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Study of Nanoclay Blends Based on PET/PEN Prepared by Reactive Extrusion

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Abstract : A new route of preparation of compatible blends, based on poly(ethylene terephthalate)(PET)/poly(ethylenenaphthalene2,6-dicarboxylate) (PEN)/clay nanocomposites has been successfully performed in one step by reactive melt extrusion. To achieve this, untreated clay was first purified and functionalized “in situ” with a compound based on an organic peroxide/sulfur mixture and (tetra methyl thiuram disulfide) TMTD as accelerator or activator for sulfur. The PET and PEN materials were first mixed separately in the melt state with different amounts of functionalized clay. It was observed that the compositions PET/4 wt% clay and PEN/7.5 wt% clay showed total exfoliation. These completely exfoliated compositions, called nPET and nPEN, respectively, were used to prepare new nPET/nPEN nanoblends in the same mixing batch. The nPET/nPEN nanoblends were compared to neat blends of PET/PEN. The blends and the nanocomposites were characterized by different techniques: differential scanning calorimetry (DSC) and wide-angle X-ray scattering (WAXS). The micro and nanostructure/properties relationships were investigated. The results of the WAXS measurements study showed that the exfoliation of tetrahedral nanolayers of clay was complete and the octahedral structure disappeared totally. From the different WAXS patterns, it is seen that all samples are amorphous phase. The thermal study showed that there are only one glass transition temperature Tg, one crystallization temperature Tc and one melting temperature Tm for every composition. This indicated that both PET/PEN blends and nPET/nPEN blends were compatible in the entire range of compositions. In addition, nPET/nPEN blends present lower Tc values and higher Tm values than the corresponding neat PET/PEN blends. The obtained results indicate that nPET/nPEN blends are somewhat different from the pure ones in nanostructure and behavior, thus showing the additional effect of nanolayers. The present study allowed establishing good correlations between the different measured properties.

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