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Abstract

The present study concerns the development of a new class of carbon fiber reinforced polymers (CFRPs) with a nano-modified matrix based on graphene nano-species. The premium target is the increase of the interlaminar fracture toughness of carbon fiber composites enhanced with graphene nano-species under mode I loading. An in-house developed methodology for the dispersion of the nano-fillers and the manufacturing of nano-doped prepregs is analytically described. Three different kinds of CFRP plates, one with neat matrix and two doped with graphene nano-platelets or graphene oxide were manufactured. Several double-cantilever beam coupons were tested for interlaminar mode I fracture toughness characterization under simultaneous recording of Acoustic Emission (AE) activity. The nano-doped composites exhibit a significant increase of the interlaminar strain energy release rate G_{IC} of the order of 50% for the case of graphene nano-platelets. AE findings combined with extensive scanning electron microscopy (SEM) attempt to delineate the fracture process variations and the involved micro-mechanisms at a meso-scale level that explain the differences in the crack propagation process.

keywords: nanocomposites, graphene, fracture toughness, acoustic emission, SEM