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Clay Effect on PET/Clay and PEN/Clay Nanocomposites Properties

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Abstract : Reinforced plastics or nanocomposites have attracted considerable attention in scientific and industrial fields because a very small amount of clay can significantly improve the properties of the polymer. The polymeric matrices used in this work are two saturated polyesters, i.e., polyethylene terephthalate (PET) and polyethylene naphthalate (PEN). The success of processing compatible blends, based on poly(ethylene terephthalate) (PET)/poly(ethylene naphthalene) (PEN)/clay nanocomposites in one step by reactive melt extrusion is described. Untreated clay was first purified and functionalized 'in situ' with a compound based on an organic peroxide/ sulfur mixture and (tetramethylthiuram disulfide) as the activator for sulfur. The PET and PEN materials were first separately mixed in the molten state with functionalized clay. The PET/4 wt% clay and PEN/7.5 wt% clay compositions showed total exfoliation. These compositions, denoted nPET and nPEN, respectively, were used to prepare new n(PET/PEN) nanoblends in the same mixing batch. The n(PET/PEN) nanoblends were compared to neat PET/PEN blends. The blends and nanocomposites were characterized using various techniques. Microstructural and nanostructural properties were investigated. Fourier transform infrared spectroscopy (FTIR) results showed that the exfoliation of tetrahedral clay nanolayers is complete, and the octahedral structure totally disappears. It was shown that total exfoliation, confirmed by wide-angle X-ray scattering (WAXS) measurements, contributes to the enhancement of impact strength and tensile modulus. In addition, WAXS results indicated that all samples are amorphous. The differential scanning calorimetry (DSC) study indicated the occurrence of one glass transition temperature Tg, one crystallization temperature Tc and one melting temperature Tm for every composition.

Keywords : exfoliation, DRX, DSC, montmorillonite, nanocomposites, PEN, PET, plastograph, reactive melt-mixing
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