Optical studies of CdZnSe thin films

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Abstract

Thin films of $Cd_{1-x}Zn_xSe$ (x = 0, 0.2, 0.4, 0.6, 0.8 & 1) obtained by mechanical mixture of CdSe and ZnSe have been deposited using vacuum thermal evaporation method. These thin films are characterized through XRD. The XRD patterns reveal that the two binary compounds have been completely transformed into ternary compound. The structure of thin films of $Cd_{1-x}Zn_xSe$ is hexagonal (wurtzite) having preferred orientation along c-direction with (002) plane. The absorption and transmission spectra of these films have been taken using spectrophotometer. The absorption edge shifts toward lower wavelength side with the increase of Zn concentration. The energy band gap has been determined using absorption spectra through Tauc relation. The energy band gap of these films increases with increase of Zn content in CdSe. The overall transmission of these thin films increases with the increase of wavelength. The refractive and extinction coefficient of these films have been determined through the transmission spectroscopic measurements drawing an envelope on transmission spectra. Current-voltage measurements confirm the ohmic nature of these thin films. The variation of electrical conductivity of $Cd_{1-x}Zn_xSe$ (x = 0, 0.2, 0.4, 0.6, 0.8 & 1) thin films with Zn concentration and temperature has been studied using the above-mentioned I-V characteristics. This variation has been explained on the basis of carrier concentration and defects, which are present in the prepared thin films. The activation energy of these films have also been determined using graph between $\ln(\sigma)$ and 1000/T. The variation of activation energy in given temperature range and with Zn concentration is studied.

Keywords: Vacuum evaporation technique, Energy band gap, Refractive index, Extinction coefficient, electrical conductivity, activation energy.