FUNCTIONALIZATION OF GRAPHITE OXIDE WITH GLYMO AND ITS USE AS REINFORCEMENT IN EPOXY MATRIX NANOCOMPOSITES

Sara Ferreira da Costa, Sérgio Henrique Pezzin

Universidade do Estado de Santa Catarina - UDESC

Abstract: The change of mechanical properties of epoxy resins after the addition of nanoparticles (f. ex. graphite oxide) depends on its concentration, state of dispersion and interaction with the polymer matrix. To improve dispersion and avoid agglomeration of the GO nanoplatelets, due to van der Waals interactions, these nanoparticles can be functionalized using organosilanes as coupling agents. This study aimed to evaluate the effect of functionalization of graphite oxide by 3-glycidoxypropyltrimethoxysilane in the final properties of nanocomposites of epoxy matrix DGEBA with OG and OGS. The functionalized nanoparticles and nanoparticles without functionalization were characterized by spectroscopic and microscopic techniques, CHN elemental analysis and X-ray diffraction. The presence of silicon on the surface of OG was confirmed by analysis of energy dispersive spectroscopy and Fourier transform infrared spectroscopy along with X-ray photoelectron spectroscopy confirmed the functionalization GO with GLYMO by rise of new bands assigned to the Si-O-C bond. Images from scanning electron microscopy and transmission electron microscopy showed that nanoplatelets OG were clustered and after functionalization with silane the nanoplateletes were exfoliated, indicating larger interaction with the epoxy matrix. The dispersion of nanoparticles in the polymer matrix was also studied by microscopy and spectroscopy techniques where noted that the functionalized nanoparticles were well dispersed. To evaluate the effect of the nanoparticles in the mechanical properties, nanocomposites containing 0.1 ,0.25, 0.5 e 1.0 wt% were prepared by in situ polymerization techniques, with the use of a solvent for better dispersion. It was observed that the addition of GO nanoparticles decrease the modulus of elasticity relative to the epoxy resin, and nanocomposites containing 0.25% and 1.0 wt% presented the highest stress decreases. For nanocomposites with GO nanoparticles silanized (GOS) a linear increase of the modulus of elasticity with the mass fraction and maximum stress higher than the epoxy resin and GO nanocomposites was observed, except OGS 1.0wt%, where the maximum stress is lower than of the epoxy resin, which is explained by the existence of larger agglomerates. Thus, the silanized GO provided a more homogeneous dispersion and larger interaction with the epoxy matrix when compared to the GO.

Keywords: silanization, graphite oxide, graphene, epoxy, nanocomposites