World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:9, No:10, 2015

Study of the Montmorillonite Effect on PET/Clay and PEN/Clay Nanocomposites

Authors : F. Zouai, F. Z. Benabid, S. Bouhelal, D. Benachour

Abstract : Nanocomposite polymer / clay are relatively important area of research. These reinforced plastics 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 ie 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. This was evidence that both PET/PEN and nPET/nPEN blends are compatible in the entire range of compositions. In addition, the nPET/nPEN blends showed lower Tc and higher Tm values than the corresponding neat PET/PEN blends. In conclusion, the results obtained indicate that n(PET/PEN) blends are different from the pure ones in nanostructure and physical behavior.

Keywords : blends, exfoliation, DRX, DSC, montmorillonite, nanocomposites, PEN, PET, plastograph, reactive melt-mixing
Conference Title : ICMET 2015 : International Conference on Materials Engineering and Technology
Conference Location : Paris, France
Conference Dates : October 29-30, 2015