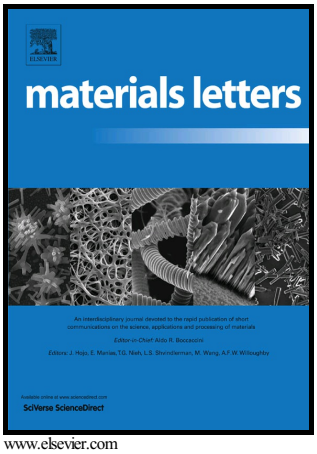

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Directly measuring interfacial shear strength between Polymethyl methacrylate and graphene nanoplatelets

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Abstract

Interfacial shear strength (IFSS) is the critical value for the stress transfer from low modulus materials to high modulus materials. However, due to the limitation of technology, direct and precise measurement of the IFSS is still challenging. In this work, we designed a sandwich structure by using two types of polymers, polymethyl methacrylate (PMMA) and polyvinyl alcohol (PVA), with the graphene nanoplatelets (GNPs) sandwiched between them to directly measure the IFSS. Then, an in-plane load was applied to shear the structure. By changing the GNP density covering the interface, we could obtain a series of mean IFSS. After linear fitting, we obtained the average IFSS between PMMA and GNPs which was 0.35 MPa when the GNPs covered areas reached 100%. The value is very close to the reported results.

Key words: Interfacial shear strength; graphene nanoplatelets; PMMA

1 Introduction

Graphene has attracted enormous attentions since reported in 2004 [1]. Due to its excellent physical and chemical properties, graphene may have a wide range of applications in a variety of engineering applications. Very recently, graphene based polymer composites have been extensively studied in order to improve electrical and mechanical properties of polymers. However, the preparation of single-layer graphene is quite expensive and involved in complicated process, which leads to a small yield. Attentions have been paid to graphene nano-platelets (GNPs), which have been studied for their use as reinforcements in polymer composites, especially for improving their mechanical properties including Young's modulus, tensile strength and toughness, as well as their electrical conductivity [2].

The mechanical properties of polymer composites are influenced by several aspects, such as dispersion, orientation and interfacial properties of the reinforcement [3]. Among them, the interfacial shear strength (IFSS) is the critically important value for the stress transfer from polymer to the reinforcement [4]. The existing stress transfer model for the two-dimensional reinforcement made the assumption that the plane of the platelet was bonded to the