

Epoxy grafted graphene oxide: A unique strategy to tailor the interface and improve the mechanical properties in epoxy based nanocomposites

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Improved interfacial adhesion between the reinforcing agent and the matrix is the key to enhanced structural properties in any composite. In the present work, graphene oxide (GO) was employed to epoxy matrix. In order to improve the interface, epoxy chains were grafted directly on to functionalized GO prior to composite preparation. The functionalized GO sheets were systematically characterized using FTIR, TEM, Raman spectroscopy and XRD. The epoxy composites with GO and epoxy grafted GO (Ep-g-GO) were prepared with the addition of only a small amount (0.5 wt%) of Ep-g-GO using mechanical stirrer coupled to a bath sonicator. This strategy manifested in an impressive 40% enhancement in the storage modulus, 70% increment in hardness and 39% increase in fracture toughness compared to neat epoxy. In addition, improvement in tensile strength by 8% was also observed in the composites. These modified composites are thermally stable up to 300°C as inferred from thermogravimetric analysis. The enhanced properties in the composites motivated the investigation in detail the effect of Ep-g-GO on epoxy/carbon fiber (CF) laminates. Interestingly, incorporation of 0.5 wt% of Ep-g-GO resulted in improved interface between Ep-g-GO and epoxy matrix which further resulted in enhanced tensile properties by 12% and inter laminar shear strength by 9% as compared to neat epoxy/CF laminates. This study clearly demonstrates the effects of tailored interface, offered by epoxy grafted GO, on the structural properties of epoxy and epoxy/CF laminates.