	Current Year	Previous Year	PAYMENT	Current Year	Previous Year
Opening Balances			Projects Grant Refunded (As per Schedule 3B)	6,34,084.00	51886421.0
a) Cash in hand	-	-	Interest from Project grants refunded to Funding Agencies	18,24,939.00	1868576
			Interest refunded on sweep in accounts	21,294.00	
			Revenue Expenses		
b) With Canara Bank			Establishment		
In Current Account	15,10,89,154.83	20,40,24,929.58	(As per Schedule 12)	11,92,62,297.00	16,87,72,844.00
In Deposit Account	18,80,31,122.98	42,68,88,358.98	Other Expense		
Cheque Pending Realisation	-	1,09,257.00	(As per Schedule 13)	17,76,42,833.31	12,33,98,038.00
Cheque Pending Realisation-Project	-	-	Project Expense		
Employees Benevolent Account	2,01,012.00	1,83,491.00	(As per Schedule 14)	3,72,79,300.32	2,82,92,259.00
Grants Received			Industrial/Consultancy Expense		
Capital Fund (As per Schedule-1)	7,79,79,493.00	8,76,97,175.00	(As per Schedule 15)	27,82,140.60	15,11,255.00
Revenue Fund (As per Schedule-8)	28,46,10,711.00	23,68,99,075.00	**Capital Expenditure on Fixed Assets**		
Projects Grant (As per Schedule 3B)	10,91,95,830.00	4,99,14,745.00	(As per Schedule 5)	9,80,73,609.45	32,51,54,714.00
Interest on GIA from Projects Grants	5,80,201.00	15,74,973.00	**Other Payments/Advances**		
			Welfare Fund	-	2,65,225.00
Interest Received					
Interest from Sweep-in Accounts	72,90,230.89	1,38,19,915.89	Advance to Parties	1,10,572.00	0
(As per Schedule 10)			Advance to Staff	2,78,423.00	253776
			Advance Projects	1,45,615.00	379344.00
Fees Subscriptions Received	10,12,640.00	8,55,831.00	TDS / TCS		31008.46
(As per Schedule 9)			PSPCL Security	22,93,083.00	
Other Income (specify)			Interest Accrued	73,237.00	
(As per Schedule 7/11)	93,53,396.84	61,42,893.82	Guest House Charges Recoverable	5,839.00	-
			Consultancy Fee Receivable		
Other Receipts			Security deducted-Consultancy	-	-
Advance to Parties	-	-	TDS Deducted	9,49,302.33	1405191
Advances Recovered- Staff	7,79,165.00	7,43,007.00	Contribution Receivable	-	-

BHADRA & THUKRAL CHARTERED ACCOUNTANTS MOHALI

RECEIPT	Current Year	Previous Year	PAYMENT	Current Year	Previous Year
T.D.S. Refund Received	2,43,570.00	23,00,820.00	Sample Testing Fee Receivable	2,28,420.00	-
Tax Deducted at Source	231.00	-			
Contribution Received for Conference	-	10,000.00	**Other Payments**		
Grant of Previous FY	-	2,07,00,000.00	Cheques of Previos FY	-	48,52,386.00
Advances Recovered (Projects)	3,91,612.00	58,667.00	Other Current Liabilities of PY	65,43,782.00	55,55,255.00
Refund by externally funded PhD. students	-	5,88,800.00	Security/EMD Deposits	25,21,423.00	
Tax Collected at Source	1,24,241.98	-	**Closing Balances**		
Consultancy Fee Receivable	20,33,502.80		a) Cash in hand	-	-
ATM Rent Receivable	9,558.00	-			
GST TDS Receivable	3,342.00		**b) With Canara Bank**		
Security/EMD Deposits Received		4,35,643.00	Current Account	10,26,95,318.65	15,10,89,154.83
Interest Accrued Received	24,238.00		Sweep-in Account Balance	28,68,26,764.66	18,80,31,122.98
Increase in Prrovisions	82,93,479.00		Employees Benevolent Account	2,01,012.00	2,01,012.00
Cheques Pending Encashment-INST	-	-	Cheque Pending Realisation	-	-
Cheques Pending Encashment-Projects	-	-	ICICI Bank	8,53,443.00	
Cheques Pending Encashment-Consultancy	-	-			
TOTAL	**84,12,46,732.32**	**1,05,29,47,582.27**	**TOTAL**	**84,12,46,732.32**	**1,05,29,47,582.27**

As per our report of even date.

For Chadha Thukral & Co.
Chartered Accountants

Vipas Thukral
Partner

Place: Mohali
Date : 22/7/24

For Institute of Nano Science and Technology

विभा मेहता / Vibha Mehta
वित्त अधिकारी / Finance Officer
नैनो विज्ञान एवं प्रौद्योगिकी संस्थान
Institute of Nano Science and Technology
(विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार का एक स्वायत्त संस्थान)
(An Autonomous Institute of the Department of Science and Technology, Government of India)
नॉलेज सिटी, सेक्टर 81, एस. ए. एस. नगर, मोहाली, पंजाब 140306, भारत
Knowledge City, Sector 81, S.A.S. Nagar, Mohali (Pb.) 140306, India

Vibha Mehta
Finance Officer

निमेश कौशिक / Nimesh Kaushik
मुख्य वित्त एवं प्रशासनिक अधिकारी
Chief Finance & Administrative Officer
नैनो विज्ञान एवं प्रौद्योगिकी संस्थान
Institute of Nano Science and Technology
(विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार का एक स्वायत्त संस्थान)
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Knowledge City, Sector 81, S.A.S. Nagar, Mohali (Pb.) 140306, India

Nimesh Kaushik
Chief Finance and Administrative Officer

प्रो. अमितावा पात्रा / Prof. Amitava Patra
निदेशक / Director
22/7/24
नैनो विज्ञान एवं प्रौद्योगिकी संस्थान
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Knowledge City, Sector 81, S.A.S. Nagar, Mohali (Pb.) 140306, India

