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New High-Impact-Polystyrene (HIPS)-Clay Nanocomposites: Effect of organic amine structure and grafting density on nanocomposite formation, thermal and mechanical properties

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Abstract

Several intercalated nanocomposites of high-impact polystyrene (HIPS) with layered organosilicates are prepared by melt processing methods. These nanocomposites are new and not reported in the literature till date. The mixing preparation conditions such as rotor speed (rpm) and time of mixing were varied and optimized for preparing well intercalated nanocomposites with significant d-spacing changes accompanying nanocomposite formation. The nanocomposites are characterized using X-Ray diffraction, differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA). The effect of organic modifier on the clay surface (physical chemistry of clay) is also studied. The effect of clay loading into HIPS matrix is also investigated in the weight range 2-12 %. Well intercalated nanocomposites are formed for all clay systems and at all loadings investigated here. Intercalation and filler presence gives rise to much enhanced tensile properties. Use of high hydrophobic coverage (dioctadecylammonium quat. based) organoclays does not give intercalation. The glass transition temperature of the nanocomposites are similar to or slightly lower than those of HIPS in low clay loading range (<6% by wt clay). Comparison in made in certain cases with the behavior of polystyrene (PS) nanocomposites (intercalated) for the dispersion structure and level of polymer intercalation into the clay interlayer spacings, using the same clays. Results will be presented over a clay loading range till 12% by wt., using a variety of different organically-modified montmorillonites.