INFLUENCE OF CARBON NANOTUBES ON THE PROPERTIES OF FIBER-REINFORCED THERMOPLASTIC COMPOSITES

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ABSTRACT

Fiber-reinforced polymer composites are widely used in structural applications. Whilst they have excellent in-plane mechanical properties, their interlaminar properties are limited by the weak matrix-fiber interfacial bonding. The incorporation of carbon nanotubes (CNTs) to these composites is one the most innovative strategies employed to overcome this drawback. The CNTs not only enhance the mechanical performance, but they can also provide additional functionalities. Recent research on these multiscale or hierarchical composites is mainly based on thermoset resins, and to date very few studies have been devoted to thermoplastics-based composites.

In this work, we developed poly (ether ether ketone) (PEEK) / single-walled carbon nanotube (SWCNT) / glass fiber (GF) laminates and investigated their morphology, thermal, mechanical and electrical properties. The laminates were fabricated by melt blending and hot-press processing. SWCNTs were synthesized by arc discharge and laser techniques. The influence of the incorporation of polysulfone as a compatibilizer for wrapping the CNTs[1] was compared to composites with the non-wrapped nanofillers. A remarkable enhancement in thermal stability and thermal conductivity was observed for the laminates with wrapped SWCNTs[2]. Significant improvements were also observed in stiffness, strength and toughness by the incorporation of SWCNTs dispersed in polysulfone. The laminates exhibited anisotropic thermal and electrical properties with out-of-plane values found to be lower than in-plane values in both cases. Short beam shear tests showed that laminates made of laser SWCNTs with compatibilizing agent had the highest interlaminar shear strength[3]. A detailed discussion of the influence of the SWCNTs content and type, as well as the presence of the compatibilizer, on the performance of these multifunctional PEEK-based laminates will be presented.

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