ABSTRACT

Novel blends based on ethylene vinyl acetate copolymer and thermoplastic polyurethane (EVA/TPU) at different ratios were prepared via melt blending technique. 80/20 EVA/TPU blend showed the optimum tensile strength and elongation at break which may be due to finer dispersion of TPU particles in continuous EVA matrix and with further addition of TPU, tensile properties gradually reduce. All the blends exhibit single Tg in between the Tg of neat polymers and with addition of TPU, Tg of the blends gradually shift towards the Tg of TPU indicating that there is technological compatibility to some extent and oil resistance gradually increase with increasing TPU content. Thermoplastic vulcanizate (TPV) based on EVA/TPU blends has been prepared at various blend ratios via dynamic vulcanization at 180 °C using di-(2-tert-butyl peroxy isopropyl) benzene (DTBPIB) peroxide as the cross-linking agent. This dynamically vulcanized blends (with 1 phr peroxide) show improved mechanical, thermal, oil resistance properties along with very good recyclability but electrical resistance reduces at higher TPU content (volume resistivity lie in the range of 10^{13} ohm cm). The EVA/TPU blends were also irradiated by using a 2.5 MeV electron beam accelerating energy over a dose range from 25 to 200 kGy for technological application. Modification of the blends via irradiation causes remarkable improvement in tensile properties, electrical resistance, thermal stability as well as oil resistance and optimum performance was obtained at 100 KGy radiation dose. Melt rheological characteristics of both EB crosslinked and peroxide cured blends were analyzed and creep deformation reduces with increasing radiation dose and peroxide content. Addition of 1 phr co-agent (triallyl cyanurate) with 1 phr peroxide further improves the modulus and the creep response of the system. EVA/TPU blend at various blend ratios have been also modified via reactive processing with 4, 4′-methylene diphenyl diisocyanate (MDI). Such modification with even small amount of MDI (1 phr) showed significant improvement in tensile strength, modulus and oil resistance property and the improvement was found to be more significant for EVA/TPU 50/50 and 30/70 blends. All the MDI modified samples show higher complex viscosity over the entire frequency range and higher storage modulus which indirectly reflects the grafting and network structure formation that eventually make the blend stiffer and reduce the chain mobility. Ethylene vinyl acetate/thermoplastic polyurethane/layered double hydroxide (EVA/TPU/LDH) nanocomposite have been prepared with varying LDH content via melt mixing technique. The nanocomposites show significant improvement in tensile strength and modulus and E70L3 containing 3 wt% LDH showed the optimum improvement in tensile properties with an increase of Tensile strength by 68.8% as compared to the unfilled blend which can be ascribed to the partial exfoliation of LDH layers as seen from TEM analysis. LDH positively affects the flame retardence characteristics with a steady increase in limiting oxygen index (LOI) value due to the formation of water vapor and metal oxide char residue that hinder the burning process by reducing the oxygen supply to the bulk phase.

Keywords: Ethylene vinyl acetate, thermoplastic polyurethane, electron beam radiation, dynamic vulcanization, , oil resistance