# School of Chemical Sciences


**Mahatma Gandhi University**
**Priyadarshini Hills Post, Kottayam , 686560**


# Research Profile of Faculty Members

## Biodegradable polymers

- Solid Phase synthesis of bioactive peptides
- Polymer-supported reagents and catalysts
- Synthesis of heterocycles and investigation of their biological properties
- Catalysis using enzyme like polymers
- Drug release studies using biodegradable polymers


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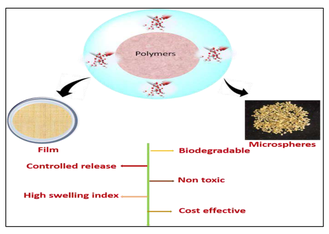


## Molecular self assembly


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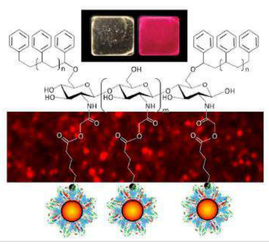
Photochemistry, Synthetic and Biopolymers, Hybrid Materials, Environmental Chemistry, Computational Chemistry



## Polymer science and technology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Our research group is focussing mainly on polymer macro, micro and nanocomposites, polymer foams and their blends


- Development and property improvements of polymer composites for high end automotive, aerospace and structural applications.
- Development of fully biodegradable, green and sustainable polymer composites from natural fibers, biopolymers etc. for industrial application.
- Electronic applications of polymer nanocomposites such as nanogenerators, electromagnetic shielding (EMI) etc.
- Biomedical applications of polymer composites for effective wound healing.
- Development of biofiller entrapped polymer nanocomposites for water remediation.

## Pathway controlled preferential crystallization of conglomerates


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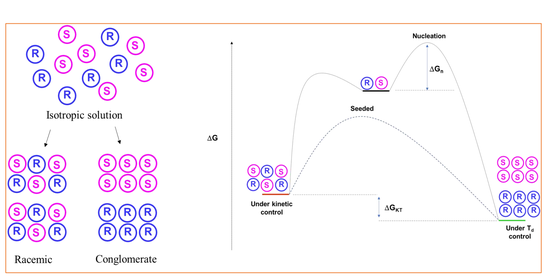


In pharmaceutical industry, conglomerate crystallization is the most suitable technique of deracemization to enrich the enantiomers of an optically active form. A general solution for preferential crystallization is to induce deracemization by applying various stimuli. However, development of a general protocol for deracemization still remains as a challenging task since such methods are unpredictable and lack fundamental understanding . To understand the complex conglomerate crystallization processes on different racemic systems, we focusses on the detailed experimental studies under variable experimental conditions

## Funding


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**Individual Funds**
(UGC, DST, DBT, CSIR, BRNS, Indian Council of Medical Research, Aeronautics R & D Board,KSCTE, UGC-DAE, Council of Scientific Research-Kolkata Centre, Indo -Czech, Indo-Poland and ISRO projects)


## Photocatalysis and sensing


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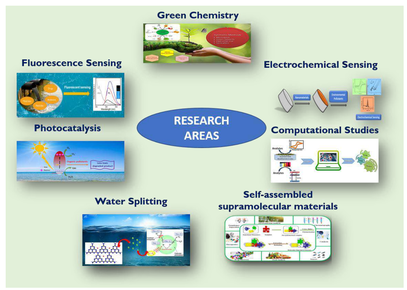


- The synthesis of self-assembled supramolecular materials for various applications
- Nanomaterial based fluorescence and electrochemical sensing
- Photocatalytic degradation for waste water treatment
- Water splitting for hydrogen generation
- Computational aspects of electrochemical and fluorescence sensing applications of nanomaterials.

## Polymeric materials for biomedical applications


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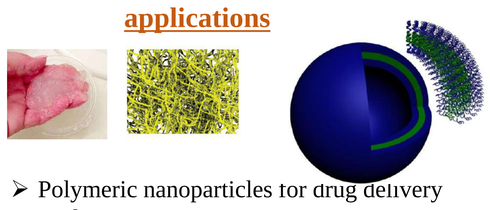

- Polymeric nanoparticles for drug delivery applications
- Hybrid polymer-peptide hydrogels for cell therapy
- Au NPs incorporated block copolymer nano composites to prepare metamaterials
- Natural and synthetic polymeric hydrogels

## Polymer functionalization and Supported Transition metal catalysis


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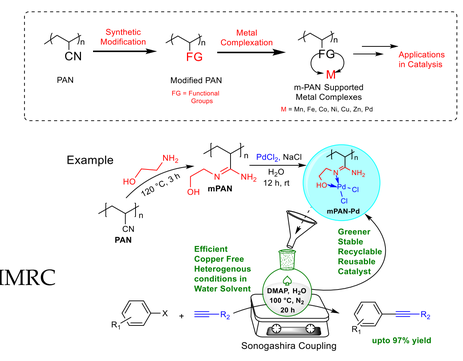


- Development of transition metal catalyzed reactions.
- Synthetic modifications of polymers and subsequent studies.
- Preparations and studies of various polymer blends/composites.
- Synthesis and applications of novel polymer supported transition metal catalysts.

