

Interlaminar Fracture Behaviour and Mechanical Properties of MWCNT Filled Epoxy Fibre Reinforced Composites

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Fiber-reinforced composites have attracted significant attention and popularity due to unique in-plane mechanical properties that are provided by the reinforcement. However, since there is no reinforcement along thickness direction, laminated composites are susceptible to delamination that is major failure mode and may significantly reduce the compressive strength.

Delamination of the composite mainly relies on the fracture toughness of the matrix material. An effective technique to improve the interlaminar fracture toughness of a composite, is to increase the matrix toughness by adding fillers, such as soft rubber particles, nanoclay and silica particles.

In this study, the mechanical properties and fracture behavior of nanocomposites carbon fiber/epoxy composites (CFRPs) have been investigated. The epoxy resin has been modified by adding 0.05 % (w/w) of multiwalled carbon nanotubes. Unidirectional Fiber reinforced composites have been manufactured by Pulsed Infusion, an Italian patented innovative vacuum assisted infusion process. Both neat and filled epoxy composites have been characterized by performing experimental tests to evaluate tensile and interlaminar properties. In particular, double-cantilever-beam (DCB) mode I delamination tests and interlaminar fracture toughness Energy-Mode II tests have been carried out to obtain the delamination fracture toughness G_{IC} and the interlaminar energy fracture toughness G_{IIC} .

Experimental results showed a general improvement of mechanical properties as summarized in the following table, where it's possible to observe that both G_{IC} and G_{IIC} of nanofilled epoxy composites are higher than those obtained for neat epoxy composites due to the high aspect ratio of carbon nanotubes.

Composite	G_{IC} (J/m ²)	G_{IIC} (J/m ²)
Neat epoxy/carbon fibers	1393.96 ± 180.35	1155.89 ± 120.11
CNT-epoxy/carbon fibers	1878.15 ± 77.62	1313.42 ± 67.17

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