Prof. Amitava Patra
Director

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY, SECTOR 81, MOHALI

SCHEDULE FORMING A PART OF BALANCE SHEET FOR THE YEAR 2023-24

Amount in (Rs)

SCHEDULE NO. -1

	CURRENT YEAR	PREVIOUS YEAR
CAPITAL FUND		
Balance at the beginning of the year	2,54,38,36,670.90	2,74,38,85,754.66
Add: Addition during the year (DST)	**7,79,79,493.00**	**8,76,97,175.00**
Less: Depreciation on fixed Assets	27,09,88,288.19	28,77,46,258.76
BALANCE AT THE YEAR END	**2,35,08,27,875.70**	**2,54,38,36,670.90**

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY SECTOR-81 MOHALI PUNJAB

SCHEDULE FORMING A PART OF BALANCE SHEET FOR THE YEAR 2023-24

Amount in (Rs)

SCHEDULE NO. -2

	CURRENT YEAR	PREVIOUS YEAR
CAPITAL RESERVE (Land provided by Punjab Govt.)	1.00	1.00
RESERVE AND SURPLUS		
General Reserve		
Balance at the beginning of the year	70,25,318.85	4,23,97,691.94
Add: Addition during the year - transfer from Income & Expenditure Account	24,29,399.40	-3,53,72,374.09
BALANCE AT THE YEAR END	**94,54,719.26**	**70,25,318.85**

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY SECTOR-81 MOHALI PUNJAB

SCHEDULE FORMING A PART OF BALANCE SHEET FOR THE YEAR 2023-24

Amount in (Rs)

SCHEDULE NO. -3A

	CURRENT YEAR	PREVIOUS YEAR
WELFARE FUND		
Benevolent Fund		
Opening Balance	1,89,030.00	1,83,491.00
Employees Benvolent Fund		
Interest on Employees Benvolent Fund		5,539.00
TOTAL	**1,89,030.00**	**1,89,030.00**

FINANCIAL STATEMENT
INSTITUTE OF NANO SCIENCE AND TECHNOLOGY
KNOWLEDGE CITY SECTOR-81 MOHALI PUNJAB
SCHEDULE FORMING A PART OF BALANCE SHEET FOR THE YEAR 2023-24

SCHEDULE NO. -3B Amount in (Rs)

	CURRENT YEAR	RECEIPTS DURING THE YEAR	REFUNDED DURING THE YEAR	PREVIOUS YEAR
PROJECT ACCOUNT				
Grant from CSIR	40,41,584.00	15,30,200.00	-	25,11,384.00
DBT Project	3,37,51,289.00	-	-	3,37,51,289.00
Grant from DAE	41,52,723.00	21,28,250.00	-	20,24,473.00
DBT for Vigyan Prakash	44,586.00	-	-	44,586.00
Grant from DIHAR	26,70,545.00	-	-	26,70,545.00
SERB Project	13,64,53,473.00	-	-	13,64,53,473.00
Hindu college Delhi (Project sponsored by DST)	15,69,590.00	-	-	15,69,590.00
Grant from JNCASR	12,64,300.00	-	-	12,64,300.00
Grant from ICMR	25,25,542.00	-	-	25,25,542.00
Grant Inspire Faculty	38,78,846.00	-	-	38,78,846.00
DST Project	25,52,30,884.00	-	-	25,52,30,884.00
Grant UGC	1,33,428.00	-	-	1,33,428.00
	44,57,16,790.00	**36,58,450.00**	-	**44,20,58,340.00**
Grant received in Saving Bank				
DST	2,24,46,943.00	-	-	2,24,46,943.00
RCCB, Trivendrum	18,06,033.00	-	-	18,06,033.00
SERB Project	5,57,17,243.00	1,90,79,986.00	6,34,084.00	3,72,71,341.00
DBT	73,30,995.00	-	-	73,30,995.00
ICMR	3,20,79,875.00	3,03,38,799.00	-	17,41,076.00
IFFCO	11,72,000.00	11,72,000.00	-	-
BIRAC	17,13,272.00	-	-	17,13,272.00
TARE	3,35,000.00	-	-	3,35,000.00
TOTAL	**12,26,01,361.00**	**5,05,90,785.00**	**6,34,084.00**	**7,26,44,660.00**
Grant Received for DBT Projects in Zero Balance Saving Bank Account	81,95,402.00	64,29,218.00	-	17,66,184.00
Grant Received for DST Inspire fellowship/faculty Projects in Zero Balance Saving Bank Account	1,34,97,317.00	12603746.00	-	8,93,571.00
Grant Received for DST Nano Mission Projects in Zero Balance Saving Bank Account	4,71,17,595.00	28405077.00	-	1,87,12,518.00
Grant Received in ZBSA for Scheme Code1819	17,23,972.00	1723972.00	-	-
Grant Received in ZBSA for Scheme Code3972	57,84,582.00	5784582.00	-	-
	64,46,37,019.00	**10,91,95,830.00**	**6,34,084.00**	**53,60,75,273.00**
Interest on F.D. from Projects Grants	3,73,36,732.75	67,304.00	75,298.00	3,73,44,726.75
Interest on Saving Account	12,09,002.00	5,06,355.00	17,49,641.00	24,52,288.00
Interest on DBT Grant	6,542.00	6,542.00	-	-
GRAND TOTAL	**68,31,89,295.75**	**10,97,76,031.00**	**24,59,023.00**	**57,58,72,287.75**
Less: Expenditure from Project Grants (Schedule 14) + Expense upto 31.03.2024)	42,33,57,044.75			35,78,05,101.05
Net Grants	**25,98,32,251.00**			**21,80,67,186.70**

