IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Dispersion and confinement of multiwall carbon nanotubes in immiscible polymer blends

Project number: IMURA0027

Monash University supervisors: Professor George Simon
Monash University contact: Professor George Simon; Email: George.Simon@eng.monash.edu.au

IITB supervisors: Arup R Bhattacharyya
IITB contact: Arup R Bhattacharyya; Email: arupranjan@iitb.ac.in

The problem

Conductive polymer blends have been recently exploited as promising candidate for potential applications in antistatic devices, EMI shielding materials, bipolar plates for PEM fuel cell and sensors. In fact, the motivation behind designing conductive polymer blends at very low level of conductive filler stems from the synergistic improvements in the blends properties associated with the co-continuous morphology in polymer blends. It is well established that confining conductive filler in any one of the phases of a co-continuous binary immiscible polymer blends or at the interface is an efficient strategy to reduce the electrical percolation threshold by employing the concept of 'double percolation'. The localization of conductive filler in a specific phase or at the interface of an immiscible polymer blends is dependent on the shear forces, rheology of each polymer phase and difference in the affinity of fillers to each component of the polymer blends during processing. In addition, selective localization of conductive filler in one of the phases of immiscible polymer blends can be achieved by utilizing specific interactions between conductive filler and one of the phases. However, conductive filler can also be localized at the interface by selecting a suitable reactive compatibilizer such that the conductive filler preferentially interacts with the compatibilizer and resides at the interface. It is particularly important and strategic to investigate this with anisotropic particles such as CNTs, as their shape factor may mean very low concentrations are required (compared to spherical particles, for example). Also of much interest is the effect these particles have on morphology modification, and on interfacial adhesion, as manifest in mechanical properties.

The project

The research work will focus on the 'network-like structure' formation of the multiwall carbon nanotubes through specific interactions either in one of the phases or at the interface in co-continuous immiscible polymer blends, which will be assessed through rheology, electrical conductivity and microscopic investigations.