Abstract Submitted
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Percolation Threshold in Polycarbonate Nanocomposites SURESH AHUJA, Retired — Nanocomposites have unique mechanical, electrical, magnetic, optical and thermal properties. Many methods could be applied to prepare polymer-inorganic nanocomposites, such as sol-gel processing, in-situ polymerization, particle in-situ formation, blending, and radiation synthesis. The analytical composite models that have been put forth include Voigt and Reuss bounds, Polymer nanocomposites offer the possibility of substantial improvements in material properties such as shear and bulk modulus, yield strength, toughness, film scratch resistance, optical properties, electrical conductivity, gas and solvent transport, with only very small amounts of nanoparticles Experimental results are compared against composite models of Hashin and Shtrikman bounds, Halpin–Tsai model, Cox model, and various Mori and Tanaka models. Examples of numerical modeling are molecular dynamics modeling and finite element modeling of reduced modulus and hardness that takes into account the modulus of the components and the effect of the interface between the hard filler and relatively soft polymer, polycarbonate. Higher nanoparticle concentration results in poor dispersion and adhesion to polymer matrix which results in lower modulus and hardness and departure from the existing composite models. As the level of silica increases beyond a threshold level, aggregates form which results in weakening of the structure. Polymer silica interface is found to be weak as silica is non-interacting promoting interfacial slip at silica-matrix junctions. Our experimental results compare favorably with those of nanocomposites of polyesters where the effect of nanoclay on composite hardness and modulus depended on dispersion of nanoclay in polyester.

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