Mechanical & Industrial Engineering
UNIVERSITY OF TORONTO

Thesis Projects (MIE498 H/Y) 2018–2019

Title/Topic:

Confining graphene at the continuous interface in multi-percolated polymer blend systems

Description:

Graphene exhibits extremely high thermal and electrical conductivities on the basal plane. However, in the through-plane direction, the conductivities are greatly reduced, limiting the performances of graphene/polymer nanocomposites. One promising approach to solve this problem is to align the graphene sheets by confining these fillers at a 2D continuous interface of a polymer blend. Moreover, the localization of graphene at the polymer interface can also significantly reduce the percolation threshold due to a volume exclusion effect. However, due to the high surface area of graphene, even there is a slight preferential interaction between graphene and one polymer, graphene is readily drawn to that phase instead of being situated at the interface. In this project, we will design a multi-percolated ternary blend system where a third polymer is assembled at the interface of the other two phases and form thin layer structures with a thickness down to 100 nm. The localization of graphene in the ternary system will be studied. Thermodynamic and kinetic factors will be controlled to confine graphene within the middle thin layer phase (equivalently a 2D interface). The thermal and electrical properties will be examined and the applications of the nanocomposites in thermal management, electromagnetic shielding and electrostatic dissipation will be explored.

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