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Effectively enhanced mechanical properties of injection molded short carbon fiber reinforced polyethersulfone composites by phenol-formaldehyde resin sizing

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ABSTRACT:

This paper reports for the first time the effects of phenol formaldehyde (PF) resin sizing modification of short carbon fiber (SCF) on the mechanical properties of injection molded PF-treated SCF reinforced polyethersulphone (PES) composites. The PF-treated SCFs are fabricated by sizing PF on the SCF surfaces using a conventional sizing process and then cured availing of the high temperature during the extrusion and injection processes. To evaluate the influence of PF sizing on the tensile and flexural properties of PF-sized SCF/PES composites, the PF content relative to SCFs varies in a range of 0.0-30.0 wt%. The results show that the PF sizing on SCF surfaces leads to the improved wettability of the PES on the SCF surfaces and thus an obviously enhanced SCF/PES interfacial adhesion. As a result, both the tensile and flexural properties are effectively enhanced. The optimal PF content relative to SCFs is found to be 20 wt% for effectively improving the overall composite mechanical performance. Compared to the untreated case, the tensile/flexural strength and modulus are improved respectively by 22.2%, 28.4%, 12.9% and 4.4% at this optimal PF coating content. Due to the easy processing and low cost of PF sizing as well as the effectively enhanced mechanical properties of the injection molded composites, the PF-sizing methodology has a great potential for practical applications in short fiber reinforced high performance polymer composites.

Keywords: A. Phenol formaldehyde, A. Polymer-matrix composites (PMCs), A. Carbon fibers, B. Adhesion, D. Mechanical testing