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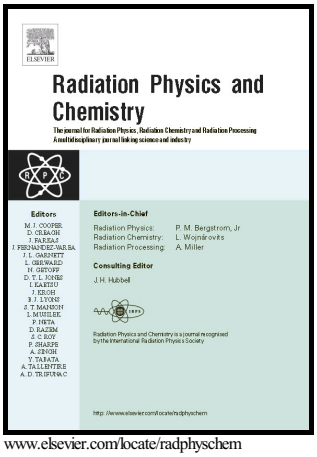

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Influence of Gamma Irradiation on Physical and Chemical Properties of Makrofol (NTD) Material

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Abstract

Physical and chemical alterations induced in Makrofol LT 6-4 Nuclear Track Detector (MK-NTD) films after gamma irradiation with different doses (150 kGy - 950 kGy) were studied. The induced modifications in irradiated samples were analyzed by various procedures namely: X-ray diffraction (XRD), Fourier-Transform-Infrared (FT-IR) spectroscopy, Photoluminescence (PL) spectroscopy, UV-Visible spectroscopy and electrical measurements, as well. XRD results show a broadening of the XRD peak after gamma irradiation, indicating a change in crystallite size of the irradiated polymeric samples. The spectra of FT-IR show overall changes in the band intensities after gamma irradiation, which indicates degradation and cross-linking of polymer chains at specified doses. The PL emission spectra reveal that the intensities of PL peaks descend with increasing gamma irradiation dose and concern the increase in the number of defects, acceptors and donors. Our UV-Vis results show a shift in the spectra of MK-NTD samples towards longer wavelengths with the increase in the gamma-dose. This shift indicates a reduction in the band gap energy, which, in turn, could be attributed to the formation of defects in the gamma irradiated samples. Additionally, the electrical results show some changes in dielectric constant according to the values of frequencies. Upon irradiation, a considerable increase in the dielectric constant and loss was observed, which could be attributed to the creation of dipoles like C=O and C−O inside the irradiated polymer.