भारतीय विज्ञान शिक्षा एवं अनुसंधान संस्थान, भोपाल
Indian Institute of Science Education and Research, Bhopal

रासायनिक अभियांत्रिकी विभाग
Department of Chemical Engineering

Information Booklet

Contact

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Department of Chemical Engineering

Introduction

The department was established in the year 2016 to encourage the interdisciplinary research among science and engineering disciplines. The programmes offered by this department are intended to encourage scientists to work towards engineering solutions and to have engineers work on fundamental problems in basic science disciplines, thus encouraging collaboration and erasing the boundaries between basic sciences and traditional engineering. Presently, the department offers BS-MS and Ph.D. programmes along with ‘minor’ to the BS-MS students majoring in natural sciences. This prospect offers students a unique opportunity to utilize (and build on) their foundation in the sciences for engineering applications.

Vision of Department

To contribute to the sustainable growth of the society by imparting high quality education and by conducting research in frontier areas.

Mission of Department

Our mission is to nurture a synergistic relationship between science and engineering by offering academic programmes and conducting research that enhances the interaction between scientists and engineers, thus building and strengthening the science-engineering-society feedback.

Faculty Profile

Dr. Manoj Kumar Tripathi
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Dr. Akshay Modi
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Contact- +91 755 269 2619

Dr. Manoj Kumar Tripathi

Academic Profile:
Ph.D., Indian Institute of Technology, Hyderabad (2015)
B.Tech., Indian Institute of Technology, Hyderabad (2012)

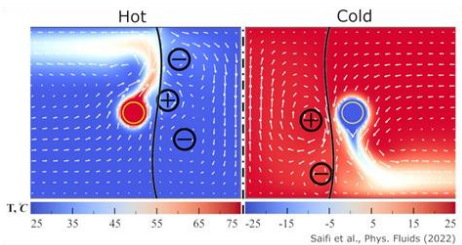
Professional Experience
Assistant Professor, Department of Chemical Engineering, IISER Bhopal (2015– Present)
Postdoctoral Fellow, TIFR Centre for Interdisciplinary Sciences, Hyderabad (March - Sept. 2015)

I work on fluid flows involving multiple phases, non-Newtonian rheology, heat and mass transfer. I employ computational methods to investigate such flows which includes traditional CFD methods and machine-learning methods for solving the governing equations.

Multiphase flows group

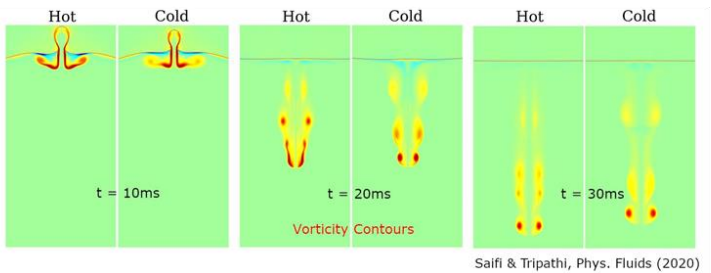
Research Areas

- Multiphase flows
- Moving contact lines
- Non-Newtonian flows
- Heat and mass transfer
- Machine learning for fluid dynamics



Key Achievement

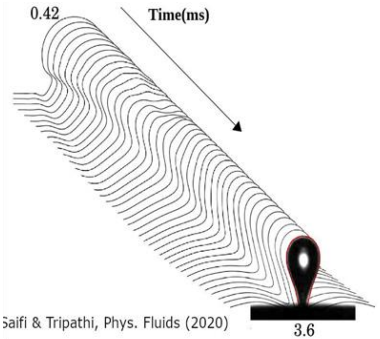
- SERB grant received for the project titled "Physics-informed neural networks for multiphase flows" in 2021
- DST project titled "Moving contact lines and solutions to complex multiphase flows" completed successfully in 2020.



