

Effect of E-M Field on Hall Coefficient of CdS Thin Film

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Thin film of CdS was prepared by vacuum evaporation method. The variation in Hall coefficient R_H of prepared thin film was recorded with electromagnetic field of different frequencies (5-15 MHz at 1MHz steps) and of 10mV, and 15mV amplitudes. The statistical analysis of obtained data was done by R-software which showed that the value of Hall coefficient decreases significantly with increment in frequency of E-M field.

Keywords: Vacuum Evaporation Method, Hall Coefficient, R-Software.

1. INTRODUCTION

To meet up the requirements of energy for world, solar energy is the ultimate answer, and this energy can be harvested using solar cells made by thin films of optically active materials, such as CdS. Thin films of CdS can be prepared by various methods[1] and their properties were studied[2-9] earlier. In reference to solar eruption and its effect on solar cells here we studied the effect of electromagnetic field on Hall coefficient of thin film of CdS.

2. EXPERIMENTAL DETAILS

Pure CdS in powdered form was taken to produce thin film. A Hind Hivac Vacuum System (model 12A4) was employed for fabrication of thin film in the present investigation. Since here specimen was in powdered form, we used boat of quartz tube of ½ inch depth, which was placed in cone shaped tungsten coil. Tungsten strips of 10 cm×0.5 cm×0.05 cm were taken and twisted into a cone like shape at the middle and the two ends of 2.5 cm each were left for fixing in the electrode system of vacuum unit.

Glass sheets were used as substrate after proper cleaning. Gold electrodes were formed on substrate such that film between electrodes was 4"×1" and of thickness 0.30 μm. The thickness of thin film was measured with Talysurf instrument (Model Talysurf 10, Taylor-Hobson). Now substrate was mounted on a wooden block and fine copper wires were adhered for the current and Hall voltage contacts on the film by air drying silver paint. We used Keithley micro-voltmeter (model 150B) to record Hall voltage. The electromagnetic field of frequencies (5-15 MHz at 1MHz steps) and of 10mV, and 15mV amplitudes were applied in the direction of flow of electric current and Hall voltage (V_H) recorded and Hall coefficient R_H was calculated accordingly. This data were tabulated and analyzed statistically by using R-software.

3. RESULTS

The values of R_H ('-ve, $\times 10^{-7} \text{ m}^3/\text{C}$) of thin film of CdS of thickness $t = 0.30 \mu\text{m}$ with frequencies of E-M field of amplitude 10mV are plotted in Fig. 1.

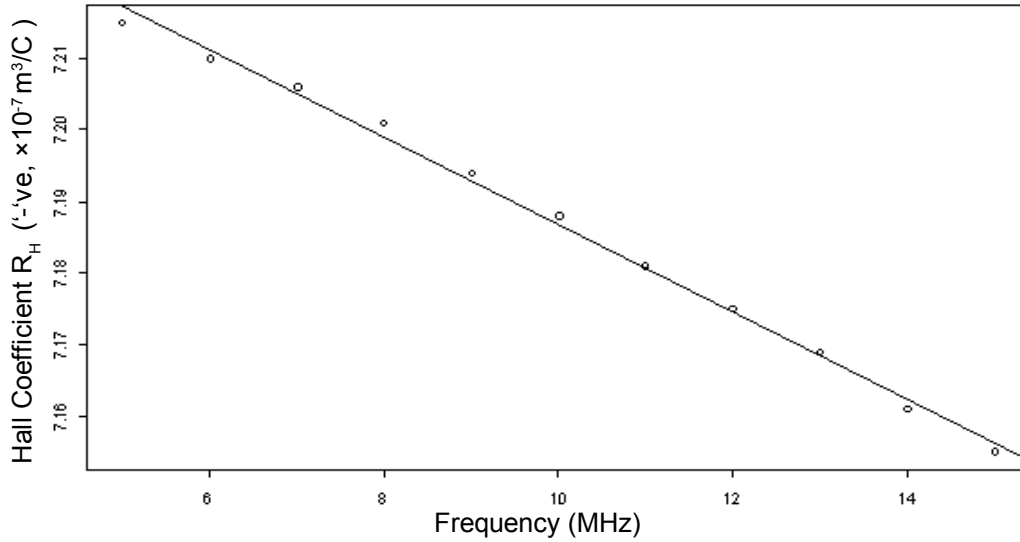


Fig. 1: R_H of CdS Thin Film with Frequencies of E-M field of Amplitude 10mV

The values of R_H ('-ve, $\times 10^{-7} \text{ m}^3/\text{C}$) of thin film of CdS of thickness $t = 0.30 \mu\text{m}$ with frequencies of E-M field of amplitude 15mV are plotted in Fig. 2.

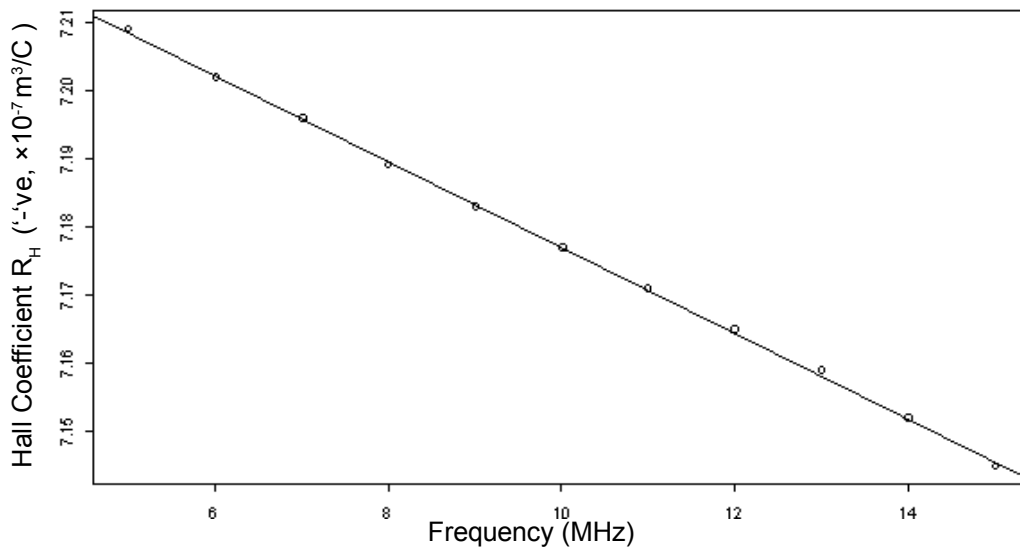


Fig. 2: R_H of CdS Thin Film with Frequencies of E-M field of Amplitude 15mV

4. DISCUSSION

From Fig. 1 and 2 we see that Hall coefficient R_H decreases with increase in frequency of E-M field and this decrement is more for E-M field of higher amplitude. Besides this the p -value for graph 1 and 2 are $6.741e^{-12}$ and $3.626e^{-16}$ respectively for 10mV and 15mV, which shows that the variation of R_H with frequency is significant. This can be understood as the E-M frequencies pass through the semiconductor, they attenuate charge carriers, so the effective mass of charge carriers decreases and their mobility increases. This effect increases with frequencies and with increase in amplitudes of electro-magnetic field. This results in the increment of effective concentration of charge carriers. Hence value of R_H decreases with increment in frequency and amplitude of E-M field.

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