Abstract

The state of nanoclay dispersion in a molded epoxy disk and its effects on the thermo-mechanical properties of the resulting nanocomposite are analyzed. A commercially available nanoclay, Cloisite® 25A, is mechanically mixed at 2wt.% with EPON 815C epoxy resin. The epoxy/clay compound is then mixed with EPI-CURE 3282 curing agent by a custom made molding setup and injected into a disk shaped mold cavity. Upon completion of curing, nanoclay dispersion is quantified using Cameca SX50 Electron Microprobe Analyzer (EMPA) on a sample cut along the radius of the composite disk. Dispersion of nanoclay clusters larger than 1.5μm are analyzed by digital image processing of scanning electron micrographs taken radially along the sample, whereas dispersion at smaller scales is quantified by compositional analysis of clay via wavelength dispersive spectrometry (WDS). Digital images of the microstructure indicate that amount of nanoclay clusters that are larger than 1.5μm remain approximately constant along the radius. However, size analysis of nanoclay clusters revealed that they are broken down into finer clusters along the radius, possibly due to high shear deformation induced through-the-thickness during mold filling. Compositional analysis by WDS signified that approximately 0.4wt.% of the nanoclay is dispersed to particles smaller than 1.5μm which are not visible in micrographs. Tensile and three-point bending tests are conducted on additional samples cut from the molded disks. Except for slight reduction in flexural strength, up to 9.5% increase in tensile strength, stiffness and flexural modulus are observed. Glass transition temperature is determined under oscillatory torsion and observed to increase by 4.5% by the addition of nanoclay.