

An Indian-Australian research partnership

**Project Title:** **Development of graphene-based composite materials for supercapacitors**

**Project Number** **IMURA0668(1)**

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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](http://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*

Recently carbon based materials have been explored for electrochemical applications and supercapacitors is one of them, The advantage of using carbon based materials is that they are environmentally friendly, however, most of these materials suffer from low specific capacitance and energy densities. Hence it is desirable to explore novel carbon based composite materials for supercapacitor applications. In this pursuit, the aim of the project would be to do an extensive literature review and understand the physical concepts related to charge storage mechanisms in supercapacitors. The student is expected to work towards synthesis of novel graphene based materials which could be used as electrodes for supercapacitors. 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.

## Project aims

*Define the aims of the project*

Synthesis of suitable graphene based nanocomposite electrode material and its characterization using advanced characterization techniques  
Electrochemical characterization of the electrode material, fabrication and characterisation of supercapacitor

## Expected outcomes

*Highlight the expected outcomes of the project*

New composite materials for application as electrodes in supercapacitors  
Prototype device in form of supercapacitor

## 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 aim of the project is to synthesize nanocomposite for electrode materials in supercapacitors which are energy devices.

## 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 and any relevant branch of engineering

## Potential Collaborators

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

Prof. Raman Singh

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

**Supercapacitors, synthesis, characterization, electrochemistry**