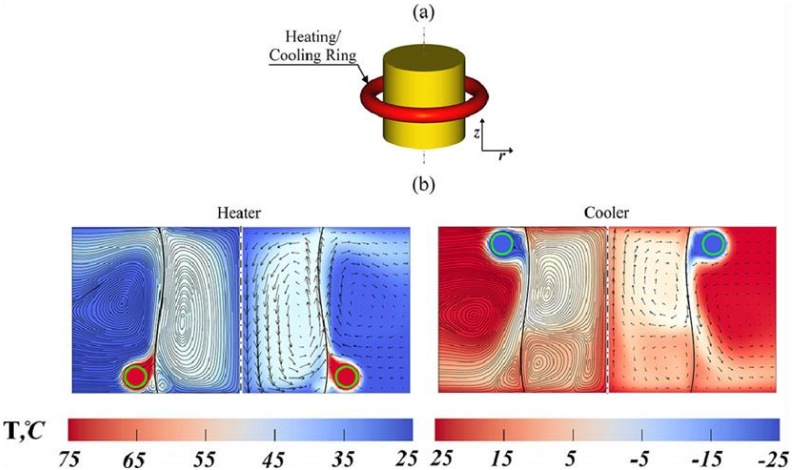
Dr. Tripathi's Research Group

Multiphase flows

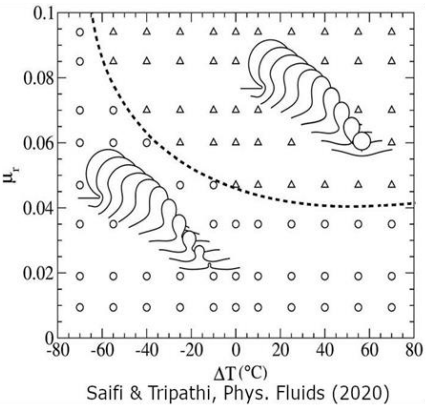
Our group works on the dynamics of multiphase flows involving different physics such as Marangoni convection, electrohydrodynamics, viscoelasticity and phase change. We employ computational methods and small experiments to investigate such flows. Some of the problems that we have been working on are prototype problems to understand the phenomena, such as liquid bridge and contact line dynamics under thermal gradients, and viscoelastic droplet migration in microchannels.



Drop coalescence on a pool (code validation)



Effect of heating/cooling ring on liquid bridge dynamics (Saifi & Tripathi, IJHMT, 2023)



Total and partial coalescence regimes

Dr. Sankar Chakma

Academic Profile:

Ph.D., Indian Institute of Technology, Guwahati (2015)
M.Tech., Indian Institute of Technology, Guwahati (2011)
B.E., Jadavpur University, Kolkata (2009)

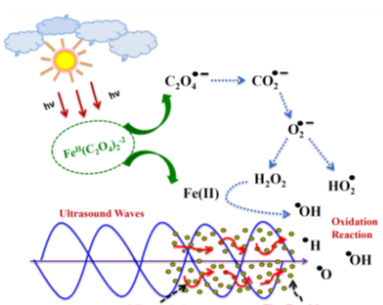
Professional Experience

Assistant Professor, Department of Chemical Engineering, IISER Bhopal (2015 - Present)
Head-in-Charge, Department of Chemical Engineering, IISER Bhopal (June 2016 - March 2019)
Faculty Advisor (Sports), IISER Bhopal (January 2017 - December 2019)

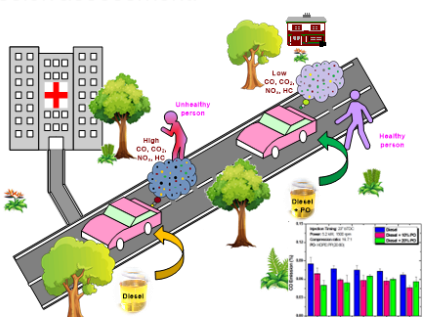
The Chakma Research Group

Research Areas

- ***Sono-Hybrid Advanced Oxidation Processes***: Mineralization of industrial effluent and pharmaceutical wastewater using chemical and biological treatment methods.
- ***Renewable & Sustainable Energy***: Production of alternative energy such as biofuels, pyrolysis oil including fuel properties and CI engine performance with gas emission assessment.
- **Nanomaterials synthesis:** Sonochemical synthesis and functionalization of nanomaterials for energy storage and conversion including other applications in environmental chemical engineering.



Rexn. mechanism and formation of fine emulsion due to cavitation



PO blending reduces emissions of CO, CO_2, NO_x, and HC

Key Achievements

- ISEES Young Scientist Award (2020)
- IEI Young Engineers Award (2018-19)
- Hiyoshi Young Leaf Award (2018)
- Associate, Indian Academy of Science (2017)
- Section Editor, Recent Innovations in Chemical Engineering, Bentham Science Publication (2020-)
- Guest Editor, Journal of The Institution of Engineers (India): Series E, Springer Nature.

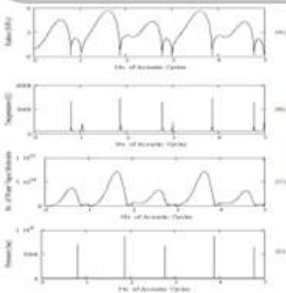
Dr. Chakma's Research Group

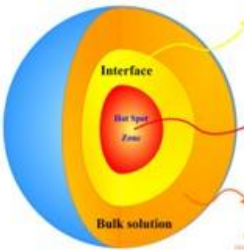
Cavitation Bubble Dynamics

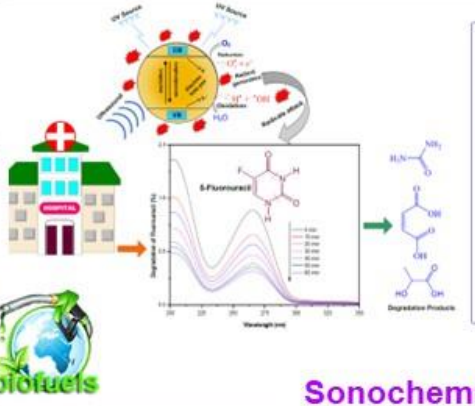
The group works on fundamental aspects of ultrasonics and sonochemistry focusing on the understanding of physical and chemical effects of ultrasound and cavitation with dual approach coupling the experimental results and simulation of cavitation bubble dynamics

