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Markus A. Downey, Lawrence T. Drzal

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Toughening of Carbon Fiber-Reinforced Epoxy Polymer Composites Utilizing Fiber Surface Treatment and Sizing

Markus A Downey**, Lawrence T Drzal

Department of Chemical Engineering and Material Science, Composite Materials and Structures Center, 428 South Shaw Lane, Room 2100, Michigan State University, East Lansing MI 48824

Abstract

Toughening of fiber-reinforced epoxy composites while maintaining other mechanical properties represents a significant challenge. This paper presents an approach of enhancing the toughness of a DGEBA/mPDA-based carbon fiber-reinforced epoxy composite, without significantly reducing the static-mechanical properties such as flexural properties and glass transition temperature. The impact of combining an UV-ozone fiber surface treatment with an aromatic and aliphatic epoxy fiber sizing on composite toughness is investigated. Carbon fiber-epoxy adhesion was increased as measured by the single fiber interfacial shear test. The Mode I composite fracture toughness was enhanced by 23% for the UV-ozone fiber surface treatment alone. With the addition of an aromatic and aliphatic fiber sizing, the composite fracture toughness was further increased to 50% and 84% respectively over the as-received, unsized fiber. The increased fiber/matrix adhesion also improved the transverse flexural strength.

* Corresponding author. Tel: 001-517-353-4708
E-Mail: downeyma@egr.msu.edu