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY SECTOR-81 MOHALI PUNJAB

SCHEDULE FORMING A PART OF BALANCE SHEET FOR THE YEAR 2023-24

	Amount in (Rs)	SCHEDULE NO. -4
	CURRENT YEAR	PREVIOUS YEAR
CURRENT LIABILITIES AND PROVISIONS		
A. CURRENT LIABILITIES		
Crystal Conference Contribution	4,381.00	4,381.00
IGST 18%	38,070.00	-
INSA Fellowship	30,000.00	-
GSLIS	-	105.00
IPMCC	1,00,000.00	-
TDS Payable	4,620.00	58,704.00
Salary Payable - INST	60,94,197.00	53,51,109.00
Security/Earnest Money Deposits	78,16,133.75	1,03,37,556.75
NPS Subscription-Employee Contribution	7,68,413.00	-
Benevolent Fund	41,200.00	16,250.00
NPS-Employer Contribution	10,75,779.00	-
GST	28,279.00	3,17,901.00
Labour Cess Payable	5,577.00	
TDS Under GST (2%)	95,180.00	15,72,424.00
TDS under GST - Projects	21,925.00	32,991.00
TDS under GST-DBT	15,555.00	31,578.00
TDS under GST-DST Nano Mission	-	1,12,849.00
TDS under GST-Scheme 1817	1,321.00	-
TDS under Income Tax (All Accounts)	42,642.00	-
Professional Tax	25,000.00	8,600.00
QMAD Conference Contribution	34,557.00	-
TENS	6,57,034.00	-
PBG for Equipment	19,78,254.00	43,31,538.00
PBG-DBT	-	36,664.00
PBG-DST Nano Mission	10,107.00	1,99,363.00
Grants of Students		
Eupa Grant	50,325.00	4,74,933.00
Grant received for NPDF Fellows	14,13,600.00	-
Grant from ICMR/DST Inspire students	73,425.00	1,77,643.00
NPDF Priyanshi Agnihotri	5,86,026.00	8,07,814.00
DBT Fellowship Vineeta Panwar	1,91,462.00	11,631.00
DBT Fellowship Rajkumar Singh Imocha	2,26,541.00	-
Grants Refundable		
NPDF Astha Yadav	7,20,000.00	7,20,000.00
Contributions for Unit wise conferences	17,275.00	77,070.00
Grant from SERB for Energy Conclave	4,73,688.00	4,73,688.00
Interest Received during FY on GIA from DST Refundable to DST	72,68,936.89	1,38,19,915.89
TOTAL (A)	**2,99,09,503.64**	**3,89,74,708.64**
B. PROVISIONS		
Pension Contribution	579814	
Leave Salary Contribution	282150	
Biomedical Waste	6199	
Electricity	17,29,620	
R.A Fellowship	1,65,280	
Professional Exp.	84,000	
Telephone	28,555	
Web Hosting	36,604	
Contractual Staff-Salary	1,62,365	
Ph.D Fellowship	52,18,892	
TOTAL (B)	**82,93,479.00**	-
TOTAL (A+B)	**3,82,02,982.64**	**3,89,74,708.64**

FINANCIAL STATEMENT
INSTITUTE OF NANO SCIENCE AND TECHNOLOGY
KNOWLEDGE CITY SECTOR-81 MOHALI PUNJAB
SCHEDULE FORMING A PART OF BALANCE SHEET FOR THE YEAR 2023-24

