International Journal of Advanced Research in Engineering Technology & Science
ISSN: 2349-2819
Email: editor@ijarets.org Volume-5, Issue-7 July- 2018 www.ijarets.org

Energy Band Gap Studies of CdS-Se Semiconducting Thin Film

Sachin Kumar Sharma
Department of Physics
Meerut College, Meerut

Deepti Saxena
Department of Physics
Ismail National Mahila P.G. College,Meerut

ABSTRACT

Spectroscopic techniques are very useful for characterizing the semi–conducting materials. We demonstrate here how out of the three methods for computing energy gap, the method based on reflection studies is better suited than the other two methods which are based on absorption and transmission

INTRODUCTION

Study on semiconducting films required the knowledge of energy band gap of the semi conducting film. We have to search for a technique which is fast and accurate Spectroscopic techniques are the best ones. Traditionally, the transmission and reflection spectra of the film were measured by using spectrophotometer and absorbance was then computed. We have found that only reflection spectra can be used to estimate energy band gap. The three techniques for estimating energy band gap of CdS-Se composite film are, presented as under:

THEORY

For direct band gap materials the well known relation for computing energy gap by absorption coefficient is [4, 5, 10, 13]

$\alpha = A(h\upsilon) - E_g)½$ [1]

where α is absorption coefficient and hυ is the incident photon energy.

α can be estimated by various ways such as

- Directly by spectrophotometer for various photon energy levels [9]

- Estimation by observing transmission and reflection spectra of the given material using the relation
  $\alpha = [1 + (R + T)]$
  where T and R are transmission and reflection coefficients. [4, 5, 10]

- We may also estimate absorption [7] as proportional to $Ln(I - I_1)$.

Where I_1 is intensity of reflected light from the upper surface of the film only and I is the intensity of reflected light due to complete film; we have used these three methods to estimate energy band gap of the given material.[10,13]

