Abstract

Thermoplastic elastomers (TPEs) have always been a keen area of interest ever since its introduction in the 1950s. These unique class of materials exhibit functional properties of vulcanized rubber and can be processed like any thermoplastic. In our study, we have developed new generation TPEs based on an ultra-high molecular weight styrene-ethylene-butylene-styrene (SEBS) and thermoplastic polyurethane (TPU) aiming potential applications in the automotive industry. Effect of SEBS-g-MA and EPM-g-MA as two structurally different compatibilizers for the blends was investigated. The improvement in micromorphology and thereby, the augmentation in various performance properties were examined. A cost-effective, yet efficient method of reactive blending of SEBS-g-MA/TPU blends have been developed and analyzed in this study. In situ generation of the graft copolymer at the blend interface was confirmed from the spectroscopical analysis. Various state-of-the-art characterization techniques, along with mechanical models were employed to meticulously evaluate the reactive blends developed. Reproducible and controllable morphology was achieved throughout the blend composition range. Temperature Scanning Stress Relaxation (TSSR) technique was used to determine the non-isothermal stress relaxation behaviour of the blends at elevated temperature. Further, the TPU phase in SEBS-g-MA/TPU blends was adhesion modified using 4,4'-Diphenylmethane diisocyanate (MDI) to effectively boost interfacial interactions between the blend components and thereby improving the properties. In a separate study, electron beam crosslinking was used as an eco-friendly technique to crosslink the blend systems to enhance the thermomechanical properties of both SEBS/TPU and SEBS-g-MA/TPU blends.

Keywords: styrene-ethylene-butylene-styrene, thermoplastic polyurethane, SEBS-g-MA, reactive blending, compatibilizer, polymer blending, morphology, mechanical properties.