

An Indian-Australian research partnership

Project Title: **Morphological and rheological characterization of immiscible polymer blends involving nano-filler**

Project Number **IMURA0343**

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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

Nano-filler based polymer nanocomposites have gained considerable research interest in academic as well as in industrial community in recent years. This is primarily due to the intrinsic mechanical, thermal and electrical properties associated with the nano-filler. In this context, it has also been realized that nano-filler also act as an efficient compatibilizer in immiscible polymer blend, which includes organically modified clay, carbon nanotubes, graphene oxide and nanosilica. However, the mechanism behind the compatibilization is still not clear in these blend system.

The current project will involve a systematic investigation of the role of carbon nanotubes and graphene oxide in various immiscible blends through morphological and rheological studies of the blends. The effect of the nano-particle as a compatibilizer will be evaluated through dynamic mechanical analysis.

Project aims

Define the aims of the project

1. To study the morphology of the blends in the presence of nano-filler via TEM and SEM
2. To study the rheological characterization of these blends in the presence of nano-filler
3. To evaluate mechanical properties through dynamic mechanical thermal analysis

Expected outcomes

Highlight the expected outcomes of the project

1. To investigate whether nano-filler (with surface modification/functionalization) can potentially be an alternative for polymeric compatibilizer
2. To investigate whether mechanical properties can be tuned with these nanofillers with respect to their localization (in any of the phases or at the interface)

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 carbon nanotubes and graphene (graphene oxide) based polymer nano-composites can be considered as sub-research area of 'Nanotechnology', wherein carbon nanotubes (graphene oxide) are aimed to disperse in their molecular dimension in a bulk polymer matrix, which should alter the mechanical and thermal properties of the polymer nanocomposites and may exhibit various functional properties.

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 2 Ph.D. students in this project; 1 Ph.D. student has to devote 100% of the time for TEM investigation; candidates who have worked in the area of polymer composites involving carbon nanotubes/graphene would be desirable.
2. M.Tech in Polymer/Fiber Science/materials Science & Engineering/Corrosion Science & Engineering
3. M.Sc in Physics, Chemistry with 2-3 years research experience