Abstract

Polyurethane elastomer is an important class of polymeric materials used for many important end-use applications. Their various grades and unique property of combining high strength, high hardness and high modulus with good resistance to attack by oil, petrol and many common non polar solvents led polyurethane to its use in wide spectrum of industries. Blends of polyurethane elastomer with other speciality elastomers having the reactive functional groups are expected to improve the processability and aging properties of the blends. In the present investigation polyurethane was blended with five different speciality elastomers to develop the new polymeric materials with enhanced performance properties for the specific end-use requirements. Two different blending techniques have been adopted to study the effect of blending technique on the properties of the blends. In the preblended technique, the elastomers were first blended at desired ratios and then the curative (peroxide) is incorporated into the preblends. To study the effect of preheating on the properties of the blends, preblends were subjected to heat treatment before addition of curative in the preheated preblended technique. The five speciality elastomers taken to blend with the polyurethane elastomer are Poly(ethylene vinyl acetate) EVA, chlorinated polyethylene elastomer (CPE), Hydrogenated acrylonitrile butadiene rubber (HNBR), ethylene acrylic rubber (VAMAC) and silicone rubber (VMQ). Polyurethane contains polar functional group and active hydrogen atom. All the speciality elastomers are having polar functional groups and expected to form interchain crosslink with polyurethane on thermal activation. In general it is the preheating preblending technique, which offers better performance properties than the preblending technique. Blend properties largely depend on the blending technique, polymer types and blend ratio. Preheating the preblends before addition of curative results interchain crosslinking between the two elastomeric phases via the reactive polar functional groups of virgin elastomers. IR spectral analysis revealed that the interchain crosslinking reaction occurs between the two elastomers without any curative and based on the spectral data a plausible mechanistic pathway for the crosslinking reaction has been reported. High temperature DSC study showed that the thermal decomposition of the preblended sample occurs at lower temperature than the preheated preblended sample having same elastomer ratio. The lower value of the exothermic heat of oxidative degradation of the preheated preblended sample also suggested the higher stability of the blends towards thermal decomposition. The glass transition temperature (T_g) of the blends shifted to the higher temperature side for preheated preblended sample, which indicated the enhancement of compatibility of blend by preheating the preblends before addition of the curative. Differential solvent swelling study has confirmed the phase adhesion between two elastomers. The extraction of the single phase by solvent was easier in the case of preblended sample. This extractibility was restricted for preheated preblended sample as indicated by the uniformity in the SEM photographs. This is due to the interchain crosslinking reaction between the two elastomeric phases upon heat treatment, which enhanced the phase adhesion between the two elastomers.

Key words : Polyurethane, Poly(ethylene vinyle acetate), Chlorinated polyethylene, Hydrogenated acrylo nitrile butadiene rubber, VAMAC, Silicone rubber, Dicumyl peroxide, Preblend, Preheated Preblend, Interchain Crosslinking, Blend Morphology.