

**. RAPID THERMAL ANNEALING (RTA) INDUCED BILAYER MIXING OF
CdTe/ZnTe THIN FILMS**

Praveen Dhangada

*A.V. College of Arts, K.M. College of Commerce,
E.S.A. College of Science, Vasai, India*

Deepak Gaikwad

*KTSP Mandal's KMC.College,
Khopoli, India*

Abstract :

In the present investigation, 200 nm thick CdTe/ ZnTe bilayer thin films were deposited by vacuum evaporation technique on glass substrates. The CdTe:ZnTe compositional ratio of the films was 1:1 and 1: 0.4. These films were annealed using Rapid Thermal Annealing (RTA) technique at 800⁰C in Argon atmosphere for 2 min. The structural characterization were done using X- ray diffraction (XRD) technique. The XRD pattern indicates formation of CdZnTe phases after RTA processing in both the ratio of compositions. The crystallite size for the bilayer films with composition 1: 1 and 1:0.4 is found to be 80 nm and 53 nm respectively. Atomic Force Microscopy (AFM) was carried for surface study. AFM images indicate formation of small granules on the film surface. The band gap energy of annealed films is estimated on the basis of optical absorption spectra obtained from UV-Vis spectroscopy. The band gap energy is found to be 2.38 eV and 1.95eV respectively for the films with the composition 1: 1 and 1:0.4. The band gap value decreases with the percentage of ZnTe in CdTe/ZnTe bilayers.



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Keywords : CdTe, ZnTe, RTA, AFM, UV-Vis.

Introduction:

In the last decade, the interest in the study of thin film CdZnTe (CZT) alloys has been increased due to their important industrial applications such as solar cells, gamma-ray detectors and photo detectors. A variety of preparation techniques have been reported for CZT thin films including chemical vapor deposition, close-spaced vapor transport, RF sputtering etc. The physical vapor deposition method is also often used for the preparation of CdZnTe thin films because it offers many possibilities to modify the preparation conditions and so to study the correlation between deposition parameters and physical properties of resultant films.

Experimental method:

CdTe/ZnTe bilayers of 200 nm were deposited onto glass substrates by thermal evaporation, in a vacuum. The starting source materials, CdTe and ZnTe, were alternately evaporated. The pressure during evaporation was maintained at 10^{-5} Torr. The deposition rate and the thickness were controlled by means of a quartz crystal monitor placed next to the substrates. Samples were then Rapid thermal annealed at 800°C . These samples were further characterized using XRD, AFM and UV.

Results and Discussions:

Characterization:

The structure of these samples were investigated using X-ray diffractometer (XRD) using Cu-K α radiation with $\lambda = 1.5418 \text{ \AA}$ on a Phillips Panalytical Xpert Pro MPD spectrometer. XRD was carried out for both the samples. As seen below in fig 1 & 2, clear peaks represents formation of crystalline CdZnTe. The optical measurements were carried out using Varian CARRY 500 UV-VIS-NIR Spectrometer.

XRD Studies:

