Improved crystallinity and dynamic mechanical properties of reclaimed waste tire rubber/EVA blends under the influence of electron beam irradiation

ABSTRACT

Dependence on automobiles has led to a huge amount of waste tires produced annually around the globe. In this study, the feasibility of recycling these waste tires by blending reclaimed waste tire rubber (RTR) with poly(ethylene-co-vinyl acetate) (EVA) and electron beam irradiation was studied. The RTR/EVA blends containing 100–0 wt% of RTR were prepared in the internal mixer followed by electron beam (EB) irradiation with doses ranging from 50 to 200 kGy. The processing torques, calorimetric and dynamic mechanical properties of the blends were studied. Blends were found to have lower processing torque indicating easier processability of RTR/EVA blends compared to EVA. RTR domains were found to be dispersed in EVA matrix, whereas, irradiation improved the dispersion of RTR into smaller domains in EVA matrix. Results showed the addition of EVA improves the efficiency of irradiation induced crosslink formation and dynamic mechanical properties of the blends at the expense of the calorimetric properties. Storage and loss modulus of 50 wt% RTR blend was higher than RTR and EVA, suggesting partial miscibility of the blend. Whereas, electron beam irradiation improved the calorimetric properties and dynamic mechanical properties of the blends through redistribution of RTR in smaller domain sizes within EVA.

Keyword: Reclaimed rubber; Waste tire rubber; Devulcanized rubber; EVA; Poly(ethylene-*co*-vinyl acetate); Ethylene vinyl acetate; Blends; Electron beam irradiation; Ionizing radiation