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Abstract

Carboxyl terminated butadiene acrylonitrile (CTBN) was added to epoxy resins to improve the fracture toughness, and then two different lateral dimensions of graphene nanoplatelets (GnPs), nominally <1 μm (GnP-C750) and 5 μm (GnP-5) in diameter, were individually incorporated into the CTBN/epoxy to fabricate multi-phase composites. The study showed that GnP-5 is more favorable for enhancing the properties of CTBN/epoxy. GnPs/CTBN/epoxy ternary composites with significant toughness and thermal conductivity enhancements combined with comparable stiffness to that of the neat resin were successfully achieved by incorporating 3 wt.% GnP-5 into 10 wt.% CTBN modified epoxy resins. According to the SEM investigations, GnP-5 debonding from the matrix is suppressed due to the presence of CTBN. Nevertheless, apart from rubber cavitation and matrix shear banding, additional active toughening mechanisms induced by GnP-5, such as crack deflection, layer breakage and separation/delamination of GnP-5 layers contributed to the enhanced fracture toughness of the hybrid composites.

Keywords: A. Polymer-matrix composites (PMCs); B. Fracture toughness; B. Mechanical properties; B. Thermal properties