Effects of Nanoclays and Carbon-Nanotubes on the Flow of Epoxy for Resin Transfer Molding

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ABSTRACT

This research focuses on understanding basics of the flow of aerospace epoxy resins, enriched with layered silicates and single wall carbon nanotubes (SWNT), through a porous media via resin transfer molding process. In the first stage of this study, the dispersion and curing of carbon-nanotubes and nanoclays are examined with several rheological (RMS), thermal (DMA), wide angle X-ray diffraction (WAXD) and morphological (SEM and TEM) characterization techniques made under different curing conditions. A dynamic rheometer, Advanced Polymer Analyzer (APA), is also used for characterizing changes in viscosity extent of cure and modulus properties of the epoxy-nanotube and epoxy-nanoclay mixtures, during curing. The gel-time of epoxy resins, containing nanoclays, presents an upper bound time limit for exfoliation. The changes in cure kinetics, thermal degradation and Raman spectroscopy of the SWNT-epoxy resin composites are also interpreted in terms of extremely high thermal conductivity of carbon nanotubes and the ability of epoxy resin to open and disperse the nanobundles, offering a higher surface for heat propagation. The flow properties of the enriched epoxy-carbon fiber composite systems are obtained by perform permeation measurements using LABVIEW data acquisition system.