Gamma irradiation induced effects on optical properties and single oscillator parameters of Fe-doped CdS diluted magnetic semiconductors thin films

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Abstract

Gamma radiation (100-500 kGy) induced effects on optical properties and single oscillator parameters of nanocrystalline diluted magnetic semiconductor thin films Cd1-xFexS (x=0.1, 0.15 and 0.2) with different compositions prepared by electron evaporation techniques have been studied. The optical characterization of the films has been carried out from spectral transmittance and reflectance obtained by double beam spectrophotometer in the wavelength range from 190 to 2500 nm. It is clearly shown that the direct optical band gap decreases with the increase in gamma radiation dose. This is attributed to the defect number growth. The refractive index and extinction coefficient have shown clear changes with irradiation and found to increase with the increase of the doses of gamma radiation. This post-irradiation increase of the refractive index was interpreted in terms of the film density increase due to ionization and/or atomic displacements. Furthermore, the dispersion of the refractive index is discussed in terms of the Wemple-DiDomenico single oscillator model. The oscillator parameters, the single oscillator energy Eo, the dispersion energy E-d, the static refractive index no, average interband oscillator wavelength 2, and the average oscillator strength So, were estimated and revealed pronounced changes with irradiation. The observed changes in optical properties and single oscillator parameters clearly indicate the possibility of using Fe doped CdS thin films as a material for gamma radiation dosimeters (C) 2015 Elsevier Ltd. All rights reserved.

Keywords

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