ABSTRACT

Novel thermoplastic elastomers (TPEs) based on linear low density polyethylene (LLDPE) and ethylene methyl acrylate (EMA) were prepared by melt blending technique. The effects of blend ratio, compatibilization and co-vulcanization on the structure property correlation of LLDPE/EMA blends were studied in details. In addition organic-inorganic hybrid nanocomposites, with the objective of achieving an improved balance between stiffness and toughness, based on LLDPE/EMA blend and two different types of organoclay (Cloisite®20A and Cloisite®30B) were prepared by varying their sequence of addition. Morphological studies showed the phase separation between LLDPE and EMA in LLDPE/EMA blends. Cloisite®20A was more properly dispersed in the polymer matrix as compared to Cloisite®30B. Rubbery nature of the blend increased with increased in EMA content in the blend and blends having EMA 40 wt% and above showed thermoplastic elastomeric behavior (tension set < 40%). Addition of compatibilizer (LLDPE-g-MA) reduced the size of the dispersed EMA phase. EMA is more prone to crosslinking than LLDPE. Co-cured blends with 0.1 and 0.3 wt% DCP can easily be reprocessed. An appreciable improvement in the impact strength and tension set properties was observed for Cloisite®20A nanocomposites. Both filled and unfilled blends exhibited rheological behavior of non-Newtonian fluid. The dynamic rheology and steady shear rheology of LLDPE/EMA/Cloisite®20A nanocomposites registered a good correlation in regard to the viscous vs. elastic response. The thermogravimetric analysis revealed that thermal stability of the LLDPE/EMA blend was improved by addition of Cloisite®20A. Addition of organoclay moderately improved the Limiting oxygen index (LOI) of LLDPE/EMA blend. The dielectric analyses showed that the dielectric constant (ε') decreased with increase in applied frequencies for all nanocomposites. All filled samples exhibited higher volume resistivity and breakdown strength than that of control blend. To further improve the properties of organoclay filled LLDPE/EMA system, small amount of DCP was added for controlled curing. DCP initiates free radical grafting between polymer and clay modifier resulted in an exfoliated morphology. DCP treatment induced high degree of reinforcement in all organoclay filled samples through better dispersion of clay platelets as well as interfacial crosslinking and controlled crosslinking of the two polymer phases.

Keywords: *Polymer blends; Thermoplastic elastomer; Co-vulcanization; Organoclays; Nanocomposites; Morphology; Rheology; Thermal degradation; Dielectric properties*