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Nanoindentation and Physical Properties of Polyvinyl Chloride/Styrene Co-Maleic Anhydride Blend Reinforced by Organo-Bentonite

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Abstract : Polymer blends represent an important class of materials in engineering applications. The incorporation of clay nanofiller may provide new opportunities for this type of materials to enhance their applications. This article reports on the effects of clay on the structure and properties of polymer blends nanocomposites, based on Polyvinyl chloride PVC and styrene co-maleic anhydride SMA blend. Modification of the Egyptian Bentonite EB was carried out using organo-modifier namely; octadecylamine ODA. Before the modification, the cation exchange capacity CEC of the EB was measured. The octadecylamine bentonite ODA-B was characterized using Fourier transform infrared Spectroscopy FTIR, X-Ray Diffraction XRD, and Transition Electron Microscope TEM. A blend of Polyvinyl chloride PVC and styrene co-maleic anhydride SMA (50:50) was prepared in Tetra Hydro Furan (THF). Then nanocomposites of PVC/SMA/ODA-B were prepared by solution intercalation polymerization from 0.50% up to 5% by weight of ODA-B. The nanocomposites are characterized by XRD, TEM. Thermal, nanoindentation, swelling and electrical properties of the nanocomposites were measured. The morphology of the nanocomposites showed that ODA-B achieved good dispersion in the PVC/SMA matrix. Incorporation of 0.5 %, 1%, 3% and 5% by weight nanoclay into the PVC/SMA blends results in an improvement in nanohardness of 16%, 76%, 92%, and 68% respectively. The elastic modulus increased from 4.59 GPa for unreinforced PVC/SMA blend to 6.30 GPa (37% increase) with the introduction of 3% by weight nanoclay. The cross-link density of the nanocomposites increases with increasing the content of ODA-B.

Keywords : PVC, SMA, nanocomposites, nanoindentation, organo-bentonite
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