IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	**Graphene based organic electronic devices**	
Project Number	**IMURA0360**	
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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

The research problem

Define the problem:

The project will focus on graphene based organic electronic devices such as organic solar cells and organic thin film transistors. Graphene is known to have ultrahigh carrier nobilities, optical transparency and high mechanical strength, which enables them to have several applications in transparent and flexible electronics. However, their solution processability is still tough and requires innovative functionalization methods to form good dispersions without compromising on the electrical properties. Hence, a dedicated study to form suitable graphene dispersions, film deposition and characterisation is highly essential to enable their usage in the aforesaid electronic devices. Once optimized, the project will then aim to fabricate organic solar cells and organic transistors using polythiophene:fullerene blends and pentacene, respectively, as active layers. The fabricated devices will then be characterized to study their electrical, optical and structural behaviour.

Project aims

Define the aims of the project

1. To optimize the film deposition process of graphene based solutions

2. To study the structural, electrical and optical characterization of the deposited films

3. To fabricate and characterize organic electronic devices such as organic solar cells and organic thin film transistors

Expected outcomes

Highlight the expected outcomes of the project

1. *Process development for graphene based solutions and investigating whether they can be used as transparent conducting electrodes or as semiconductor material.*
2. *Demonstration of organic solar cells and transistors utilizing the developed graphene based solutions*

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 research area in the field of graphene based organic electronic devices can be considered as sub-research area of 'Nanotechnology', wherein graphene based solutions will be used for making electrically conducting films. Here, not only the material, but also the process of solution formation is occurring at the nanoscale. Further, the charge transport behaviour in the graphene based film also has to be seen at nanoscale level.

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.

1. We are looking for 1 Ph.D. student in this project; Candidates would be desirable with following academic background
2. M.Tech in Materials Science & Engineering
3. M.Sc in Physics