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Effects of grafting strength and density on interfacial shear strength of carbon nanotube grafted carbon fibre reinforced composites

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ABSTRACT

This paper presents a test method of twin-fibre single-lap joint bonded with a micro-droplet of epoxy and subjected to tensile loading for determining fibre-matrix interfacial shear strength (IFSS). Twenty-five carbon fibre (CF)/epoxy specimens and fifty-six carbon nanotube (CNT)-grafted CF/epoxy specimens were prepared and tested. The average IFSS measured for specimens with a mean grafting density of 10.9, 25.8, 35.1 or 58.8 CNTs per μm^2 can be improved by 51%, 101%, 155% and 273% (223%) respectively comparing to that without grafted CNTs. A multi-scale analytical model that relates micro-scale IFSS to nanoscale CNT grafting strength and density is developed and then used for predicting the IFSS of CNT-CF reinforced composites. There exists a good correlation between the measured and predicted IFSS of specimens with different grafting densities.

Keywords: Carbon nanotubes; hybrid composites; interfacial shear strength; single-lap joint test; multi-scale modelling

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