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Improving the interfacial strength of silicone resin composites by chemically grafting silica nanoparticles on carbon fiber

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ABSTRACT

Controlling interfacial microstructure and interactions between carbon fiber (CF) and matrix is of crucial importance for the fabrication of advanced polymer composites. In this paper, a hierarchical reinforcement (CF-g-SiO_2) was prepared through directly grafting 3-aminopropyltriethoxysilane (APS) functionalized silica nanoparticles (SiO_2-APS) onto CF surface by the covalent linkage for the first time. SiO_2-APS nanoparticles distributed onto the fiber surface uniformly, which could increase surface polarity and roughness obviously. CF-g-SiO_2 exhibited a low contact angle and high surface free energy, and thus enhanced the wettability between CF and matrix greatly. Simultaneous increases of interlaminar shear strength (ILSS) and interfacial shear strength (IFSS) of CF-g-SiO_2 composites were achieved, increasing 53.27% in ILSS and 40.92% in IFSS compared with those of untreated composites. These enhancements can be attributed to the existent of SiO_2-APS interface with providing sufficient chemical bonding and strong mechanical interlocking between the fiber and matrix.

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