Preparation of Super HIPS via Nanocomposite Assemblies in the Presence of Toughener-Intercalant

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Summary:
The polymer-clay nanocomposites typically exhibited superior thermal, mechanical, and gas barrier properties compared to the neat (pure) polymers. The unique properties of the nanocomposites are usually observed when the silicate layers are homogeneously dispersed in nanoscale. Although the homogeneous dispersion of the delaminated silicate layers is desirable for maximum reinforcement of the properties, the individual nanolayers are not easily separated and dispersed in most polymers, due to intrinsic incompatibility of hydrophilic layered silicates and hydrophobic polymer matrix. Thus the silicate layers are usually treated with a cationic surfactant to obtain organically modified clay (organoclay) prior to use. The selection of cationic surfactant is also important, because it can enlarge the clay galleries as well as improve the compatibility between clay and the polymer matrix. [1-2]

High-impact polystyrene (HIPS) is a typical thermoplastic that is widely used in packaging, toys, bottles, housewares, electronic appliances, and light-duty industrial components because of its rigidity and ease of coloring and processing. [3]

In this study highly toughened super high-impact polystyrene (HIPS)/organophilic montmorillonite (Org-MMT) nanocomposites were prepared by solution blending method. Organophilic modification of MMT layered silicate was achieved by using a special toughener-intercalant, quaternary ammonium salt of α-tertiary amine functionalized polybutadiene, and revealed by X-ray diffraction. The resulting HIPS/Org-MMT nanocomposites were characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM), atomic force microscopy (AFM), thermogravimetric analysis (TGA), and static and dynamic mechanical analyses. The morphological study of HIPS/Org-MMT nanocomposites showed that nanolayers were exfoliated in nanocomposites and moreover caused much more well dispersed and reduced PS occluded rubber domains. This mechanism was found to be responsible from dramatic increase in toughness of nanocomposites. Additionally, improved thermal and dynamic mechanical properties of the resultant nanocomposites promises to open a new way for highly toughened super HIPSs via nanocomposite assemblies even with a very low loading degrees.

REFERENCES