30,95,845.94

(Amount in Rs)
SCHEDULE NO. -5

ASSETS	RATE (%)	GROSS BLOCK					DEPRECIATION			NET BLOCK	
		COST AS AT 01.04.2023	ADDITION USED FOR 180 DAYS OR MORE	ADDITION USED FOR LESS THAN 180 DAYS	SALE	COST AS ON 31.03.2024	AS ON 01.04.2023	DURING THE YEAR (Adjustment)	AS ON 31.03.2024	WDV AS ON 31.03.2023	WDV AS ON 31.03.2024
Fixed Assets-INST											
Land	0.00	1.00				1.00	-	-	-	1.00	1.00
Airconditioners	15.00	54,93,018.00	70,348.00	3,79,841.00		59,43,207.00	30,84,612.51	4,00,301.10	34,84,913.61	24,08,405.49	24,58,293.39
Computer & Peripherils	40.00	3,52,92,540.00	37,978.00	2,11,421.00	-	3,55,41,939.00	2,35,60,481.51	47,50,298.80	2,83,10,780.31	1,17,32,058.49	72,31,158.69
Computer-IND 04	40.00	1,46,000.00				1,46,000.00	1,38,052.93	3,178.83	1,41,231.76	7,947.07	4,768.24
Electrical & Plumbing items	15.00	1,13,05,997.00	3,06,087.00	3,29,036.00	-	1,19,41,120.00	42,36,853.48	11,30,962.28	53,67,815.76	70,69,143.52	65,73,304.24
Office Equipments	15.00	2,69,91,649.00		3,44,903.00		2,73,36,552.00	1,34,24,125.48	20,60,996.25	1,54,85,121.74	1,35,67,523.52	1,18,51,430.26
Office Equipment-IND 02	15.00	23,600.00				23,600.00	13,913.91	1,452.91	15,366.83	9,686.09	8,233.17
Furniture & Fixtures	10.00	3,55,62,441.00	2,01,472.00	3,20,502.00		3,60,84,415.00	1,48,92,816.39	21,03,134.76	1,69,95,951.15	2,06,69,624.61	1,90,88,463.85
Library Books	15.00	42,64,985.00	1,30,698.00	17,700.00		44,13,383.00	27,09,686.38	2,54,226.99	29,63,913.38	15,55,298.62	14,49,469.62
Clean Room	15.00	65,29,110.00			-	65,29,110.00	20,13,402.01	6,77,356.20	26,90,758.21	45,15,707.99	38,38,351.79
Building	10.00	1,94,64,18,643.00			-	1,94,64,18,643.00	36,92,49,267.55	15,77,16,937.55	52,69,66,205.10	1,57,71,69,375.45	1,41,94,52,437.91
Buiing Boundary Wall	10.00	47,53,743.00			-	47,53,743.00	6,34,674.39	4,11,906.86	10,46,581.25	41,19,068.62	37,07,161.75
Building-Auditorium	10.00	4,14,47,095.00		-	-	4,14,47,095.00	67,84,421.66	34,66,267.33	1,02,50,688.99	3,46,62,673.35	3,11,96,406.01
Building CCTV	15.00	43,89,440.00			-	43,89,440.00	9,39,069.00	5,17,555.65	14,56,624.65	34,50,371.00	29,32,815.35
Building-Data Networking	15.00	4,59,16,396.00			-	4,59,16,396.00	2,52,77,423.06	30,95,845.94	2,83,73,269.00	2,06,38,972.94	1,75,43,127.00
Building-Furniture	10.00	1,36,24,989.00			-	1,36,24,989.00	30,23,634.09	10,60,135.49	40,83,769.58	1,06,01,354.91	95,41,219.42
Building-Lab Furniture	15.00	4,98,85,483.00	19,82,270.00		-	5,18,67,753.00	1,08,06,134.24	61,59,242.81	1,69,65,377.05	3,90,79,348.76	3,49,02,375.95
Building-Signage	10.00	15,13,855.00			-	15,13,855.00	2,91,171.61	1,22,268.34	4,13,439.95	12,22,683.39	11,00,415.05
Building-UPS	15.00	36,73,972.00			-	36,73,972.00	5,49,143.21	4,68,724.32	10,17,867.53	31,24,828.79	26,56,104.47
Park Huts and benches, Gym Equipments	10.00	6,44,254.00			-	6,44,254.00	1,22,408.26	52,184.57	1,74,592.83	5,21,845.74	4,69,661.17
Aluminium Partition	10.00	43,40,457.00	4,63,819.00	3,18,449.00	-	51,22,725.00	4,69,235.96	4,49,426.45	9,18,662.41	38,71,221.05	42,04,062.59
Lab Equipments	15.00	88,08,21,732.00	2,92,96,866.00	4,85,41,056.45	-	95,86,59,654.45	36,88,94,628.06	8,48,24,174.72	45,37,18,802.79	51,19,27,103.94	50,49,40,851.66
Tennis Court	10.00	19,16,550.00				19,16,550.00	95,827.50	1,82,072.25	2,77,899.75	18,20,722.50	16,38,650.25
Horticulture	15.00	14,10,452.00				14,10,452.00	1,20,087.00	1,93,554.75	3,13,641.75	12,90,365.00	10,96,810.25
Building-Audio Visuals	15.00	33,11,226.00				33,11,226.00	2,48,341.95	4,59,432.61	7,07,774.56	30,62,884.05	26,03,451.44
Shed, Speed Breakers etc.	10.00	11,76,766.00				11,76,766.00	71,228.30	1,10,553.77	1,81,782.07	11,05,537.70	9,94,983.93
UPS	15.00	11,30,740.00	66,105.00	80,940.00		12,77,785.00	84,805.50	1,72,876.43	2,57,681.93	10,45,934.50	10,20,103.08
First Aid Boxes	15.00	19,470.00				19,470.00	2,920.50	2,482.43	5,402.93	16,549.50	14,067.08
LAN Networking	15.00	1,64,893.00				1,64,893.00	22,904.18	21,298.32	44,202.50	1,41,988.83	1,20,690.50
Animal House equipment	15.00	7,62,306.00	24,240.00	1,97,442.00		9,83,988.00	89,003.85	1,19,439.47	2,08,443.32	6,73,302.15	7,75,544.68
Total-INST		3,13,29,31,803.00	3,25,79,883.00	5,07,41,290.45	-	3,21,62,52,976.45	85,18,50,274.45	27,09,88,288.19	1,12,28,38,562.64	2,28,10,81,528.55	2,09,34,14,413.81
Fixed Assets-Projects											
Computer & Peripherils	40.00	50,13,492.00		1,09,981.00	-	51,23,473.00	43,25,797.55	2,97,073.98	46,22,871.53	6,87,694.45	5,00,601.47
Furniture & Fixtures	10.00	28,047.00			-	28,047.00	11,706.16	1,634.08	13,340.25	16,340.84	14,706.75
Office Equipments	15.00	22,94,664.00			-	22,94,664.00	6,93,908.82	2,40,113.28	9,34,022.10	16,00,755.18	13,60,641.90
Lab Equipments	15.00	32,11,32,940.00	75,61,966.00	70,80,489.00		33,57,75,395.00	14,73,43,003.54	2,77,33,822.04	17,50,76,825.58	17,37,89,936.46	16,06,98,569.42
Total-Projects		32,84,69,143.00	75,61,966.00	71,90,470.00	-	34,32,21,579.00	15,23,74,416.08	2,82,72,643.38	18,06,47,059.46	17,60,94,726.92	16,25,74,519.54

ASSETS	RATE (%)	GROSS BLOCK					DEPRECIATION			NET BLOCK	
		COST AS AT 01.04.2023	ADDITION USED FOR 180 DAYS OR MORE	ADDITION USED FOR LESS THAN 180 DAYS	SALE	COST AS ON 31.03.2024	AS ON 01.04.2023	DURING THE YEAR (Adjustment)	AS ON 31.03.2024	WDV AS ON 31.03.2023	WDV AS ON 31.03.2024
Fixed Assets-Consultancy											
Computer & Peripherils	40.00	2,28,390.00			-	2,28,390.00	1,88,462.43	15,971.03	2,04,433.46	39927.57	23,956.54
Lab Equipments	15.00	13,93,914.00			-	13,93,914.00	6,52,205.87	1,11,256.22	7,63,462.09	741708.13	6,30,451.91
Lab Equipments	15.00	24,675.00	-	-	-	24,675.00	12,760.53	1,787.17	14,547.70	11914.47	10,127.30
Total-Consultancy		**16,46,979.00**	-	-	-	**16,46,979.00**	**8,53,428.83**	**1,29,014.42**	**9,82,443.25**	**7,93,550.17**	**6,64,535.75**
Grand Total		**3,46,30,47,925.00**	**4,01,41,849.00**	**5,79,31,760.45**	-	**3,56,11,21,534.45**	**1,00,50,78,119.36**	**29,93,89,945.99**	**1,30,44,68,065.35**	**2,45,79,69,805.64**	**2,25,66,53,469.10**