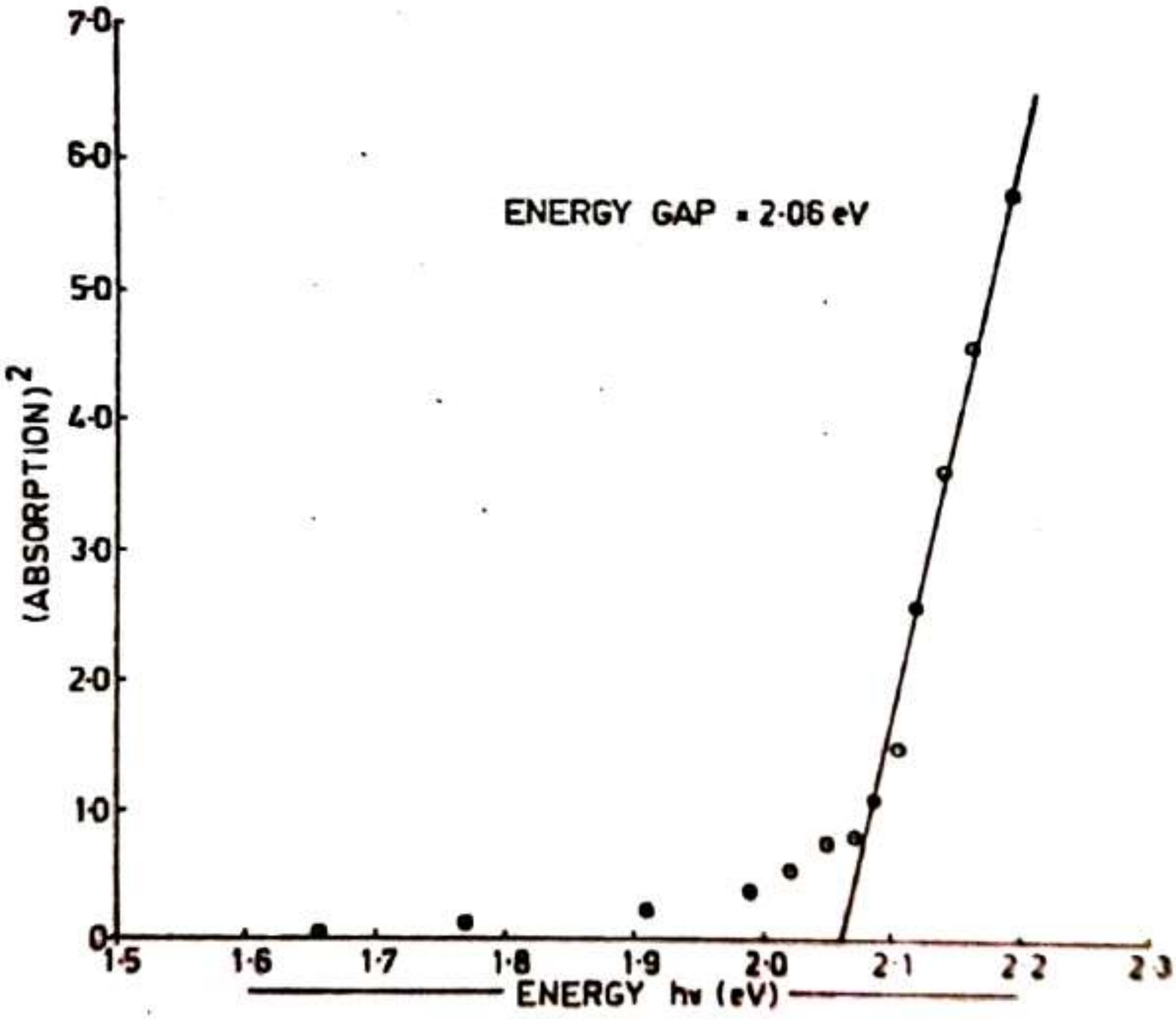

Fig 1 : Variation of α^2 Vs hυ for CdS-Se Film [4, 5, 10]

