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ABSTRACT

In-situ characterization of the fiber/matrix interfacial failure behavior at microscopic scale is important to optimize the fiber surface treatment and to design high performance composites. In this study, in-situ tensile tests in scanning electron microscope (SEM) were used to investigate the interfacial adhesion strength of epoxy composites reinforced by four kinds of carbon fibers (CF)—raw CF, desized CF, carbon nanotube-grafted CF (CNT-CF) and oxidized CNT-CF. The crack initiation position and fracture failure mode were well recorded. The strains and the interfacial adhesion strength were obtained for these four kinds of composites. It was found that the interfacial strength decreased from 53 MPa to 48 MPa after removing the sizing on carbon fiber surface. However, by grafting CNTs on the CF surface, the interfacial strength reached 55 MPa and was further increased to 58 MPa after a simple thermal oxidation treatment. Moreover, energy dispersion X-ray analysis (EDX) was carried out using scanning transmission electron microscopy (STEM). The EDX mapping demonstrated that oxygen aggregated at the interfaces of raw CF/epoxy and oxidized CNT-CF/epoxy. Thus, a combination of CNT grafting with chemical functionalization should be necessary to achieve high performance carbon fiber reinforced polymer composites.

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