FINANCIAL STATEMENT
INSTITUTE OF NANO SCIENCE AND TECHNOLOGY
KNOWLEDGE CITY, SECTOR 81, MOHALI
SCHEDULE FORMING A PART OF BALANCE SHEET FOR THE YEAR 2023-24

Amount in (Rs)

SCHEDULE NO. -6

CURRENT ASSETS, LOANS & ADVANCES	CURRENT YEAR		PREVIOUS YEAR	
A. CURRENT ASSETS				
1 Cash in Hand		-		-
2 Bank Balances				
Canara Bank				
a) Current Account No. 2452201001102-INST	8,98,87,405.02		14,67,47,068.78	
b) Auto Sweep Accounts-INST	23,72,30,548.37		16,77,57,021.37	
c) Current Account No.2919201000578-Projects	41,90,326.55		2,82,481.65	
d) Auto SweepAccounts-Projects	12,71,071.61		21,26,922.61	
e) Current Account No. -Consultancy	77,72,546.08		40,59,604.40	
f) Saving Account No. -2919101003285	4,83,25,144.68		1,81,47,179.00	
g) INST Conferences Account	8,45,041.00		-	
h) ICICI Bank	8,53,443.00		-	
g) Benevolent Account No. 2919101002412	2,01,012.00	39,05,76,538.31	2,01,012.00	33,93,21,289.81
3 Cheque Pending Realisation-INST				-
4 Cheque Pending Realisation-Project		-		-
TOTAL: (A)		**39,05,76,538.31**		**33,93,21,289.81**
B LOANS, ADVANCES/DEPOSITS AND OTHER ASSETS				
Advance to parties	1,10,572.00		0.00	
Advance to Staff	35,79,460.00		40,80,202.00	
Advance to staff (INST Projects)	1,51,922.00		4,36,076.00	
Advance to staff (INST Consultancy)	42,552.00		4,395.00	
Advance to staff (INST Conferences	-		-	
Tax Deducted at Source-INST	18,31,570.00		14,39,352.00	
Tax Deducted at Source-Project	1,802.00		4.00	
Tax Deducted at Source-Conference	35,559.00		-	
Tax Deducted at Source-Consultancy	6,18,195.69		3,42,037.37	
Tax Deducted at Source-GST	40,720.00		40,720.00	
ACCRUED INTEREST FROM PSPCL	73,237.00		24,238.00	
SECURITY DEPOSIT	18,42,766.00		18,42,766.00	
PSPCL Security	22,93,083.00		-	
GST-TDS deducted on Consultancy projects	37,378.00		40,720.00	
Guest House Charges Receivable	5,839.00		-	
Security deducted-Consultancy	1,30,000.00		1,30,000.00	
Sample Testing Fee Receivable	2,28,420.00		-	
Tax Collected at Source	53,775.50		1,78,017.48	
Income Tax Contractors			231.00	
Consultancy Fee Receivable	2,00,000.00		22,33,502.80	
ATM Rent Receivable			9,558.00	
TOTAL (B)		**1,12,76,851.19**		**1,08,01,819.65**
TOTAL (A+B)		**40,18,53,389.50**		**35,01,23,109.46**

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY, SECTOR 81, MOHALI

SCHEDULE FORMING A PART OF INCOME AND EXPENDITURE FOR THE YEAR 2023-24

Amount in (Rs)

SCHEDULE NO. -7

	Current Year	Previous Year
INCOME FROM SALES & SERVICES		
1 Receipts from Consultancy/Industrial Projects	35,29,776.00	28,54,771.00
2 INST Share in Industrial Projects	3,95,000.00	66,000.00
TOTAL	**39,24,776.00**	**29,20,771.00**

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY, SECTOR 81, MOHALI

SCHEDULE FORMING A PART OF INCOME AND EXPENDITURE FOR THE YEAR 2023-24

Amount in (Rs)

SCHEDULE NO. -8

	Current Year	Previous Year
GRANTS/SUBSIDIES		
1 Grant in Aid General (Plan)	15,28,44,167.00	7,16,74,760.00
2 Grant in Aid Salaries (Plan)	13,17,66,544.00	16,52,24,315.00
TOTAL	**28,46,10,711.00**	**23,68,99,075.00**

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY, SECTOR 81, MOHALI

SCHEDULE FORMING A PART OF INCOME AND EXPENDITURE FOR THE YEAR 2023-24

Amount in (Rs)

SCHEDULE NO. -9

	Current Year	Previous Year
FEES/SUBSCRIPTIONS		
1 Application Fee	1,12,500.00	2,51,371.00
2 RTI Fee	10.00	40.00
3 Tender Fee	10,500.00	1,23,860.00
4 License Fee	4,56,130.00	4,35,270.00
5 Internship Fee	2,61,000.00	45,290.00
6 Admission Fee	1,72,500.00	-
TOTAL	**10,12,640.00**	**8,55,831.00**

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY, SECTOR 81, MOHALI

SCHEDULE FORMING A PART OF INCOME AND EXPENDITURE FOR THE YEAR 2023-24

Amount in (Rs)

SCHEDULE NO. -10

	Current Year	Previous Year
INTEREST EARNED		
1 On Flexi Bank Account		
1. INST Main	72,68,936.89	1,38,19,915.89
TOTAL	**72,68,936.89**	**1,38,19,915.89**

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY, SECTOR 81, MOHALI

SCHEDULE FORMING A PART OF INCOME AND EXPENDITURE FOR THE YEAR 2023-24

Amount in (Rs)