## Design and development for semiconducting nanomaterials for energy applications


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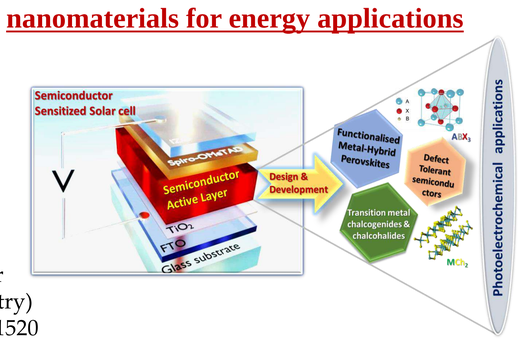


Our group is focussing mainly on the design and development of efficient and low cost semiconducting nanomaterials for photovoltaic and photoelectrochemical applications via exploring the chemistry of materials. Defect tolerant properties of Semiconductors are also investigating towards improved efficiency of semiconductor sanitized solar cell.

## Development of polymer blends and nanocomposites for high-performance applications


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## Transition metal catalysis


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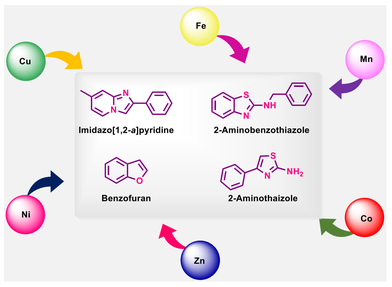
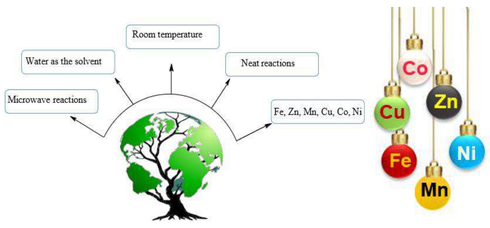
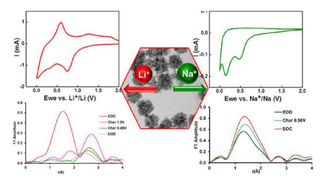
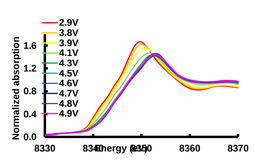



- Exploring 3d series active transition metals in catalysis, particularly for coupling reactions, C-H activation etc.
- Synthesis of nitrogen, oxygen and sulphur containing heterocycles such as
- 2-aminobenzothiazole, 2-aminothaizole, imidazo[1,2-*a*]pyridine, benzofuran etc. via transition metal catalysis.
- Novel methods for the establishment of C-C and C-Heteroatom bonds.
- Synthesizing pharmacologically important molecules under microwave, neat and on-water conditions by using Cu, Fe, Zn, Mn, Co and Ni as the eco-friendly catalysts.

## Development and operando diagnostic of batteries and fuel Cells





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**Materials Development and Operando Characterization of energy storage and conversion devices**

- Our group mainly focus on the development of batteries (Li-ion, Na-ion, Metal-Air Redox flow ) and Fuel Cells ( PEM, Alkaline PEM and HT-PEM).
- Operando diagnostic of batteries and fuel cell by X-ray Absorption and Emission Spectroscopy to elucidate the operating mechanism

## Natural Product Chemistry and Catalysis


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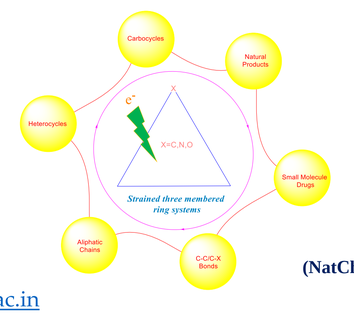


(NatChemCat@MGU)

Our group aiming at and striving to investigate chemical reactions driven by visible light-enabled metal-free photoredox catalysis. Our effort is to explore novel synthetic methods employing relatively simple, cheaply available strained ring systems to enable hitherto elusive C-C/C-heteroatom bond constructions to harvest diverse organic small molecules, thereby extending its synthetic significance to the areas of pharmaceutical, medicinal, and material research.

## Programmable supramolecular polymerization of discrete π-system


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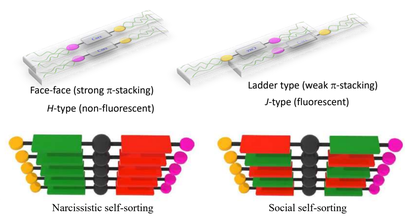


- Control over molecular packing in supramolecular polymerization of p-systems through molecular design
- Fabrication of diverse nano architectures based on p-systems with tunable optical properties via controlling the molecular packing

**Thank You**