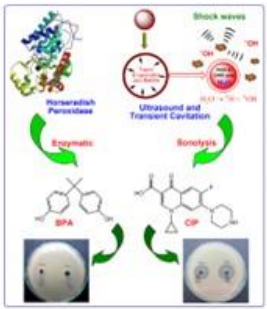
Industrial Effluent Treatment

Mineralization of industrial effluent and pharmaceutical wastewater using Chemical and Biological Treatment Methods

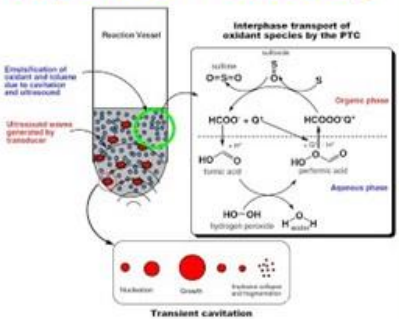








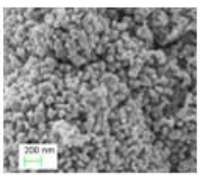
Liquid Fuel Processing

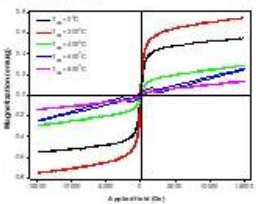


Renewable & Sustainable Energy

The group is actively involved to address the environmental pollution related issues arises from the emission of greenhouse gases which impact the climate change. Research mainly focus on the solid waste management to produce liquid fuels from waste plastic as an alternative energy source to fossil fuels.

Sonochemistry & Materials





Dr. Paramita Das

Academic Profile:

Ph.D., in Natural Sciences, RWTH Aachen University, Germany (2016).
M.Tech., in Polymer Science and Technology, Indian Institute of Technology, Delhi (2011).
B.Tech., in Polymer Science and Technology, University of Calcutta, KOLKATA (2009)

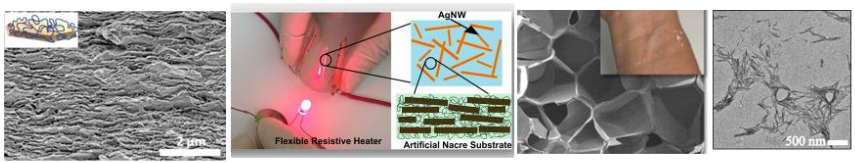
Professional Experience

Assistant Professor, Department of Chemical Engineering, IISER Bhopal (30th August 2018 – Present)
Postdoc Research Fellow, Nanyang Technological University, Singapore (March 2016 – August 2018)
Postdoctoral Researcher, Technical University of Denmark, Denmark (July – October 2015)

Functional Nanocomposite (FunNanoCom) Laboratory

Research Areas

- Functional Materials
- Polymer Nanocomposites
- Bioinspired Nanocomposites
- Hybrid Hydrogels
- Structural Design and Interface Engineering
- Structure-Property Relationships
- Extraction of Value-added Compounds from Biomass
- Materials for Energy, Environment, and Biomedical Applications



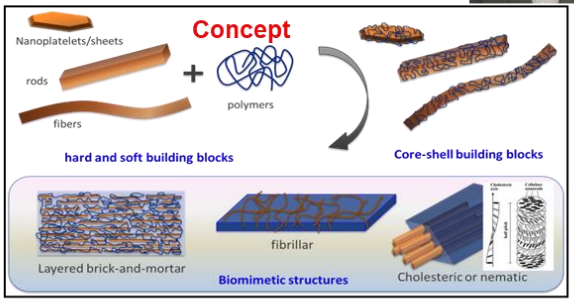
Key Achievement

- Received external grants (> 1.25 core) from multiple funding agencies as a PI and Project Coordinators
- Total number of publications: 31, H-index: 11
- Magna Cum Laude Award in Ph.D, 2016 from the Faculty of Natural Sciences, RWTH Aachen University, Germany.
- DAAD scholarship for M.Tech research project in Germany under DAAD-IIT Master's sandwich Program 2010.

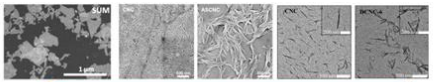
Das Research Group

Functional Nanocomposites Laboratory

We develop structurally ordered and highly reinforced functional nanocomposites in the form of films, fibers, and hydrogels for structural, barrier, environmental, energy, and biomedical applications. We work on inorganic-organic hybrid materials prepared by biomimetic pathways while addressing the critical points like interfacial interactions, surface engineering, and mechanical synergy.

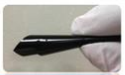


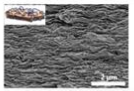
Overview



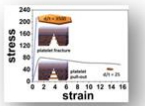
- Extraction and synthesis of cellulose NPs from biowaste – CNC, NFC.
- 2D layered nanomaterials - nanoclays, Graphene, MoS2.
- Surface functionalization of NPs.
- Incorporate multifunctionality.