SCHEDULE NO. -11

	Current Year	Previous Year
OTHER MISCELLANEOUS INCOME/RECEIPTS		
1 Guest House Receipts	3,95,226.00	2,98,159.00
2 Miscellaneous Receipts-Savings	10,788.00	-
3 Overhead receipt	6,61,973.00	1,61,149.00
4 Overheads-NPDF	-	10,79,933.00
5 Miscellaneous Receipts-INST	28,810.00	26,121.00
6 Miscellaneous Receipts-Consultancy	400.00	-
7 Rent of Hub Area Shops	4,74,607.00	4,10,595.00
8 Sample testing	20,97,214.00	3,25,460.00
9 Recovery of Hostel Expenses	2,97,836.60	-
10 Hostel Fees	3,01,400.00	5,42,905.00
11 Library Book Fine	1,485.00	610.00
12 Electricity Charges recovered from Staff/Students/Hut	6,75,697.24	8,20,881.62
13 Interest on TDS Refund	29,310.00	22,780.00
14 Auditorium Usage for events/meetings/conferences of INST	2,59,000.00	2,04,500.00
15 Notice Period recovery from fellows	-	51,256.00
16 Interest from PSPCL	81,374.00	26,931.00
17 Recovery of Diesel Expenses for Auditorium Usage for INST events	1,13,500.00	2,500.00
TOTAL	**54,28,620.84**	**39,73,780.62**

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY, SECTOR 81, MOHALI

SCHEDULE FORMING A PART OF INCOME AND EXPENDITURE FOR THE YEAR 2023-24

Amount in (Rs)

SCHEDULE NO. -12

	Current Year	Previous Year
ESTABLISHMENT EXPENSES		
1 Pay of Regular Staff	9,72,92,312.00	8,51,41,370.00
2 NPS Contribution-Employer Share	1,19,62,582.00	1,03,83,098.00
3 Salary consultants, Visiting Consultants & contractual	-	14,40,024.00
4 Fellowship-RA	-	1,29,06,561.00
5 Fellowship & Contingency of Post DOC	-	-
6 Fellowship & Contingency of Ph.D Students	-	5,22,78,218.00
7 Children Education Allowance	9,72,000.00	5,94,000.00
8 LTC	24,03,980.00	25,15,009.00
9 Leave Salary & Encashment	5,40,028.00	8,83,918.00
10 Medical Reimbursement Expenses	19,02,428.00	17,88,907.00
11 Leave and Pension Contribution	34,44,607.00	2,46,370.00
12 Staff Newspaper	1,12,850.00	-
13 Telephone	6,31,510.00	5,95,369.00
TOTAL	**11,92,62,297.00**	**16,87,72,844.00**

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY, SECTOR 81, MOHALI

SCHEDULE FORMING A PART OF INCOME AND EXPENDITURE FOR THE YEAR 2023-24

Amount in (Rs)

SCHEDULE NO. -13

	Current Year	Previous Year
OTHER EXPENSES		
1 Salary of outsourced staff	39364381.00	38525152.00
2 Advertisement	2,63,690.00	2,92,309.00
3 Annual Maintenance Expenses	52,39,957.00	57,92,503.00
4 Bio-Medical Waste Disposal Charges	1,12,881.00	1,48,338.00
5 Anti Virus	-	1,99,879.00
6 CGEWEC ANNNULA SUBSCRIPTION CHARGES	4,000.00	2,000.00
7 Building Innaugration Exp.	8,65,302.00	-
8 Electricity/Power Supply Charges	3,28,04,959.98	2,60,30,731.54
9 Garbage Lifting Charges	84,000.00	84,000.00
10 IISER Animal House Usage Charges	13,02,500.00	14,95,220.00
11 Animal House Registeration Fee	35,000.00	-
12 Medical Charges	38,382.00	84,502.00
13 Medical Reimbursemeent-Student	3,82,048.00	4,84,137.00
14 Repair and Maintenance	26,65,946.00	43,60,552.00
15 Guest House Expenses	3,00,438.00	3,25,267.00
16 Printing and Stationery	5,62,093.00	10,68,543.00
17 Conveyance	10,01,292.00	9,61,355.00
18 Postage and Courier	2,49,577.00	2,73,990.00
19 Miscellaneous Expenses	1,28,186.00	2,01,283.00
20 RA Fellowship	61,78,814.00	-
21 Bank Charges	22,394.82	39,673.57
22 Professional Charges	12,87,098.00	13,20,744.00
23 Honorarium Paid	2,61,747.00	4,25,784.00
24 Horticulture, Gardening & Plantation	4,25,407.00	9,96,588.00
25 Meeting Expenses	4,01,222.00	7,98,278.00
26 Membership Fee	18,792.00	43,752.00
27 Telephone Expenses	3,85,198.00	3,68,444.00
28 Computer Repair and Maintenance	1,90,555.00	2,36,301.00
29 Conference Expenses	8,97,783.00	8,37,005.00
30 Consumable Stores	3,85,736.00	14,51,762.00
31 Digital Signatures	-	9,600.00
32 Diesel for Generator Set	19,09,341.00	81,61,753.00
33 CIC Hearing Expenses	-	630.00
34 Internet Expenses	34,194.00	6,226.00
35 Newspapers and Periodicals	27,040.00	1,32,475.00
36 Patent Filling	2,950.00	-
37 Registration Fee	-	12,761.00
38 Web Hosting	1,85,380.00	1,18,070.00
39 Foundation Day Expenses	3,24,780.00	5,69,420.00
40 Web Designing		1,45,000.00
41 Staff Welfare	1,16,887.00	1,29,565.00
42 Lab Chemicals	36,08,175.62	71,11,674.00
43 Caution Money	-	2,000.00
44 Overhead expense	9,91,729.00	13,78,758.00
45 Sports/Sports Day Expenses	95,684.00	1,82,365.00
46 CAT Fees	28,350.00	19,800.00
47 TA/DA	8,95,973.00	21,74,961.00
48 Republic Day Expenses	45,710.00	1,29,552.00

