Controlling the dielectric and optical properties of PVA/PEG polymer blend via e-beam irradiation

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Abstract Polyvinyl alcohol (PVA)/polyethylene glycol (PEG) blend films were prepared by the solution casting method. The films were irradiated using 1.5 MeV of the electron beam at varying doses over the range 0–70 kGy to investigate the modifications induced in the dielectric and optical properties. The dielectric constant (ε') and dielectric loss (ε'') were measured in the temperature range 308–408 K and in the frequency range 30 kHz - 3 MHz. According to the frequency and temperature dependence of ε'; an α- relaxation peaks were observed in all samples and assigned to the micro-Brownian motion of the polymer blend chains. Both ε' and ε'' showed a decrease with 5and10kGy doses and an increase in the dose rang10–70kGy. The temperature dependence of the ac conductivity (σ_{ac} (T)) shows an Arrhenius type behavior separated into three distinct regions. The frequency dependence of the ac conductivity (σ_{ac} (f)) indicates that the correlated barrier hopping (CBH) is the most suitable mechanism for conduction. Also, the influence of e-beam irradiation on the absorption coefficient (α), the indirect optical band gap (E_g) and the refractive index (n) of PVA/PEG copolymer films were investigated. The results of the present system are compared with those of similar materials.

Keywords: PVA/PEG; Blend; e-beam irradiation; AC conductivity; Activation energy; Optical energy band gap; Refractive index; Dielectric relaxation; UV–vis spectroscopy