Answer on Question #73573, Physics / Other

when 1.5 A of current is passed through a zinc specimen under a magnetic field of 2.0 T ,the Hall voltage is 4.45 uV the width of the specimen is 0.03 mm. calculate the carrier concentration

Solution:

If a current carrying conductor placed in a perpendicular magnetic field, a potential difference will generate in the conductor which is perpendicular to both magnetic field and current. This phenomenon is called Hall Effect.

In steady state condition, the magnetic force is balanced by the electric force. Mathematically we can express it as

$$eE = evB$$

where '*e*' the electric charge, '*E*' the hall electric field developed, '*B*' the applied magnetic field and '*v*' is the drift velocity of charge carriers.

And the current '*I*' can be expressed as,

$$I = neAv$$

where *n* is the number density of electrons in the conductor of length l ,breadth w and thickness t.

So, the Hall voltage V_H can be written as,

$$V_H = Ew = vBw = \frac{IB}{net}$$

Rearranging we get,

$$n = \frac{IB}{V_H et}$$

So,

$$n = \frac{(1.5\ A)(2.0\ T)}{(4.45 \times 10^{-6}\ V)(1.6 \times 10^{-19}\ C)(0.03 \times 10^{-3}\ m)} = 1.4 \times 10^{29}\ m^{-3}$$

Answer: $1.4 \times 10^{29}\ m^{-3}$