	Current Year	Previous Year
49 Sample Testing	11,285.00	12,158.00
50 Research Scholar Day	6,39,050.00	3,33,091.00
51 Hindi Pakhwada	21,998.00	64,695.00
52 Reverse GST	40,881.00	-
53 National Science Day	54,535.00	58,530.00
54 Interest on TDS	39,188.00	-
55 Contractual Staff Salary	16,32,412.00	-
56 PhD Fellowship	5,92,55,725.00	-
57 PhD Contingencies	26,57,799.00	-
58 Interest on GIA received from DST refundable to DST	72,68,936.89	1,38,19,915.89
59 Fire NoC & Renewal Charges	49,544.00	25,250.00
60 Best Thesis Award	12,300.00	-
61 Independence Day Exp.	71,911.00	1,89,791.00
62 Fee for Consent to Operate -Fire Air Water	11,28,000.00	5,64,000.00
63 Audit Expenses	-	36,244.00
64 GST RCM	-	1,800.00
65 Internship Expenses	32,655.00	77,743.00
66 Kargil Day Celebrations	-	9,100.00
67 National Technology Day	31,200.00	1,32,211.00
68 IISF 2022	-	1,77,000.00
69 Jaipur Expo 2022	-	1,88,445.00
70 National Unity Day	-	2,800.00
71 O&M of STP	5,57,550.00	5,57,550.00
72 Professional Development Allowance	-	8,511.00
73 Yoga Day Expenses	12,290.00	6,500.00
TOTAL	**17,76,42,833.31**	**12,33,98,038.00**

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY, SECTOR 81, MOHALI

SCHEDULE FORMING A PART OF INCOME AND EXPENDITURE FOR THE YEAR 2023-24

Amount in (Rs)

SCHEDULE NO. -14

		Current Year	Previous Year
	PROJECT ACCOUNT-EXPENDITURE		
A.	**Current and Saving Bank Account**		
1	Bank Charges	23,845.32	19,704.00
2	Contingency	17,50,452.00	26,39,818.00
3	JCB Fellowship	3,25,000.00	2,75,000.00
4	Lab Chemicals	71,77,562.00	1,43,02,183.00
5	Social Responsibility	89,000.00	10,000.00
6	Overhead Expenses	75,722.00	1,062.00
7	Salary- Project	65,81,878.00	76,61,957.00
8	T.A./ D.A.	12,69,904.00	9,82,025.00
9	Fellowship	4,20,000.00	2,10,536.00
B.	**DBT**		
1	Lab Chemicals	25,78,294.00	74,984.00
2	Salary & Cash Awards	12,81,246.00	96,786.00
3	Overheads	3,99,076.00	-
4	TA/DA	46,604.00	-
5	Contingencies	4,46,684.00	14,000.00
	DST-INSPIRE	1,20,89,794.00	10,64,186.00
C.	**DST Nano Mission**		
1	Lab Chemicals	3,00,000.00	5,16,755.00
2	Salary	45,965.00	-
3	TA/DA	2,51,015.00	45,516.00
4	Overheads		1,00,000.00
5	Contingencies	2,27,812.00	2,77,747.00
D.	**Scheme Code 1819**		
1	Contingency	50,873.00	-
2	Salary	1,38,467.00	-
3	Lab Chemicals	1,64,589.00	-
4	Overheads	1,57,897.00	-
5	Travel	3,000.00	-
E.	**Scheme Code 3972**		
1	Contingency	2,15,018.00	-
2	Salary	1,52,796.00	-
3	Lab Chemicals	8,30,555.00	-
4	Travel	1,86,252.00	-
F.	Bank Interest earned on Grants refunded through Bharat Kosh	18,24,939.00	18,68,576.00
G.	Depreciation on Project Assets	2,82,72,643.38	2,92,95,445.27
	TOTAL	**6,73,76,882.70**	**5,94,56,280.27**

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY, SECTOR 81, MOHALI

SCHEDULE FORMING A PART OF INCOME AND EXPENDITURE FOR THE YEAR 2023-24

Amount in (Rs)

SCHEDULE NO. -15

		Current Year	Previous Year
	INDUSTRIAL AND CONSULTANCY PROJECTS-EXPENDITURE		
1	Bank Charges	241.00	2,049.00
2	Contingency	1,65,159.80	91,350.00
3	Lab Chemicals	11,00,940.00	4,49,383.00
4	Salary	6,08,957.00	3,28,522.00
5	T.A./ D.A.	2,50,524.00	29,480.00
6	INST Share in Mandays	50,000.00	-
7	PI Share	1,72,500.00	90,000.00
8	INST Share of Consultancy Fee	1,15,000.00	-
9	INST Share of Overheads	2,46,000.00	1,46,000.00
10	Overheads	67,818.80	23,258.00
11	Conference	5,000.00	3,51,213.00
12	Depreciation on Project Assets	1,29,014.42	1,59,610.60
	TOTAL	**29,11,155.02**	**16,70,865.60**

FINANCIAL STATEMENT

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

KNOWLEDGE CITY, SECTOR 81, MOHALI

SCHEDULE FORMING A PART OF BALANCE SHEET FOR THE YEAR 2023-24

Amount in Rs.

SCHEDULE NO. -16

		Current Year	Previous Year
	CONTINGENT LIABILITIES		
1	Claim against the institute not acknowledged as debts	5,52,00,000.00	5,52,00,000.00
	TOTAL	**5,52,00,000.00**	**5,52,00,000.00**

FINANCIAL STATEMENT
INSTITUTE OF NANO SCIENCE AND TECHNOLOGY
KNOWLEDGE CITY, SECTOR 81, MOHALI-PUNJAB

Schedule-17 Significant Accounting Policies

1. **Accounting concepts & Basis of preparation of Financial Statements**

   The financial statements have been prepared under the historical cost convention in accordance with the generally accepted accounting principles. The institute generally follows the accrual system of accounting and recognizes significant items of income & Expenditure on accrual basis unless otherwise stated.

2. **Grants**

   Grant received from Department of Science & Technology (DST) for Creation of Capital Assets is treated as Capital Fund of the Institute. Grants received for General, Salaries are treated as of revenue nature and shown under Income & Expenditure Account.

