Annealing effects on the optical parameters of Cu10Se90 and Cu20Se80 films deposited by evaporation technique

A. Abu-Fadla, M. M. Hafiz, M. M. Wakaad, A. S. Ashour

Abstract:

In this study, amorphous chalcogenide Cu10Se90 and Cu20Se80 thin films have been obtained by thermal evaporation deposition process on well-cleaned quartz substrates. Thin films were annealed at various temperatures in N2 atmosphere. X-ray diffraction patterns (XRD) showed that the films are like amorphous in nature for as prepared but annealed films produced crystalline peaks and that their crystallinity was proportional to annealing temperature. Thin film morphologies were examined using scanning electron microscopy (SEM). The optical absorption coefficient (α) for the as-deposited and annealed films was calculated using spectrophotometer measurements of the transmittance (T) and reflectance (R) at normal incidence of light in the wavelength range 200–2500 nm. The optical band gap (Eg) was found to be around 2.281 and 2.231 eV for as-prepared Cu10Se90 and Cu20Se80 thin films respectively, (Eg) showed a decrease with increasing of the annealing temperature higher than the glass transition temperature (Tg). The high frequency dielectric constant (ε∞) and the ratios of the carrier concentration to the effective mass (N/m*) were also determined for the as-deposited and annealed films. The dispersion of the refractive index is discussed in terms of the single-oscillator model. The oscillator energy Eo and the dispersion energy Ed were obtained. The results are discussed and correlated in terms of amorphous-crystalline transformations.

Keywords:

Glasses; Optical; X-ray diffraction; Annealing

Published In: