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Viscoelasticity of Epoxy nano-composites SURESH AHUJA, Retired

— Nanocomposites have been modeled in a multiscale covering from molecular scale (e.g., molecular dynamics, Monte Carlo), microscale (e.g., Brownian dynamics, dissipative particle dynamics, lattice Boltzmann, time-dependent Ginzburg–Landau method, dynamic density functional theory method) to mesoscale and macroscale (e.g., micromechanics, equivalent-continuum and self-similar approaches, finite element method) The presence of layered silicates in nonaqueous polymers changes the viscoelastic behavior of the unfilled matrix from liquid-like to solid-like because of the formation of a three-dimensional percolating network of exfoliated or intercalated stacks. This gel-like behavior is a direct consequence of the highly anisotropic nature of the nanoclays which prevents their free rotation and the dissipation of stress. Particle to particle interactions is the dominant mechanism in fumed silica nanocomposites whereas particle to polymer interaction is the dominant one in colloidal silica nanocomposites at identical filler concentrations. These interactions are balanced in each nanocomposite systems by the silica surface treatments (chain grafting, silane modification) and the molecular weight of the matrix. Two different types of nanocomposite structures exist namely, intercalated nanocomposites where the polymer chains are sandwiched between silicate layers and exfoliated nanocomposites where the layers can be considered individually but remain more or less dispersed in the polymer matrix. Yield stress from Carreau-Yasuda model has been correlated to exfoliation. Also, equilibrium modulus and zero shear rate viscosity has been used to analyze percolation threshold and sol-gel transition. Nano clays organically functionalized were mixed with Epoxy in a high shear mixer.

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