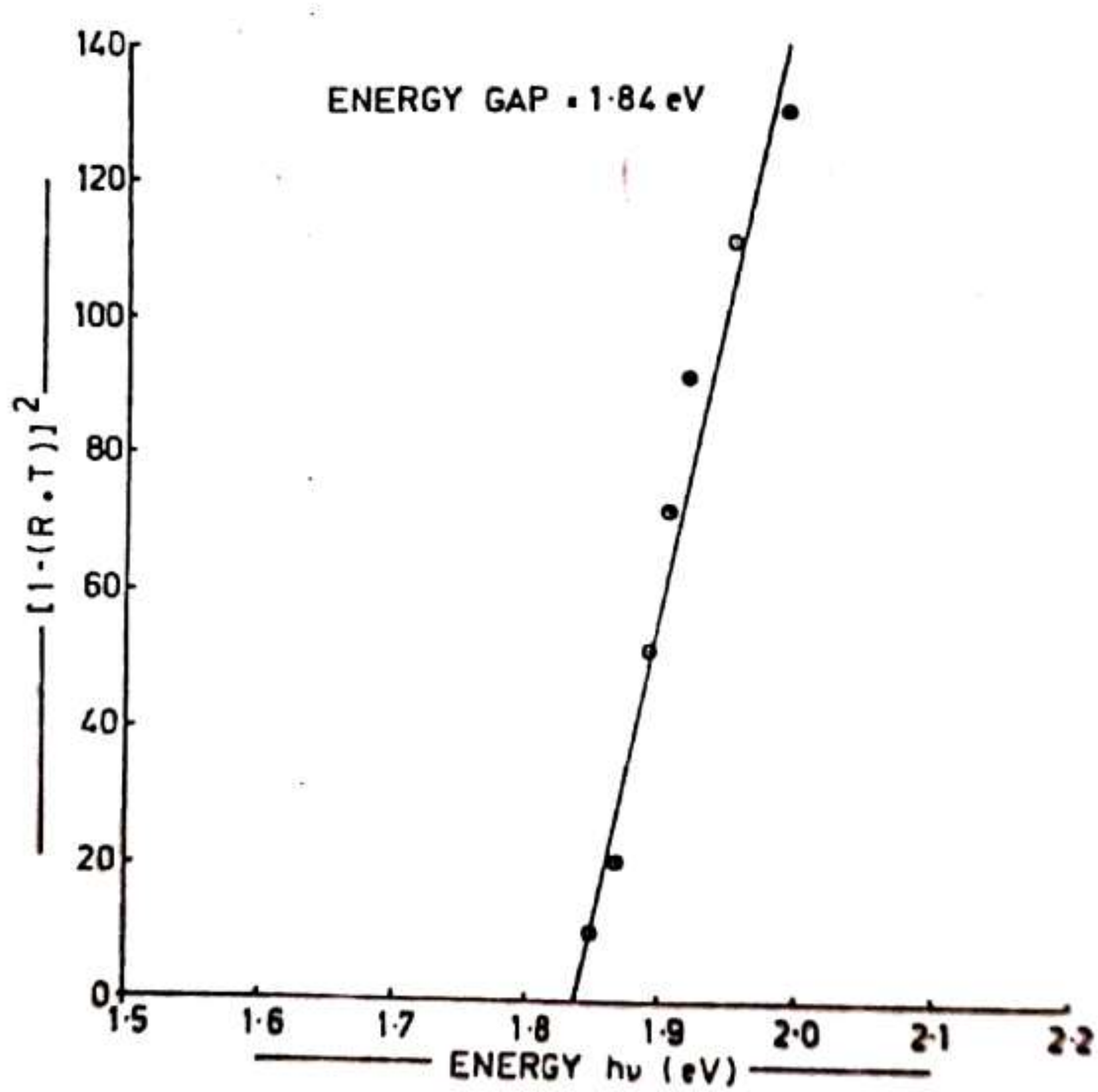

Fig. 2 : Variatin of $[1 - (R - T)]^2$ Vs hυ for CdS- Se Film [10, 13]

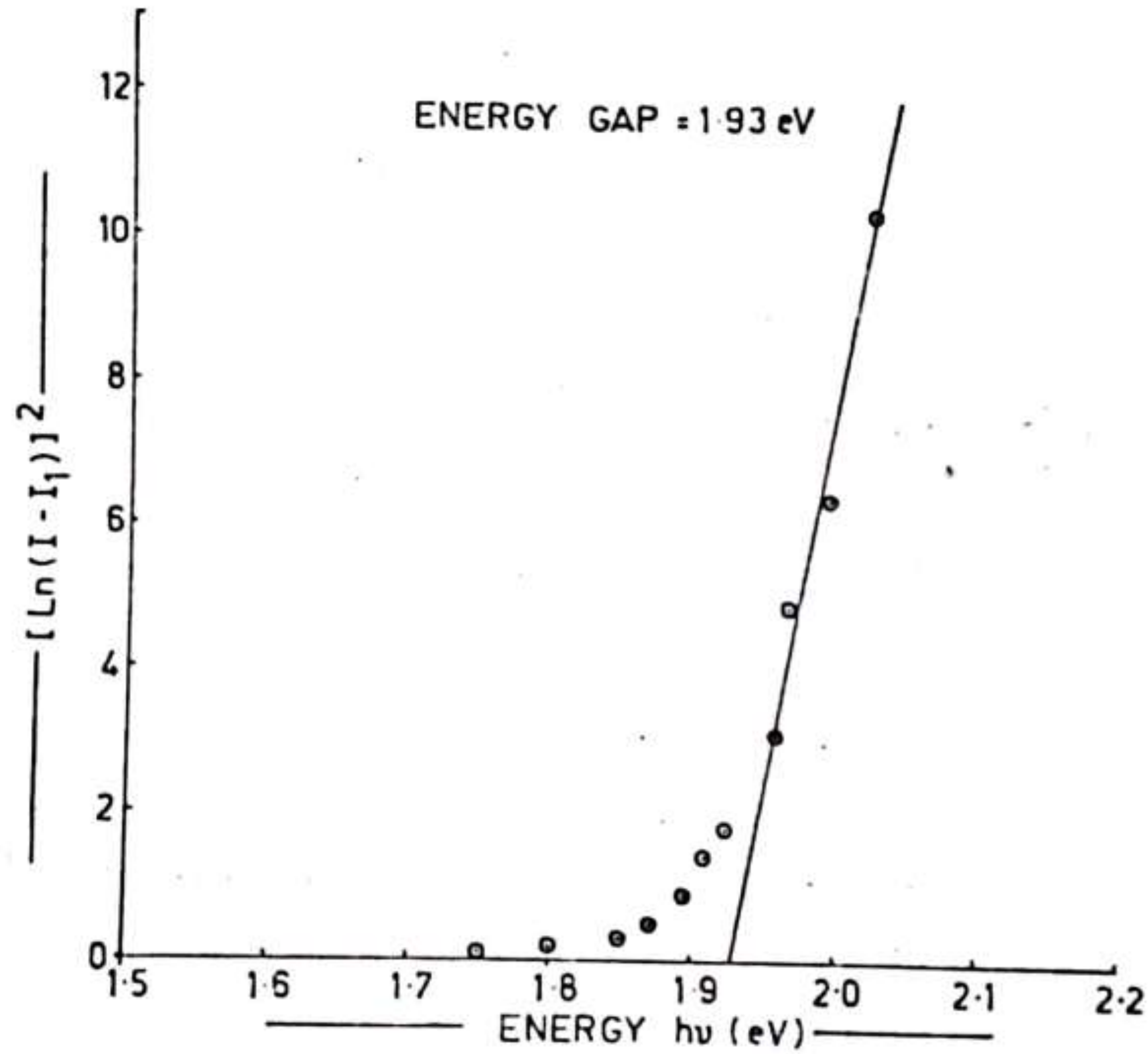

Fig. 3 : Variation of $[Ln (I – I_1)]^2$ Vs hυ for CdS-Se Film [4, 5, 10]

