Assignment: Experiment No-1

Determination of Hall Coefficient and carrier type for a Semi-conducting Material

Aim

To determine the hall coefficient of the given n type or p-type semiconductor

Apparatus Required

Hall probe (n type or p type), Hall effect setup, Electromagnet, constant current power supply, gauss meter etc.,

Formulae

i)   Hall coefficient (R_H) $= \dfrac{V_H \cdot t}{IH} \times 10^{8}\, cm^3\, C^{-1}$

where V_H = Hall voltage (volt)

t   = Thickness of the sample (cm)

I   = Current (ampere)

H   = Magnetic field (Gauss)

ii)   Carrier density (n) $= \dfrac{1}{R_H\, q}$ cm^{-3}

where R_H = Hall coefficient $(cm^3 C^{-1})$

q   = Charge of the electron or hole (C)

iii)   Carrier mobility (μ) $= R_H\sigma\ cm^2V^{-1}\,s^{-1}$

where R_H = Hall coefficient $(cm^3 C^{-1})$

σ = Conductivity $(C\ V^{-1}\ s^{-1}\ cm^{-1})$

Table for Measurement of Hall coefficient:

 Current in the Hall Effect setup (I) = 2 mA

Current in the constant current power supply (A)	Magnetic field (**H**) (Gauss)	Hall Voltage (V_H) (**mV**)	Hall coefficient (R_H) $cm^3 C^{-1}$
1.0	1320	12.5	?
1.5	1940	18.1	?
2.0	2620	23.2	?
2.5	3040	27.4	?
3.0	3600	31.2	?
3.5	4390	35.6	?

Observations and Calculations

(1)	Thickness of the sample, t	=	0.05 cms
(2)	Resistivity of the sample, ρ	=	$10 \text{ V C}^{-1}\text{s cm}$
(3)	Conductivity of the sample, σ	=	$0.1 \text{ CV}^{-1}\text{s}^{-1}\text{cm}^{-1}$
(4)	Charge of electron or hole q	=	$1.6 \times 10^{-19} \text{ C}$

Assignment Question:

1. By using the readings in the tabular coloum and Observations, calculate the Hall Coefficient of the given semiconducting material and enter the same in the last coloum of the tabular coloum in your observation note book.

2. Also calculate the following using the mean value of Hall Coefficient, Charge of electron and Conductivity of sample.

(i)   The carrier density of the semiconducting material
(ii)   The carrier mobility

3. Write the result in the observation note book in the following order
- The Hall coefficient of the given semi conducting material =………. $\text{cm}^3 \text{ C}^{-1}$
- The carrier density =…………carriers/cm^3
- The carrier mobility =………….. cm^2/volt.sec

Finally, submit the scanned copy of your observation note book in GCR on (or) before THREE working days from the date of experiment.