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Simultaneous improvement of the fracture toughness and mechanical characteristics of amine-functionalized nano/micro glass fibril-reinforced epoxy resin

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Abstract: Nano/micro glass fibril (nGF) was used as a reinforcement material for the modification of epoxy resin with different contents, in which the amino group was introduced initially to the nGF surface via a silane treatment reaction. Composite samples based on untreated nGF filled epoxy were also fabricated for comparison. The effects of these fillers on the characteristics of cured epoxy resin, such as compatibility, curing degree, fracture toughness, mechanical, morphological, and thermal properties, were examined. The addition of amine-functionalized nGF (nGF-NH₂) to the epoxy resin resulted in improvements in their fracture toughness, and mechanical and thermal properties. The fracture toughness, tensile strength, and flexural strength of the epoxy resin in the presence of 0.2 phr nGF-NH₂ were improved by 50.79%, 32.67%, and 28.88%, respectively, compared to the virgin epoxy resin. Scanning electron microscopy revealed a relatively rough surface with shear deformation and tortuous cracks, thereby inducing higher fracture toughness in the nGF-NH₂-modified epoxy system.

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