Assessment of mechanical, thermal and morphological behavior of nano-Al_2O_3 embedded glass fiber/epoxy composites at in-situ elevated temperatures

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ABSTRACT

Owing to the outstanding properties of nano-Al_2O_3 particles have incited material researchers to have a promising invasion in the field of fibrous polymeric composites. There is an uncertainty of nano-Al_2O_3/polymer interfacial stability at high temperature engineering applications. Current investigations explicate the effects of nano-Al_2O_3 content on the mechanical behavior of glass/epoxy (GE) composites at various in-situ elevated temperatures. The flexural properties and viscoelastic behaviour of the composites have been investigated and evaluated. The Weibull design parameters were analysed as a function of nano-Al_2O_3 content and different test temperatures. Scanning electron microscopy analyses were carried out to understand various interfacial strengthening mechanism and micro-mechanism failures. These results indicated that incorporation of 0.1 wt.% of nano-Al_2O_3 in GE composites at room temperature could be considered an optimal value in flexural strength enhancement. The fracture surfaces demonstrated a combination of fiber pullout, interfacial debonding, matrix drainage and fiber imprints failure morphologies. Weibull analyses responded a reasonable agreement with the experimental results.

More in Elsevier, Composites Part B: Engineering, Volume 166, 1 June 2019, Pages 688-700, https://doi.org/10.1016/j.compositesb.2019.03.009