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Homogeneous Liquid Phase Transfer of Graphene Oxide into Epoxy Resins

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Abstract

© 2017 American Chemical Society. The quality of polymer composite materials depends on the distribution of the filler in the polymer matrix. Due to the presence of the oxygen functional groups, graphene oxide (GO) has a strong affinity to epoxy resins, providing potential opportunity for the uniform distribution of GO sheets in the matrix. Another advantage of GO over its nonoxidized counterpart is its ability to exfoliate to single-atomic-layer sheets in water and in some organic solvents. However, these advantages of GO have not yet been fully realized due to the lack of the methods efficiently introducing GO into the epoxy resin. Here we develop a novel homogeneous liquid phase transfer method that affords uniform distribution, and fully exfoliated condition of GO in the polymer matrix. The most pronounced alteration of properties of the cured composites is registered at the 0.10%-0.15% GO content. Addition of as little as 0.10% GO leads to the increase of the Young's modulus by 48%. Moreover, we demonstrate successful introduction of GO into the epoxy matrix containing an active diluent-modifier; this opens new venues for fabrication of improved GO-epoxy-modifier composites with a broad range of predesigned properties. The experiments done on reproducing the two literature methods, using alternative GO introduction techniques, lead to either decrease or insignificant increase of the Young's modulus of the resulting GO-epoxy composites.

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Keywords

epoxy resin, graphene oxide, phase transfer, polymer composite, viscosity

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