Polymer nanocomposite
thin film/membrane/fiber





- Structural hierarchy.
- Mechanical robustness.
- Thermal stability.
- Better optical properties.
- Wide spectrum of applications



Nanoparticle Synthesis & Multifunctionality

Structural Design & Controlled Interface

Functional Nanocomposites

Green composites
thin film/membrane

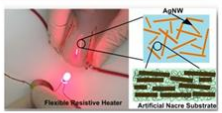
Bioinspired nanocomposite
thin film/membrane/fiber

Structure & Property Relationships, Rheology

Surface Modification & Interface Engineering

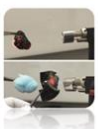
Applications

- Hybrid biofiber for catalysis.
- Transparent substrate for flexible opto-electronics.
- Flexible resistive heaters.
- Proton exchange membranes.
- Hydrogel patch for controlled drug delivery.
- Smart hydrogel for controlled release of fertiliser.

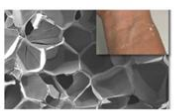


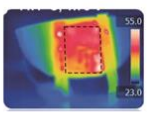
Applications

- Structural materials.
- Gradient materials.
- Barrier materials (fire, heat, gas).
- Functional materials.



Nanocomposite Hydrogels





FunNanoCom Lab

Dr. Venkateshwar Rao Dugyala

Academic Profile:

Ph.D., Indian Institute of Technology, Madras (2016)
M.Tech., Indian Institute of Technology, Madras (2008)
B.Tech., Jawaharlal Nehru Technological University, Anantapur (2006)

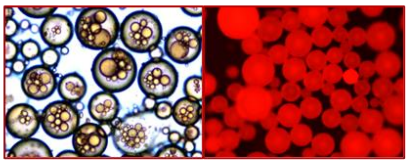
Professional Experience

Assistant Professor, Chemical Engineering, IISER Bhopal (Sept. 2018 – Present)
Postdoctoral Fellow, Katholieke Universiteit, Leuven (Aug. 2016 – July 2018)
Process Engineer, General Electric, Bangalore (June 2008 – May 2010)

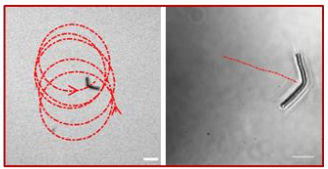
Soft matter and Active Matter Research lab

Research Areas

- Pickering emulsion
- Self-propulsion
- Sessile drop evaporation
- Self-assembly
- Fluid-fluid interface
- Crack patterns
- Capillary suspensions

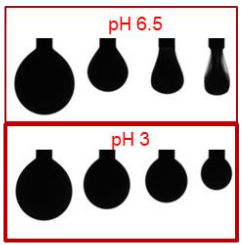


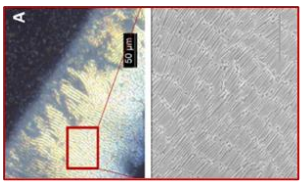
Pickering double and single emulsions



Self-propulsion of anisotropic particles

Particle adsorption at fluid-fluid interface





Self-assembly of anisotropic particles

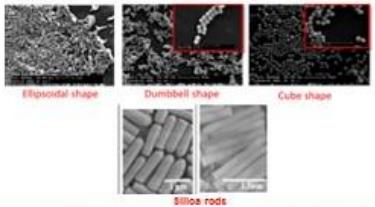
Key Achievement

- Developed low cost oxygen concentrated during Covid-19
- Received external grants (> 1 core) from multiple funding agencies as a PI and Co-PI
- Total number of publications: 12

Dr. Dugyala Venkateshwar Rao - Soft matter and Active matter research group

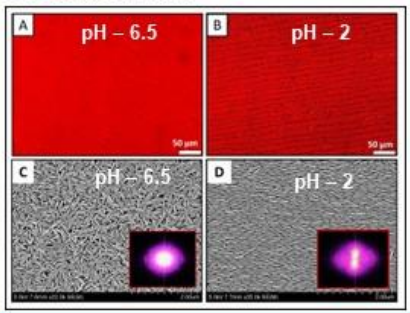
The main aim of this group is synthesis of different anisotropic particles and elucidate the particle shape effects on different fields, such as self-assembly, emulsion stability, capillary suspensions, crack patterns and self-propulsion

Synthesis of anisotropic particles



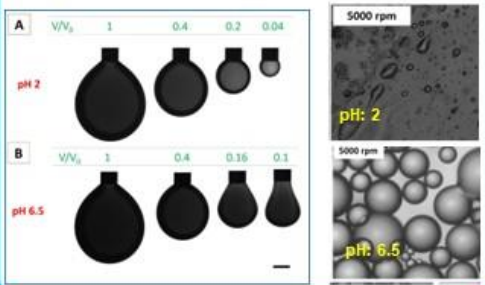
Self-assembly of anisotropic particles:

The main objective of this work is controlling the self-assembly structure of anisotropic particle without external fields.



