

Project Title:

Project Number

Monash Main Supervisor
(Name, Email Id, Phone) *Full name, Email*

Monash Co-supervisor(s)
(Name, Email Id, Phone)

Monash Head of Dept/Centre (Name,Email) *Full name, email*

Monash Department:

Monash ADGR
(Name,Email) *Full name, email*

IITB Main Supervisor
(Name, Email Id, Phone) *Full name, Email*

IITB Co-supervisor(s)
(Name, Email Id, Phone) *Full name, Email*

IITB Head of Dept
(Name, Email, Phone) *Full name, email*

IITB Department:

Research Clusters:

Research Themes:

| Highlight which of the Academy's CLUSTERS this project will address? <i>(Please nominate JUST <u>one</u>. For more information, see www.iitbmonash.org)</i> | | Highlight which of the Academy's Theme(s) this project will address? <i>(Feel free to nominate more than one. For more information, see www.iitbmonash.org)</i> | |
|---|--|---|---------------------|
| 1 | Material Science/Engineering (including Nano, Metallurgy) | 1 | Clean Energy |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |

The research problem

This project is related to next generation organic solar cell technology where the scholar will be working with high performance non-fullerene based acceptor molecules in bulk heterojunction organic blends. The power conversion efficiency of organic solar cells has crossed the 20% mark with a scope for further development in applied research aspects. However, there are many interesting fundamental issues relating to underlying mechanisms that will aid further developments. This includes the origin of process dependent morphological changes and its impact of solar cell operation.

Project aims

Overall the scope of this project is to understand structure-function relationships in this novel class of photovoltaic material using advanced characterization techniques to provide a deeper insight of solar cell operation. Morphological, structural and optoelectronic properties of these BHJ blend will be studied.

How skills/experience of the IITB and the Monash supervisor(s) support the proposed project

Photophysics and device optimization will be carried out at IIT Bombay. Structural studies will be performed at Monash University covering both synchrotron-based X-ray characterization (performed in the group CRM who has expertise in this area) and cryo electron microscopy (performed in the group of AL who is an electron microscopy expert).

What is expected of the student when at IITB and when at Monash?

Highlight how the project will gain from the students stay at IITB and at Monash

First 1 year student stays at IIT Bombay to work on optimization of device fabrication and learns advanced micro-spectroscopic characterization.

Students visit 6 months to CRM group and 6 months to AL group to study structural and microscopic characterizations on the samples prepared either at IITB or at CRM group.

Expected outcomes

Highlight the expected outcomes of the project

A fundamental understanding of complex bulk-heterojunction blends is an essential need for further development of organic solar cells. It is going to be beyond efficiency number explanation but also towards stability factor, where aging of devices introduces a change in morphology of BHJ blend.

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.

Novel functional hydrocarbon materials with semi-conducting properties and energy is well suited for described project proposal.

Potential RPCs from IITB and Monash

Provide names of the potential research progress committee members (RPCs) and describe why they are most suited for the proposed project

Anil Kumar, Chemistry Department – IIT Bombay
Known expertise with organic semiconductor material system

Nikhil Bhandarkar, Materials Science, Monash

Known expertise with materials science subject and been as RPC for similar area of proposal for last two scholars for same team of supervisors.

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.

MSc (Physics or Material Science)

B.Tech. (Eng. Phys.)

M.Tech. (Solid State Phys)

M.Tech. (Photonics)

M.Tech. (Materials Science/engineering)

M.Tech. (energy science/engineering)

Necessary Courses

Name three tentative courses relevant to the project that the student should complete during his/her coursework at IITB (the student will require to secure 8 point in these courses)

Thin-film fabrication and characterization

Physics of Solar Cells

Condense Matter Physics

Microscopy

Spectroscopy

Select up to **(4)** keywords from the Academy's approved keyword list (**available at <http://www.iitbmonash.org/becoming-a-research-supervisor/>**) relating to this project to make it easier for the students to apply.

Novel functional materials, semiconductor, nanoscience, energy