Abstract

Electron beam modification of the films prepared from the blend of low density polyethylene (LDPE) and ethylene vinyl acetate copolymer (EVA) containing 45% vinyl acetate and ditrimethylol propane tetraacrylate (DTMPTA) has been carried out over a range of radiation doses (20 - 500 kGy), concentrations of DTMPTA (1 - 5 wt%) and blend compositions. The infrared (IR) studies reveal that oxidation and crosslinking dominate up to an irradiation dose of 100 kGy. At higher irradiation doses chain scission and disproportionation predominate among all the competitive processes for the 50 : 50 blend without DTMPTA. The gel fraction of the films increases with the increase in irradiation dose, DTMPTA level and EVA content of the blends. X-ray diffraction (XRD) and differential scanning calorimetry (DSC) studies show that the crystalline portion of the blends are only affected by radiation at higher irradiation doses (200 kGy and above). Scanning electron microscopy (SEM) studies indicate that in the 50 : 50 blend the LDPE forms the continuous phase, which is further confirmed from the atomic force microscopy (AFM) and transmission electron microscopy (TEM). However, a co-continuous morphology is formed when the EVA content is increased. When DTMPTA is added to the blends (≥ 3 wt%), the 50 : 50 blend exhibits a co-continuous morphology. The mechanical and dynamic mechanical properties of the films are changed with the above variables. Reprocessibility studies reveal that the blends irradiated at 50 kGy and below are thermoplastic elastomers with a low permanent set. The electrical properties, heat shrinkability, printability and surface properties of the modified TPE films have been evaluated at different radiation doses, monomer levels and blend proportions, keeping the potential application of the electron beam modified films in mind.

New thermoplastic elastomers have been prepared from the blends of metallocene-based polyolefins (Engage) with LDPE and EVA of various vinyl acetate contents with LDPE by electron beam modification. The structural changes of these blends with or without sensitizer in the presence of irradiation and the effect of variation of the elastomeric portion of the TPE blends have been

evaluated by XRD and DSC. The SEM studies in conjunction with the AFM studies indicate the soft rubber domain in the continuous plastic matrix. Significant improvements of the mechanical, dynamic mechanical and set properties have been obtained by electron beam modification, retaining its reprocessibility characteristics. Effect of the addition of DTMPTA as a radiation sensitizer has also been evaluated from the mechanical, dynamic mechanical properties and reprocessibility studies.

Thermoplastic elastomeric films have been prepared from the blends of EVA with LDPE, HDPE or PP by electron beam modification in the presence of radiation sensitizer. The study is also taken up to evaluate the effect of variation of the plastic portion of the TPE blends keeping EVA 45 as the elastomeric phase. XRD and DSC studies were carried out to evaluate the structural changes of these blends. SEM studies indicate the morphological features of the blends. Significant improvement in the mechanical, dynamic mechanical and set properties have been obtained by electron beam modification of the blends of EVA with LDPE or HDPE. However, in the case of EVA-PP blend, degradation of the PP phase has been observed. The effects of DTMPTA as a radiation sensitizer have also been evaluated from the mechanical and dynamic mechanical properties.

Key words: *Radiation, Electron beam, Thermoplastic elastomer, Polymer blends, Polyolefin, low density polyethylene, Ethylene vinyl acetate, Engage, Ditrimethylol propane tetraacrylate, Modification of polymers, Radiation sensitizer, Mechanical properties, Dynamic mechanical properties, Morphology, Reprocessibility, Permanent set, Dielectric properties, Heat shrinkability, Surface modification, Printability.*