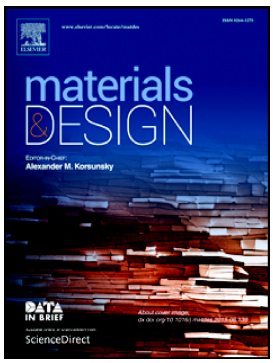

Simultaneous improvement of interfacial strength and toughness between carbon fiber and epoxy by introducing amino functionalized ZrO2 on fiber surface

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Simultaneous improvement of interfacial strength and toughness between carbon fiber and epoxy by introducing amino functionalized ZrO_2 on fiber surface

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Abstract

Amino-functionalized ZrO_2 was prepared and incorporated on carbon fiber surface by a simple dip-coating approach to simultaneously strengthen and toughen the interphase of carbon fiber/epoxy composite. Fourier transform infrared spectroscopy, X-ray photoelectron spectroscopy and thermogravimetry confirmed the successful functionalization of ZrO_2 by (3-Aminopropyl) triethoxysilane (APTES-ZrO_2). Scanning electron microscopy and atomic force microscope demonstrated that uniform coating with well dispersed particles on fiber surface was achieved at 1.0 wt.% addition of APTES-ZrO_2 particles. Under this condition, the interfacial shear strength (IFSS) and fracture toughness (G_{ic}) revealed respective 41.3% and 257.6% augments, compared with epoxy-only coated fiber composite. The enhanced IFSS is attributed to the improved chemical bonds between fiber and resin. While the increase in G_{ic} can be ascribed to the intermittent distribution of strong/weak bonding zones and the mobility of APTES-ZrO_2 particles in the interphase region. This work affords a simple, scalable and cost effective approach to simultaneously increase the interfacial strength and toughness of composites, which has always been sought after for structural materials.

Keywords

Carbon fiber; Polymer-matrix composites; Surface treatment; Interface/interphase; Sizing

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