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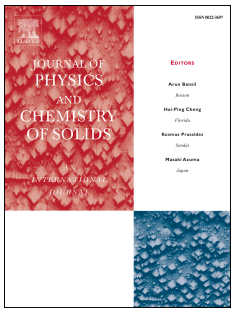

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Effects of Gamma-ray Irradiation on the Optical Properties of Amorphous $Se_{100-x}Hg_x$ Thin Films

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Abstract

In this study, the thermal quenching technique was employed to prepare bulk samples of $Se_{100-x}Hg_x$ (x = 0, 5, 10, 15). Thin films with a thickness of ~ 250 nm were deposited on glass substrates using the thermal evaporation technique. These films were irradiated with gamma rays at doses of 25–100 kGy. The elemental compositions of the as-deposited thin films were confirmed by energy dispersive X-ray analysis and Rutherford backscattering spectrometry. X-ray diffraction analysis confirmed the crystalline nature of the thin films obtained with a dose of 75 kGy. Fourier transform-infrared spectroscopy showed that the concentration of defects decreased after gamma irradiation. Microstructural analysis by field emission scanning electron microscopy indicated that the grain size increased after irradiation. Optical study based on spectrophotometry showed that the optical band gap values of these films increased after the addition of Hg whereas they decreased after gamma irradiation. We found that the absorption coefficient increased with doses up to 75 kGy but decreased at higher doses. These remarkable shifts in the optical band gap and absorption coefficient values were interpreted in terms of the creation and annihilation of defects, which are the main effects produced by gamma irradiation.

Keywords— Chalcogenide; Gamma irradiation; Optical property; Thin Film.