

An Indian-Australian research partnership

**Project Title:**

**Project Number**

Monash Supervisor(s)  *Full names and titles*

Monash Primary Contact:   
 *Email, phone*

IITB Supervisor(s)  *Full names and titles*

IITB Primary Contact:   
 *Email, phone*

## 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

## The Research Problem

*Define the problem*

Graphene—a 2D structure with a honeycomb carbon lattice—is attracting tremendous attention as a promising material for next generation optoelectronic devices. Recent advances in graphene growth using chemical vapor deposition techniques provide a pathway for the large-area synthesis of graphene—a significant step in making graphene-based devices commercially feasible. This project aims to investigate the chemical and electronic properties of graphene grown using chemical vapor deposition techniques, with a particular emphasis on understanding the mechanisms of nucleation and growth of graphene on substrates of technological importance. These experimental observations will be supported by atomistic molecular dynamics and first principles calculations.

## Project Aims

*Define the aims of the project*

- i) Develop an experimental setup for large-area synthesis of graphene using chemical vapor deposition
- ii) Using atomic-level microscopy and imaging techniques, identify nucleation and growth mechanisms,
- iii) Conduct simple preliminary measurements for graphene devices, and
- iv) Perform atomistic molecular dynamics and first principles simulations to understand experimental observations for nucleation and growth mechanisms.

## Expected Outcomes

*Highlight the expected outcomes of the project*

This project will develop CVD system design and analysis tools for the controlled growth of graphene. By controlling growth mechanisms on various substrates, our study will provide a strategy to control large-scale electronic and chemical properties of graphene devices.

## 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.*

On the account of its novel physical and electronic properties, graphene—the central topic of our study—is a potential candidate for the next-generation nanoscale electronic devices. This project also involves atomistic simulations requiring high-performance computing. Therefore, our project will address the goals of both the themes highlighted above.

## 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.*

Persons with the following degrees should be considered eligible:

- i) M.Sc. In Physics
- ii) B.Tech/M Tech degree in various engineering disciplines with background in applied physics, or
- iii) B Tech/M Tech degree in Engineering Physics/Nanoscience/Nanotechnology

Capabilities: An ideal candidate will have some experience and interest in basic programming languages (Fortran/C/C++/MATLAB).