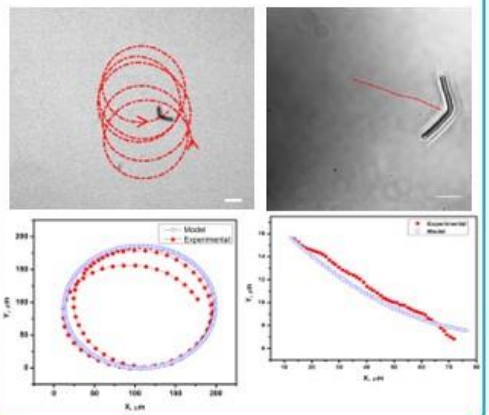
Particle adsorption at interface:

The main focus of this work is understand the particle adsorption at fluid-fluid interface as a function particle surface charge and control the emulsion and capillary suspension stability.



Self-propulsion of bimetallic coated particles:

We are studying the self-propulsion of bimetallic coated particles in hydrogen peroxide solution in order to understand the particle shape effects on self-propulsion behavior.



Dr. Mahesh Ijjada

Academic Profile:
M.Tech., & Ph.D, Indian Institute of Technology, Bombay (2018)
B.Tech, Osmania University, 2010

Professional Experience
Assistant Professor, Chemical Engineering, IISER Bhopal (2021 - Present)
Post-Doctoral Researcher, Case Western Reserve University,(February 2019 - February 2021)

Laboratory of Electrochemical and Energy Materials (LEEM)

Research Areas

- Electrochemical processes: Water electrolysis, Fuel cells, Carbon dioxide reduction to fuels, electrochemical deposition
- Nanomaterials: Design, synthesis and physico-chemical characterization of electrocatalysts (nano-alloys, core@shell structures).

Key Achievement

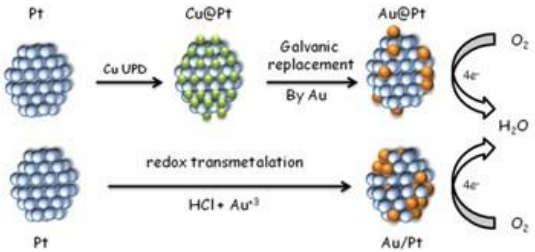
- Start-up research grant by SERB

Laboratory of Electrochemical and Energy Materials (LEEM)

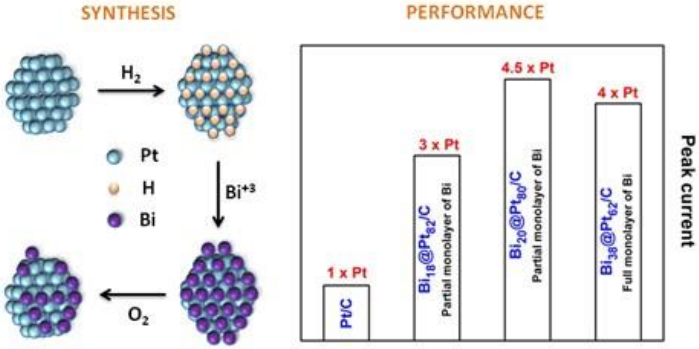
Electrochemical energy conversion

The group works on the design and synthesis of the electrocatalysts for the energy conversion devices. This includes core@shell and alloy nanoparticles. The group also focuses on the design of electrolyzers for water electrolysis

Approaches:



Atomic layer deposition by under potential deposition



Controlled deposition of Bi shell and catalytic performance for ethanol oxidation

Applications:

Water electrolysis, Fuel cells, Carbon dioxide conversion to fuels

Dr. Sweta Lal

Academic Profile:

Ph.D, Indian Institute of Technology Hyderabad (2019)
M.Tech, Malaviya National Institute of Technology, Jaipur (2014)
B.Tech, Banasthali University (2012)

Professional Experience

Assistant Professor, Chemical Engineering, IISER Bhopal (July 2021- Present)
Research Associate, Hindustan Petroleum Green R&D Center, Bengaluru (March-June, 2021)

Paper-based Electrochemical Energy Devices and Sensors Lab

Research Areas

Our research group primarily focuses on:

- Development and fabrication of cost-effective and disposable electrochemical energy devices and sensors based on paper-scaffolds. The applications of these devices encompass energy conversion, electrochemical sensing and biosensing applications.
- Development of self-powered diagnostics devices on flexible platforms, such as paper, for quantitative analysis of different biomarkers.
- Synthesis and characterization of electrocatalysts for electrochemical energy devices and systems.
- Mathematical modelling of fluid flow in paper-based energy devices.

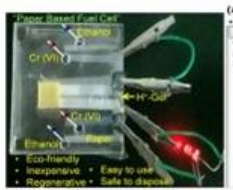
Key Achievement

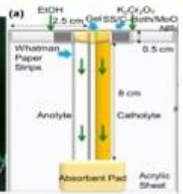
- SERB-International Travel Support, 2017.
- Gold Medal, M.Tech Chemical Engineering, NIT Jaipur, 2015.
- Qualified GATE (Chemical Engineering), 2012 & 2014.
- Merit Rank-1, B.Tech (all branches), Banasthali University, 2011.

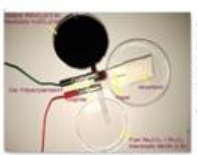
Paper-based Electrochemical Energy Devices and Sensors Lab

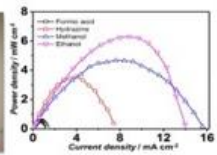
Our research group is interested the development and fabrication of paper-based electrochemical energy devices, paper-based electrochemical sensors and synthesis of electrocatalysts for these systems.

