

An Indian-Australian research partnership

Project Title:	Mechanics of Multi-functional Polymer Thin Films	
Project Number	IMURA0384	
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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

Measure and model the mechanical behaviour of multi-functional thin films (sub 10 micron) used in MEMS/Microfluidic applications.. The main focus would be on polymer and polymer composite (carbon, ZnO) films. Multifunctional polymer nanocomposite films, where piezoelectric sensing components are embedded in a thin (approximately 10 μm thick) and flexible substrate have a great potential for a wide range of sensor applications (ranging from biomedical devices to structural health monitoring). The student working on this project will focus on the development and characterisation of carbon and ZnO polymer composite films. Specifically he/she will investigate their mechanical and electrical performance through novel processing methods, in-situ experiments and constitutive modelling.

Project aims

1. Develop new microfabrication methods for freestanding polymeric/polymer-composite films with electrical and piezoelectric properties.
2. Understand their mechanical-electrical-piezoelectric response using in situ experiments

3. *Modelling their time dependent mechanical behaviour using continuum and other relevant methods (e.g., MD)*
4. *Investigate applications of the films for biomedical sensing.*

Expected outcomes

1. *Novel processing methods for polymer films and their constitutive models for improved/multi-functional properties.*
2. *Publications in leading polymer-polymer composite journals.*

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

1. *The mechanical behaviour under various loading conditions will be computationally modelled to predict their response for device design.*
2. *The functional polymeric films will contain nanolayers and nanofillers to generate electrical and piezoelectric properties along with desired mechanical response.*

Capabilities and Degrees Required

1. *BTech or MTech degree in Mechanical Engineering with good academic background.*
2. *Interest in experimental work and some knowledge of programming in Matlab, C or Fortran are desirable.*