

An Indian-Australian research partnership

Project Title: **Development of Stimuli Responsive Materials for Energy Applications**

Project Number **IMURA0734**

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Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address?

(Feel free to nominate more than one. For more information, see www.iitbmonash.org)

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. **Clean Energy**
4. Water
5. **Nanotechnology**
6. Biotechnology and Stem Cell Research
7. Humanities and Social Sciences

The research problem

Define the problem

Energy storage and generation is the current problem at hand due to large demand for energy usage. With depletion of fossil fuel, the current situation is expected to get aggravated thereby requiring immediate attention. Several strategies are being explored in this pursuit and development of stimuli responsive materials is expected to be the workhorse for next generation of energy storage devices. The advantage of using these materials is that energy could be stored or discharged as per requirement on exposure to external stimuli such as light, pH, temperature, mechanical stress, fields, etc. to name a few. These materials alter their physical or chemical properties upon exposure to one or more of such stimuli. Light is probably the fastest stimulant. This project is designed to explore the properties of light responsive polymeric material in energy storage devices. The student will be required to perform extensive literature review and understand the concepts related to such materials and charge storage mechanisms in energy storage devices. The student is expected to work towards synthesis of light responsive polymers and develop novel concept to incorporating them in energy storage solutions. This will be followed by materials characterization such as optical spectroscopy, structural analysis using X-rays along with microscopy (SEM, TEM, AFM). Further these will also be characterized electrochemically and several techniques such as impedance spectroscopy, CV, charge-discharge techniques etc will be used. The project will also involve a computational part in which the student will be required to do molecular simulations to develop an understanding at molecular or atomistic scales.

Project aims

Define the aims of the project

Synthesis of novel light responsive polymeric materials
Materials characterizations
Electrochemical characterization
Development of strategies for energy storage devices

Expected outcomes

Highlight the expected outcomes of the project

New hybrid devices, Novel light responsive materials

How will the project address the Goals of the above Themes?

Describe how the project will address the goals of one or more of the 6 Themes listed above.

The project is aimed towards energy storage solutions and will be using nanomaterials for the same.

Capabilities and Degrees Required

List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.

Bachelors/Masters in Physics/ Chemistry/Materials Science/ Electrical engineering/Chemical Engineering/Polymers and any relevant branch of engineering

Potential Collaborators

Please visit the IITB website www.iitb.ac.in OR Monash Website www.monash.edu to highlight some potential collaborators that would be best suited for the area of research you are intending to float.

Please provide a few key words relating to this project to make it easier for the students to apply.

Energy storage, Stimuli responsive polymers, synthesis, characterization, electrochemistry