

Nano silica dispersion in epoxy: the investigation of heat, milling speed and duration effect

Abstract

Nano composites are a promising development but the challenge of homogenous and discrete dispersion of the nano fillers are barriers that must be overcome before they can be effectively implemented. Although the common dispersion methods such as particle surface modification, comprehensive milling methodologies and the usage of solvents bear results, these are time consuming and not cost effective. In this paper, we explore the efficiency of coupling the usage of ball-media and heat on the dispersion of nano silica in epoxy. No solvents are involved. The effects of milling speed and duration are also studied albeit under a fixed ball media : silica-epoxy volume ratio of 3:5. The experiment set-up involves a simple 3-blade mixer, round bottom flask and 60 μ m zirconia ball. At nano silica loading of 10 wt % the nano silica clusters are systematically reduced from 1.5 - 2 μ m to 100 - 200 nm with the usage of ball media and application of heat. At the optimum milling speed and duration of 500 rpm for 5 hours, the aggregate sizes were further reduced to 30 - 70 nm, which is almost a discrete dispersion.