   After implementation of Treasury Single Account (TSA) w.e.f. 01.04.2022, a limit is assigned by Department of Science and Technology (DST) in the Assignment Account of INST opened with RBI in e-kuber. Unutilized assignments lapse to the Government at the close of the Financial Year as per the extant norms of Budget execution which is not available to the CNAs /SAs for expenditure in the next financial year. In PFMS too, all e-assignments/e-sub assignments cease to exist after the close of financial years and is flushed out from the system as per the current practice in TSA module.

3. **Fixed Assets**

   Tangible Fixed Assets are stated at cost of acquisition less accumulated depreciation and impairment losses, if any. Cost comprises the purchase price and any attributable cost of bringing the asset to its working condition for its intended use.

   At each balance sheet date, an assessment is made whether any indication exists that an asset has been impaired. If any such indication exists, an impairment loss i.e. the amount by which the carrying amount of an asset exceeds its recoverable amount, is provided in the books of account.

   The Government of Punjab has provided approx. 35 acres of land in Sector – 81, Knowledge City, Mohali to the Institute, free of cost, for setting up of INST Campus. Therefore, the cost of INST land has been taken as nominal value of Re.1 and corresponding accounting effect has been given in Schedule-2

4. **Depreciation**

   Depreciation on assets has been charged at the rates applicable under Income Tax Act. Depreciation, on assets used for less than 180 days, is restricted to 50% of the prescribed rates. Cost of Fixed assets includes Custom Duty, Clearing & Forwarding Charges and Freight relating to such assets.

   The depreciation on the Assets created out of the GOI Grants other than on assets under projects and Consultancy projects has been charged to Capital fund instead of Income &

Expenditure Account. However, the Depreciation on Assets under projects have been charged to the project Expenses. Similarly, the depreciation on assets under consultancy projects are charged to the Consultancy expenses, in their relevant schedules.

5. **Revenue Recognition**
Revenue is recognized as and when services are rendered and completed. It is recognized net of taxes and discounts.

6. **Foreign transactions:**
The foreign exchange transactions are recorded in the books on payment basis.

7. **Inventories :**
The Institute issues the material the same day the material is received and hence no inventory of the items are held with the stores records.

8. **Employee Benefits:**

a. **National Pension Scheme** The regular employees of the Institute are covered by NPS. Employee's contribution @ 10% is recovered from their salary and the Institute makes a corresponding contribution @ 14% of the salary, which is deposited with NPS Trust on a monthly basis.

b. **Gratuity**: Death and Retirement Gratuity Provisions are not applicable to the employees of the Autonomous bodies covered under NPS

c. **Short Term Employee Benefit**: Short Term Employee benefits like leave encashment, etc are recognized as an expense on payment basis.

9. **TAXES ON INCOME**
INST is an approved institute under the provisions of section u/s 35(1) (i)/ (ii) of the Income Tax Act, hence no taxes on Income are payable.

10. **Deferred Tax**
As the income of the Institute is exempt from tax under Income tax Act 1961, hence no deferred tax calculations have been made.

Schedules- 18 Notes to the Accounts

1. Funds amounting to Rs. 3245.96 Lakhs have been utilized out of limit of Rs. 3552.00 lakhs assigned by Department of Science and Technology (DST) during the 2022-23, During the previous year 2023-24, following grants have been utilized out of Rs.3731 lakhs received from Department of Science and Technology (DST):

	Rs.
-Grant in Aid Creation of Capital Assets	7,79,79,493
-Grant in Aid General	15,28,44,167
-Grant in Aid Salaries	13,17,66,544
	36,25,90,204

Capital Grants amounting to Rs.779.79 Lakhs has been shown as Capital Fund. The other Grants amounting of Rs.2846.11 Lakhs has been shown as revenue under Income & Expenditure Account.

2. In the opinion of the management the current assets, loans and advances are approximately of the value stated, if realized in the ordinary course of business. The provision of all the known liabilities is adequate and not excess of the amount considered reasonable and necessary.

3. Bank Balances as on 31.03.2024 shown in the Balance Sheet are as certified by the management of the Institute and are subject to confirmation.

4. The Interest earned and accrued during the year is refundable in Consolidated Fund of India through Bharat Kosh. Accordingly, the interest income has been credited to the Income and expenditure account with corresponding similar amount has been charged to expense under the head "Other expenses". The same amount has been included as an item of Current Liability in Schedule 4.

5. Contingent Liabilities:
Claim against the institute not acknowledged as debts – Rs.5.52 Crore. During the financial year 2020-21, an arbitration case involving a claim amount for Rs.5.52 crore approx. has been lodged against the Institute by M/s. SAM India Builtwell Private Ltd. The institute has disclaimed its liability and is defending the action.

6. Previous year figures have been regrouped/rearranged where ever considered necessary.

7. All Schedules form an integral part of the Balance Sheet and Income & Expenditure Account and have been duly authenticated by the management of the Institute.

विभा मेहता / Vibha Mehta
वित्त अधिकारी / Finance Officer
नैनो विज्ञान एवं प्रौद्योगिकी संस्थान
Institute of Nano Science and Technology
(विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार का एक स्वायत्त संस्थान)
(An Autonomous Institute of the Department of Science and Technology, Government of India)
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निमेष कौशिक / Nimesh Kaushik
मुख्य वित्त एवं प्रशासनिक अधिकारी
Chief Finance & Administrative Officer
नैनो विज्ञान एवं प्रौद्योगिकी संस्थान
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For CHADHA & THUKRAL
CHARTERED ACCOUNTANTS
Reg. No. 022374N

(CA Vikas Thukral)
Partner

Vibha Mehta
Finance officer

Nimesh Kaushik
Chief Finance and Administrative Officer

Prof. Amitava Patra
Director 26/7/24

प्रो. अमितावा पात्रा / Prof. Amitava Patra
निदेशक / Director
नैनो विज्ञान एवं प्रौद्योगिकी संस्थान
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Knowledge City, Sector 81, S.A.S. Nagar, Mohali (Pb.) 140306, India

Place: Mohali
Date: 22.07.2024

INSTITUTE OF NANO SCIENCE AND TECHNOLOGY

(An Autonomous Research Institute of Dept. of Science & Technology, Govt. of India)

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