

RHEOLOGICAL, MECHANICAL, MORPHOLOGICAL AND THERMAL
PROPERTIES OF RECYCLED POLY (ETHYLENE TEREPHTHALATE)-
POLYETHYLENE FILLED MONTMORILLONITE

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*Special dedications to my beloved wife and parents...
Thanks for the love and memories*

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ABSTRACT

The objective of this research is to investigate the effect of incorporating nanofiller, montmorillonite (MMT) on mechanical, morphology, rheological and thermal properties of recycled poly(ethylene terephthalate) (rPET) and High density polyethylene (HDPE) nanocomposites. The MMT contents in 90:10 rPET/HDPE and 70:30 rPET/PE ranged from 1 to 5 wt.%. Blends based on rPET/HDPE nanocomposites were made through single extrusion and injection-molded into tensile and impact test samples. Samples underwent rheological test by using capillary rheometer, and the morphology of the nanocomposites was investigated by scanning electron microscopy (SEM). Thermal stability of organoclays and nanocomposites was tested by thermogravimetric analysis (TGA). The results pointed out that MMT displayed a higher compatibilizing act giving rise to a neat improvement of phase dispersion and interfacial adhesion in the blends. The maximum tensile strength was at 3 wt. % and 1 wt. % of MMT for 90:10 and 70:30 rPET/HDPE blends. However, tensile modulus decreased significantly with the incorporation of MMT. Impact strength for both blending 90:10 and 70:30 reached a maximum point at 3 wt. % and started to decrease beyond 3 wt. %. The incorporation of MMT increased the shear viscosity of 90:10 and 70:30 which reached a maximum value at 3 wt. % and 1 wt. %.

ABSTRAK

Objektif penyelidikan ini adalah untuk mengkaji kesan penambahan pengisi nano montmorillonite (MMT) terhadap pencirian morfologi, mekanikal, sifat reologi dan terma komposit bersaiz nano poli(etilena terephthalate) kitar semula (rPET) dan polietilena berketumpatan tinggi (HDPE). Komposisi komposit bersaiz nano dibahagikan kepada 90:10 dan 70:30 rPET/HDPE dengan kesan penambahan MMT dari 1 hingga 5 wt%. Komposisi komposit nano rPET/HDPE telah disediakan menggunakan mesin penyemperit berskru tunggal berpenyebati nano dan mesin acuan penyuntikan bagi membentuk sampel untuk ujian kekuatan regangan dan kekuatan hentaman. Ujian reologi dijalankan menggunakan reometer kapilari serta ciri-ciri morfologi komposit nano dilakukan menggunakan mikroskopi pengimbasan elektron (SEM). Kestabilan terma pengisi nano MMT dan komposit nano telah diuji menggunakan alat analisis termogravimetri (TGA). Keputusan menunjukkan penambahan MMT mampu menyumbang peningkatan kebolehserakan fasa dan lekatan antara muka komposit. Kekuatan regangan maksima bagi komposisi komposit bersaiz nano 90:10 dan 70:30 rPET/HDPE dengan penambahan MMT adalah pada 3 wt. % dan 1 wt. %. Modulus regangan menurun secara ketara dengan penambahan MMT. Kekuatan hentaman kedua-dua komposisi komposit bersaiz nano 90:10 dan 70:30 mencapai nilai maksima pada penambahan MMT sebanyak 3 wt. % tetapi berkurang apabila melebihi 3 wt. %. MMT meningkat kelikatan ricih 90:10 dan 70:30 dengan mencapai nilai maksima pada penambahan 3 wt. % dan 1 wt. %.