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Impact behavior and fractographic study of carbon nanotubes grafted carbon fiber-reinforced epoxy matrix multi-scale hybrid composites

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Abstract:

Carbon nanotubes are the most promising reinforcement for high performance composites. Multiwall carbon nanotubes were directly grown onto the carbon fiber surface by catalytic thermal chemical vapor deposition technique. Multi-scale hybrid composites were fabricated using the carbon nanotubes grown fibers with epoxy matrix. Morphology of the grown carbon nanotubes was investigated using field emission scanning electron microscopy and transmission electron microscopy. The fabricated composites were subjected to impact tests which showed 48.7 and 42.2 % higher energy absorption in Charpy and Izod impact tests respectively. Fractographic analysis of the impact tested specimens revealed the presence of carbon nanotubes both at the fiber surface and within the matrix which explained the reason for improved energy absorption capability of these composites. Carbon nanotubes presence at various cracks formed during loading provided a direct evidence of micro crack bridging. Thus the enhanced fracture strength of these composites is attributed to stronger fiber-matrix interfacial bonding and simultaneous matrix strengthening due to the grown carbon nanotubes.

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