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Phosphonium Based Montmorillonite-PET Nanocomposites

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Poly(ethylene terephthalate) and quaternary ammonium modified clays were melt-mixed in a twin screw extruder and the resulting nanocomposites were characterized by using WAXD technique. Although, there was a slight increase in tensile modulus, the tensile strength of the material decreased. It was found that the reduction in molecular weight during processing of the nanocomposites was responsible for the inferior mechanical properties. This may be attributed to the low thermal stability of the ammonium clays, which led us to prepare highly thermally stable phosphonium based clays. Phosphonium surfactants, viz.; octadecyltriphenylphosphonium bromide, dodecyltriphenylphosphonium bromide and benzyltriphenylphosphonium chloride, having different chain length were synthesized by one-step synthesis process. The clay was modified by the above surfactants using cation-exchange reaction. The onset of degradation of various phosphonium clays was found to be around 300 °C., which was much higher than that of the ammonium clays, as determined from thermogravimetric analysis. The organoclays were characterized using WAXD and FTIR techniques to find out the d-spacing and interaction of surfactants with the clay layers, respectively. It was found that the d-spacing of clay galleries increased with the carbon chain length. Poly(ethylene terephthalate)-clay nanocomposites were prepared by melt-mixing method using both unmodified and phosphonium modified montmorillonite clays and the resulting nanocomposites were characterized by using WAXD technique. Absence of d001 plane of clay in nanocomposites indicates the nano level dispersion of clay particles, as may be expected from the favourable interaction between the polar functional group of PET with phosphonium modifier of clay. Non-isothermal crystallization study was carried out using DSC. Tensile strength and modulus of resulting nanocomposites were found to increase. DMA revealed a significant increase in storage modulus of the nanocomposites.