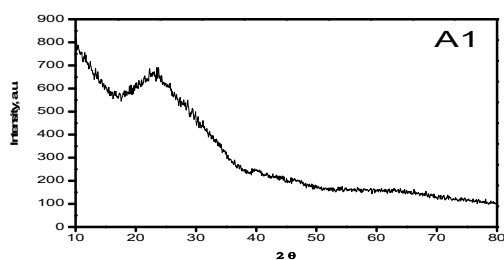


Fig 1a

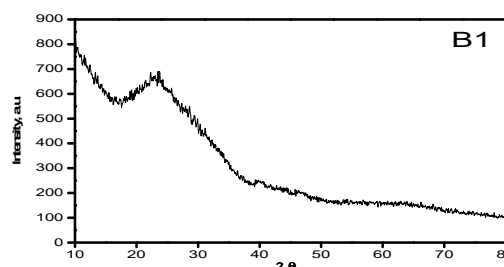


Fig 2a

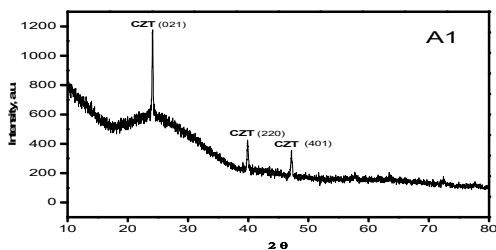


Fig 1b

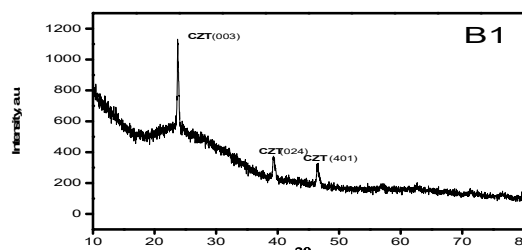


Fig 2b

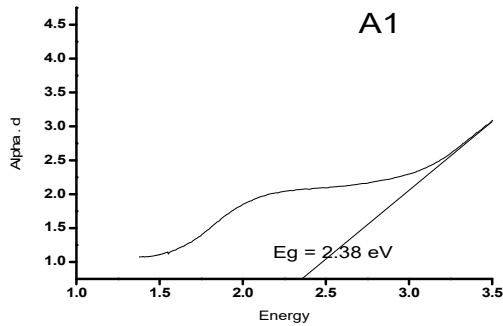
UV Studies :

Fig 3

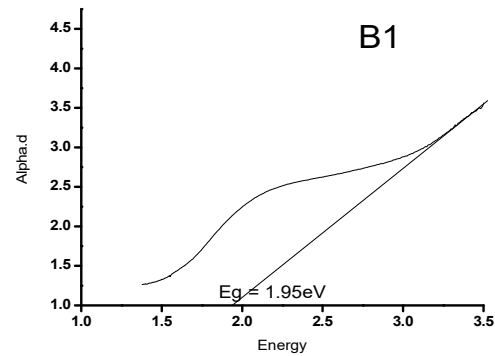


Fig 4

The band gap energy is found to be 2.38 eV and 1.95eV respectively for the films with the composition 1: 1 and 1:0.4.

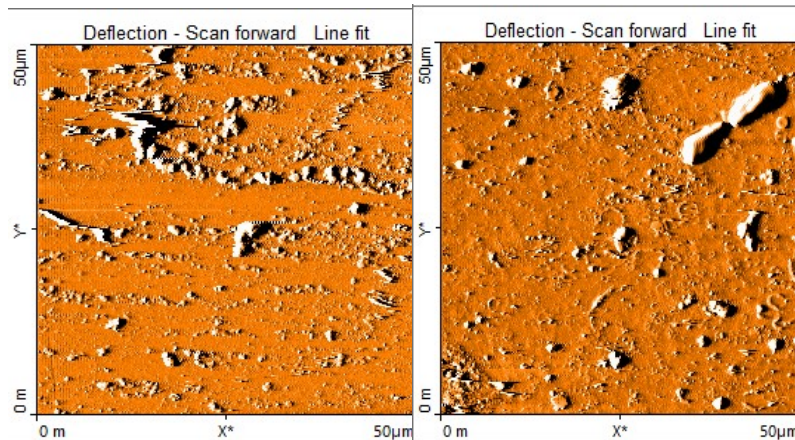
AFM Studies :

Fig 5a

Fig 6a

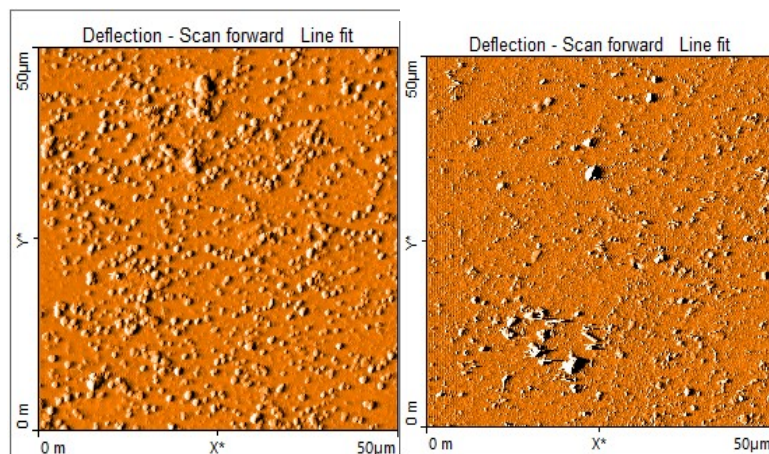


Fig 5b

Fig 6b

Conclusion:

CdZnTe crystalline phase formation is confirmed in XRD of post annealed samples. The crystallite size lies between 53 to 80 nm as confirmed by AFM images. The band gap energy is found to be 2.38 eV and 1.95 eV. It is observed that the band gap energy decreases with change in proportion of CdTe : ZnTe.

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