Fuel Cells on Paper-based Scaffold





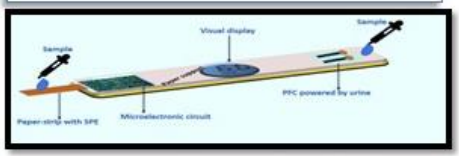




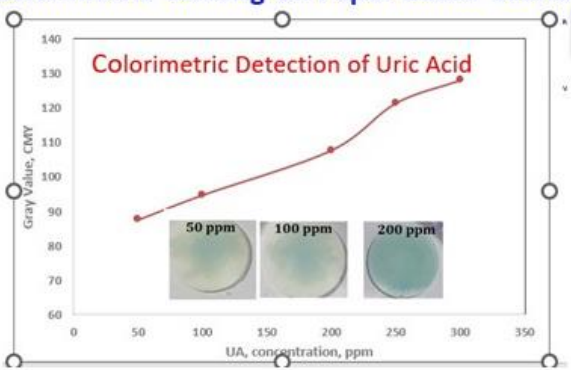
Development and fabrication of cost-effective and disposable electrochemical energy devices and sensors based on paper-scaffolds. The applications of these devices encompass energy conversion, electrochemical sensing and biosensing applications.

Self-Powered Paper-based Analytical Devices

Development of self-powered diagnostics devices on flexible platforms, such as paper, for quantitative analysis of different biomarkers.

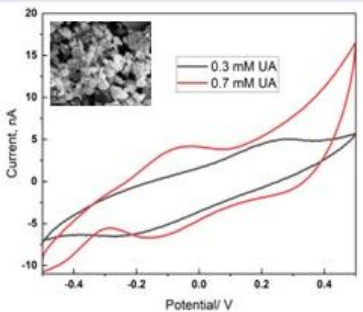


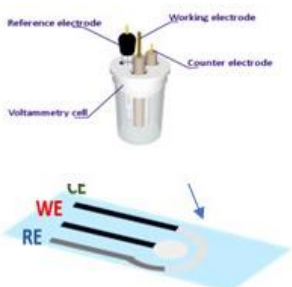
Colorimetric Sensing on Paper-based Scaffold



Electrochemical Sensing on Paper-based Scaffold

Electrocatalysts for electrochemical energy devices and systems.





Dr. Rohit Ranganathan Gaddam

Academic Profile:

Ph.D, University of Queensland (UQ), Australia (2019)
M.Tech(Integrated), Amity University, India (2014)

Professional Experience

Assistant Professor, Chemical Engineering, IISER Bhopal (2021- Present)
Alexander von Humboldt Fellow, School of Physics, Technical University of Munich (Mar 2020 – Sept 2021)
Postdoctoral Research Fellow, School of Chemical Engineering, The University of Queensland (UQ), Australia (Dec 2018- Nov 2019)

Clean Energy Research Group

Research Areas

- Solid-State Electrolytes
- Alkali-metal batteries (Li, Na, and K)
- Aqueous battery systems for grid storage
- Development of analytical techniques to understand electrode-electrolyte interactions
- Material synthesis and optimization for energy applications

Key Achievement

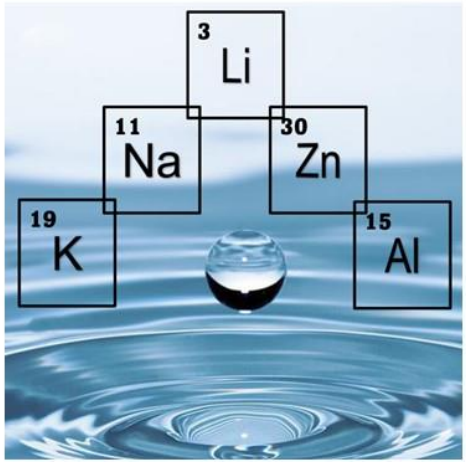
- Awarded with a start-up research grant from SERB (2022)
- Alexander von Humboldt Fellowship (2019)
- Carl Friedrich von Siemens Supporting Fund (2019)
- IPRS and UQ Centennial Scholarship (2015)
- 35+ publications in high-impact journals, few book chapters, edited book with 1359+ citations and H-index of 19

Clean Energy Research Group

Dr. Gaddam's Research Group is located at the Chemical Engineering Department of the Indian Institute of Science Education and Research (IISER), Bhopal, India. We work on clean energy technologies and focus on finding solutions to overcome the bottlenecks in present-day energy storage systems. Our research interests are multidisciplinary, and we work to understand fundamental science and contribute equally to technological developments.

