Thickness effect on the optical parameters of Ge 20 Se 50 Te 30 thin films

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Abstract:

The bulk Ge20Se50Te30 glasses were prepared by the melt-quenching method and the studied films of different thicknesses 100, 130, 160, and 200 nm were synthesized on glass substrates from the bulk glasses by the thermal evaporation technique under high vacuum. The stoichiometry of the studied thin films was determined by energy dispersive X-ray diffraction (EDX). The structure of the investigated bulk glasses as well as thin films was determined by X-ray diffraction (XRD). The XRD data confirmed the amorphous state of the bulk Ge20Se50Te30 glasses. However, the prepared films exhibit a mainly amorphous structure with some crystallites which are related to Se and GeSe2-phases. These crystalline particles were identified by scanning electron microscopy (SEM). The effect of thickness on the optical parameters of Ge20Se50Te30 films was investigated. The optical transmittance and reflectance spectra were recorded using a double beam spectrophotometer in the photon wavelength range of 190-900 nm. The values of some important optical constants such as the absorption coefficient, energy gap, refractive index, and extinction coefficient were calculated. The optical absorption measurements showed that the fundamental absorption edge is a function of film thickness. The indirect band-gap was found to decrease from 1.78 to 1.53 eV as the film thickness increased from 100 to 200 nm.

Keywords:

Chalcogenides; Thin films; Optical parameters

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