

Properties and morphology of bulk epoxy composites filled with modified fumed silica-epoxy nanocomposites

Abstract

Modified fumed silica-epoxy nanocomposites were obtained by refluxing epoxy molecule with fumed silica using imidazole as catalyst. The modified fumed silica was then used as filler in epoxy resin with amine as curing agent. The properties of the surface modified silica and their effect as fillers in bulk epoxy composite were characterized by Fourier Transform Infrared spectroscopy (FTIR), Proton Nuclear Magnetic Resonance Spectroscopy (¹H-NMR), Thermogravimetric Analysis (TGA), Differential Scanning Calorimeter (DSC), Coefficient of Thermal Expansion (CTE), Tensile testing, Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray spectrometry (EDX). From FTIR, ¹H-NMR and TGA analysis, it was found that the epoxy resin was chemically bonded onto silica surface. From the DSC and CTE analysis, the addition of modified silica filler in the composite matrix highly influences thermal properties. This new synthesis filler shows higher glass transition temperature and more stable CTE data compared to unmodified filler when introduced into composite matrix. The tensile properties of composite matrix with and without the addition of filler show no significant difference in their tensile properties. SEM-EDX analysis shows modified fillers have better adhesion with composite matrix compared to unmodified filler.