EXPERIMENTAL PROCEDURE

To demonstrate these methods, we have prepared thin film of CdS-Se by discrete evaporation method under vacuum of the order of 10^{-5} torr on glass substrate. The optical properties were measured by Hitach U-3400 spectrophotometer. The absorption coefficient was recorded at normal incidence and reflectance [R] measured at 5 spectular reflection. [2, 10, 12]

RESULTS AND DISCUSSION

Fig [1] shows the plot of α [6, 12] versus hυ. The intercept of α^2 versus hυ curve extrapolated to $\alpha^2=0$ was taken as the value of the direct band gap. Fig [2] shows the band gap of the film calculated from the absorption [obtained by subtraction of (R+T) from 1] by plotting a graph between $[1-(R+T)]^2$ vs hυ Fig [3] shows the plot between $[Ln(I-I_1)]^2$ vs hυ, to calculate the band gap of the film material by reflection spectra.

Here I is the intensity in the region where reflectivity falls from higher to lower value and I_1 the intensity due to upper layer [the minimum intensity after fall in reflectivity]. The band gaps of the CdS–Se film by these three graphs come out to 2.06 1.84 and 1.93 eV respectively. In the first method effect of reflection is ignored whereas in second method, reflection due to reference is ignored therefore none of these method are accurate. In the third method we have not ignored any such important factors. [4, 5, 10, 13]

CONCLUSIONS

We conclude that among these three methods the third method is a better one.

REFERENCES

1. Mishra S.C.K. et al Ind. Jour of tech. vol. 29 pp 228 -230, may 1691.
2. Heavens OS, Optical properties of thin solid films, Dover publications Inc New Delhi 1965.
3. Hurwitz E Efficient visible lasers of by electron beam excitation Appl Phys Letters 8 pp 243-245 1966.
4. Sharma T. P., Mishra S.C.K. et el, Ind. Journal of Tech. Vol 28, pp 205-207 May 1990.
5. Sharma , TP et al, Indian Journal of pure and Applied physics, Vol 28 pp. 486- 489 Aug 1990.
6. Mishra SCK, S Arma TP, Bull MAT. Sci. Vol 14 no 1 pp no 1 pp 43-47 Feb 1991.
7. Sharma T.P., Singh V, and Sharma Sachin Kumar "Characterization of thick films 6th International workshop on physics of semiconductor devices, New Delhi Dec 1991.
8. Liu, G., schulneyer, T. Brotz, J., Klein, A. and Jalgermain, W., Interface properties and band alignment of Cu2S/CdS thin film Solar cells. Thin Solid Films, 431, 477-482, 2003.
9. Ashour A. The Physical characteristics of Cu~2S/CdS thin film Solar Cell. Journal of Optoelectronics and Advanced Materials, 84(19) 1447, 2006.
10. Ouachtari, F., Rmili, A., elidrissi, B., Bouasud, A. Erguig, H. and Elies, P. Influence of both deposition time an S/Cd ratio on the structure, surface morphology, Chemical Composition and optical properties of CdS Thin Films elaborated by chemical bath deposition. Journal of Modern Physics 2011.

11. Parameshwari, P.M., Bhatt, S.P., Electrical behavior of Ag in–Cds thin film schottpy diode irradiated with 8 Mev electron beam International Journal of Materials Science 12(2), 211-2220, 2017.

12. Fathy, M. Elymany, S. Bishara A.A., Kertan, G.D., and Kashyont, A.E.H.B., Sns noncrystalline thin films. for n-Cds/P-Sns Solar cell devices. Journal of Materials Science: Materials in Electronics, 31(2), 18120-18134, 2020.

13. Gadaua, A.S., Al-Shamiri, H.A., Alsherani, S.M., Khalil, H.F., ElNahas M.M. and Khedr, M.A. Epitaxial growth and opitcal properties of Lash deparited Cds thin films. Coating, 12(1), 87, 2022.