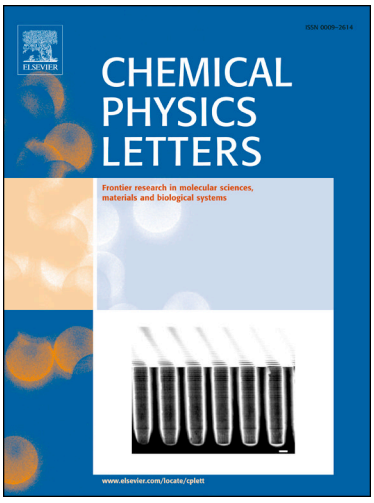

Research paper

Mechanical and Fracture Properties of Hyperbranched Polymer Covalent Functionalized Multiwalled Carbon Nanotube-Reinforced Epoxy Composites

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Mechanical and Fracture Properties of Hyperbranched Polymer Covalent Functionalized Multiwalled Carbon Nanotube-Reinforced Epoxy Composites

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Abstract: Using a covalent functionalization strategy, hyperbranched poly (trimellitic anhydride-diethylene glycol) ester epoxy resin (HTDE) was grafted on multiwalled carbon nanotubes (MWCNTs). Then the HTDE grafted MWCNTs (HTDE-g-MWCNTs) were used as toughener to prepare epoxy composites (HTDE-g-MWCNT/EP). The results show that the HTDE-g-MWCNTs are homogeneously dispersed in the epoxy matrix and the tensile strength and fracture toughness of HTDE-g-MWCNT/EP composites are enhanced. The property improvements are due to the enhanced interfacial shear stress and relieved internal residual stress. The main toughening mechanisms are pull-out, breakage of HTDE-g-MWCNTs, and their bridging effect to crack, and shear failure of epoxy matrix around HTDE-g-MWCNTs.

Keywords: Epoxy composites; HTDE; MWCNTs; Mechanical properties; IFSS; Toughening mechanism

1. Introduction

Carbon nanotubes (CNTs) have earned a great reputation in composite materials research for their unique physical, chemical, thermal, and mechanical properties [1]. CNT-reinforced polymer composites combine the mechanical properties of high strength, high elastic modulus, light weight, and high toughness [2]. These properties make CNTs an ideal reinforcing agent for high-performance polymer composites. In this view, multiwalled carbon nanotubes (MWCNTs) are more attractive from the standpoint of their excellent comprehensive performance when compared to