Our Interests

- Aqueous, organic, and all-solid-state batteries
- Advanced material synthesis
- Fundamental understanding of electrochemical processes
- Development of characterization techniques
- Understanding electrified interfaces



Email: rohitg@iiserb.ac.in **Office: +91 755 269 2617** **Group Homepage: https://bit.ly/3vxjPEA**

Dr. Akshay Modi

Academic Profile:

Ph.D. (Chemical Engineering), Indian Institute of Technology Bombay, India (2020)
M.Tech. (Chemical Engineering), Indian Institute of Technology Kanpur, India (2015)
B.Tech. (Chemical Engineering), National Institute of Technology Srinagar, India (2013)

Professional Experience:

Assistant Professor, Chemical Engineering, IISER Bhopal (April 2022 onwards)
Prestigious Blaustein Postdoctoral Fellow, Ben-Gurion University of the Negev, Israel (July 2020 – April 2022)

Advanced Materials (AM) Research Group

Research Areas

1. Membrane technology
2. Nanostructured materials
3. Water and wastewater treatment
4. Gas separations
5. Microbial fuel cells
6. Biomedical engineering

❖ Key Research Articles (Total Article: 27 & h-index: 19)

1. Modi *et al*. Chemical Engineering Journal 434 (2022) 133513
2. Modi *et al*. Separation and Purification Technology 249 (2020) 117160
3. Modi *et al*. Electrochimica Acta 190 (2016) 620-627

Key Achievements

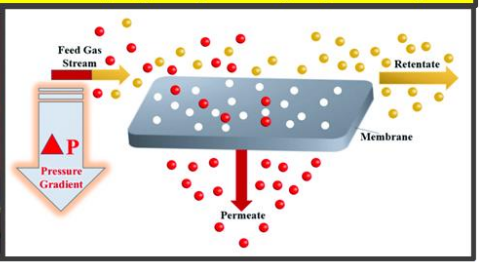
1. DST-INSPIRE Faculty Fellowship (2022-2027)
2. Early Career Board Member, Chemical Engineering Journal, Elsevier (May 2022 onwards)
3. Topical Advisory Panel Member, Applied Sciences, MDPI (August 2021 onwards)
4. Topical Advisory Panel Member, Membranes MDPI (March 2022 onwards)
5. Indian/PCT Patents/Patent Applications – 7 Granted and 5 Under Examination
6. Invited Reviewer for the Elsevier, ACS, Taylor & Francis, Springer Nature and MDPI journals.

Advanced Materials (AM) Research Group

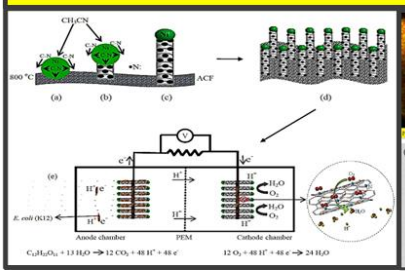
Principal Investigator: Dr. Akshay Modi
Email ID: akshaymodi@iiserb.ac.in

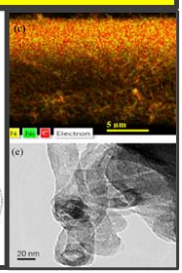
1. To make innovations in manufacturing advanced materials (membranes and nanostructured materials), and processes thereof
2. Application domains: Energy, Environment, and Biomedical
3. Focus Sectors: Municipal and Industry

Application Domain 1: Gas Separations (e.g., CO_2 and H_2 Separation)

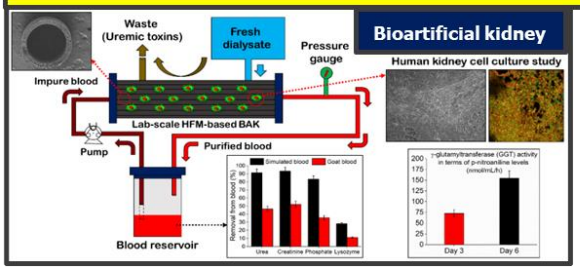


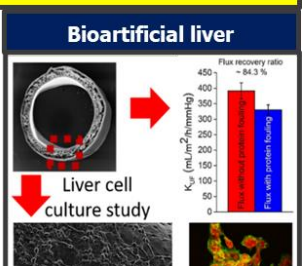
Application Domain 2: Energy Applications



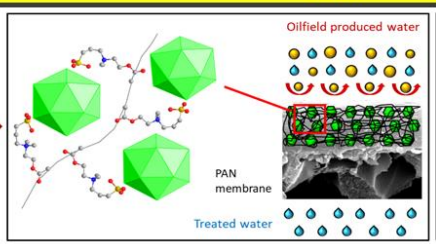


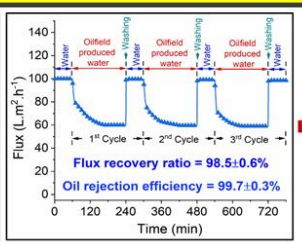
Application Domain 3: Biomedical Applications (e.g., Bioartificial Organs)

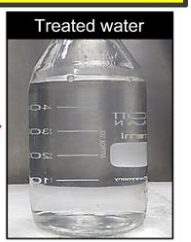


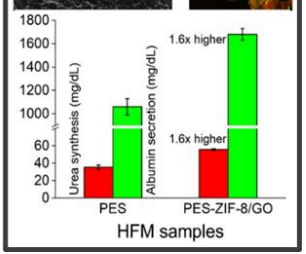


Application Domain 4: Water Reclamation (e.g., Industrial Wastewater Treatment, Desalination)





