

Preparation of Novel Nanocomposites Using the Ultra-Sonication Technique

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Abstract

Abstract: Graphene nanosheets (xGnP) and cup-stacked carbon nanotubes (CSCNT) were used to enhance the mechanical properties of three types of epoxy composites prepared with the following formulations; a). xGnP/epoxy nanocomposite, b) CSCNT/epoxy nanocomposite and c) xGnP-CSCNT/hybrid epoxy nanocomposite). Different weight contents of both xGnP and CSCNT were used to prepare these novel nanocomposites, namely 0 (base tests), 2.5, 4, 5, 6 and 7 wt. %. The principal challenge to the manufacturing processes was to achieve uniform dispersion for both xGnP and CSCNT in the epoxy matrix and the method of Ultra-sonication was used in this work to disperse these two types of nanomaterials in the epoxy. Tensile and flexural tests were conducted to assess the effect of nanoparticle content on the mechanical properties of the composites. The results demonstrate that the tensile strength and elastic modulus increased by approximately 15.62% and 14.17% respectively for the CSCNT/epoxy nanocomposite, 14% and 10.45% respectively for the xGnP/epoxy nanocomposite, and a significant increase in tensile strength of approximately 12.5% for the xGnP-CSCNT/hybrid epoxy nanocomposite. The flexural strength and modulus improved by approximately 28.5% and 25% respectively for the CSCNT/epoxy nanocomposite, while a mechanical property improvement of 21.5% was observed for the xGnP-CSCNT/hybrid epoxy nanocomposite, attained at a somewhat low weight content of 4 wt. %. Scanning Electron Microscopy (SEM) was used to assess the dispersion of nanomaterials in the epoxy resin which showed a reasonable dispersion of nanoparticles in the resin albeit with some regions of agglomerate nanoparticles.