Abstract

Nitrile rubber , the copolymer of acrylonitrile (33%) and butadiene have been blended with varying concentrations of multifunctional monomers namely tripropyleneglycol diacrylate (TPGDA), trimethylolpropane triacrylate (TMPTA), trimethylolpropane trimethacrylate (TMPTMA) and tetramethylmethane tetracrylate (TMMT) and irradiated with electron beam at different doses (0-500 kGy). In a similar manner, the influence of electron beam on the other grades of nitrile rubbers with 18% and 50% ACN contents, carboxylated nitrile rubber (XNBR) with 33% ACN content, hydrogenated nitrile rubber (HNBR) with 44% ACN content and also on three grades of acrylic rubbers with different cure sites in the presence and absence of polyfunctional monomers have been studied. FTIR (Fourier Transform Infrared Spectroscopy) and Solid state NMR (Nuclear magnetic resonance) studies reveal formation of polar carbonyl groups and there is a decrease in double bonds on irradiation. Spectroscopic crosslink densities have been determined for nitrile rubber with different acrylonitrile contents by NMR and compared with chemical crosslink densities. More crosslink clustering is observed in nitrile rubber with 18% nitrile content. Various crosslinking and scission reactions are also indicated. Polyfunctional monomer has been found to suppress the scission reactions in the control rubber. Gel fraction and crosslink density increase with radiation dose and the increment is marginal at higher doses. Multifunctional monomers promote the efficiency of crosslinking at lower doses. Mechanical and dynamic mechanical properties improve upon irradiation up to a certain level. Nitrile rubber vulcanizates with varying levels of sulphur and accelerator have also been subjected to different doses of electron beam radiation. Nitrile rubber vulcanizates with higher amount of sulphur lead to more monosulphidic linkages on irradiation and also result in improvement in their mechanical and dynamic mechanical properties. An artificial neural network (ANN) has been constructed to predict the mechanical properties of nitrile rubber

vulcanizates radiated with electron beam. Thermal degradation of various nitrile rubber vulcanizates has also been studied.

Keywords: Nitrile rubber, Multifunctional Monomer, Electron beam, Irradiation, Mechanical Properties, Dynamic Mechanical Properties, Gel Fraction, Vulcanizates, Artificial Neural Network