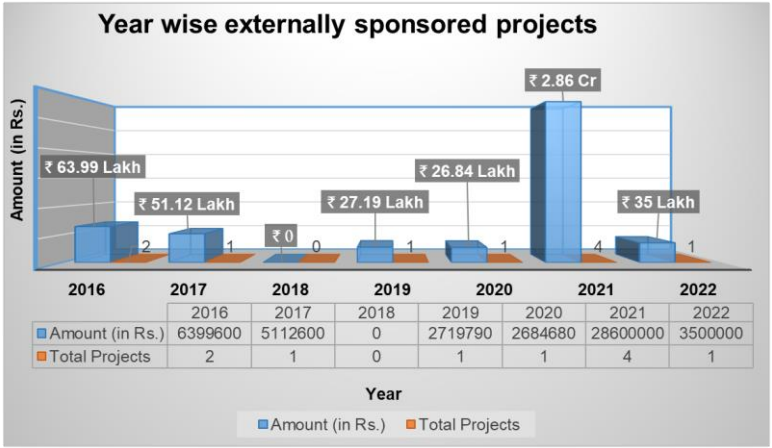




PhD Profile

S. No.	Student Name	Mentor	Year of Joining
01	Aadil Hashim Saifi	Dr. Manoj Kumar Tripathi	July 2016
02	Bablu Alawa	Dr. Sankar Chakma	July 2017
03	Anant Kumar Nema	Dr. Manoj Kumar Tripathi	Dec 2017
04	Manju Nagar Galodiya	Dr. Sankar Chakma	Dec 2017
05	Vyankatesh Manoj Mundhada	Dr. Manoj Kumar Tripathi	July 2018
06	Prachi Upadhyay	Dr. Sankar Chakma	July 2018
07	Roop Singh Lodhi	Dr. Paramita Das	Dec 2018
08	Pankaj Kumar	Dr. Paramita Das	July 2019
09	Madhvi Tiwari	Dr. Venkateshwar Rao Dugyala	July 2019
10	Aman Tripathi	Dr. Manoj Kumar Tripathi	July 2020
11	Himanshu Kumar Bhatt	Dr. Paramita Das	Dec 2020
12	Mohnish Lakhera	Dr. Manoj Kumar Tripathi	Dec 2020
13	Gaurav Gurjar	Dr. Venkateshwar Rao Dugyala	Dec 2020
14	Megha Verma	Dr. Venkateshwar Rao dugyala	Dec 2020
15	Sharad Dnyanu Pinjari	Dr. Rohit Ranganathan Gaddam	Dec 2021
16	Akshay Singh	Dr. Sweta Lal	July 2022
17	Yashraj Soni	Dr. Rohit Ranganathan Gaddam	July 2022
18	Vignesh Raja P	Dr. Mahesh Ijjada	July 2022
19	Animesh Jana	Dr. Akshay Modi	July 2022

Sponsored Projects



	2016	2017	2018	2019	2020	2021	2022
Amount (in Rs.)	6399600	5112600	0	2719790	2684680	28600000	3500000
Total Projects	2	1	0	1	1	4	1

Publications

	2015	2016	2017	2018	2019	2020	2021	2022
Number of publications	1	5	7	5	11	7	8	9

Department Activities

Alumni Profile

Aditya Patidar
Degree- BS-MS, Year of Passing-2022
Presently Pursuing PhD at IIT Kanpur

Anasua Barman
Degree- BS, Year of Passing-2022
Presently Pursuing Master of Science in at Katholieke Universiteit Leuven, Belgium

Adarsh Goswami
Degree- BS-MS, Year of Passing-2022
Presently Pursuing MTech from IIT Guwahati

Jitendra Choudhary
Degree- BS-MS, Year of Passing-2022
Presently Pursuing PhD at Texas, A&M University US

Prajna Sahu
Degree- BS-MS, Year of Passing-2022
Presently Pursuing PhD at IIT Kanpur

Shama Gode
Degree- BS, Year of Passing-2022
Presently Pursuing MTech at IIT Kharagpur

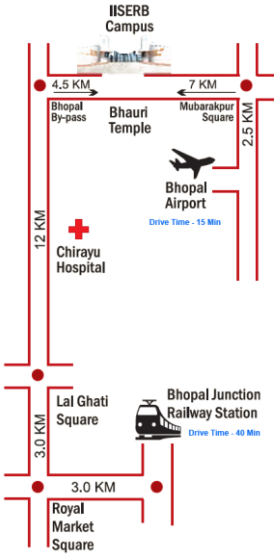
Viplav Kumar Bhondekar
Degree- BS-MS, Year of Passing-2022
Presently Pursuing PhD at IIT Bombay

Vishrant Kumar
Degree- BS-MS, Year of Passing-2022

Yashraj Soni
Degree- BS, Year of Passing-2022
Presently Pursuing PhD at IISER Bhopal

Aman Patel
Degree- BS, Year of Passing-2022
Working as a software Developer

How to reach IISER Bhopal



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