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Study the magneto-resistance of semiconductors

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Abstract
The aim of this paper is to contemplate the properties of a semi-director bar exceptionally the magneto-obstruction, transporter focus, Energy band hole and the impact of attractive field on Hall coefficient utilizing another trial arrangement and furthermore talk about its application. Another target of this paper has been approving the Drude's Model and proposing an answer for the Hall Effect downside. The plan can be utilized as a substitution to the Hall Effect explore where as it joins the attractive field's impact for the Hall co-proficient.

Keywords: magneto-resistance and semiconductors

Introduction
The autonomous electron model or the free electron model has been the foundation for semiconductor examines and applying the ideas of those models the different marvels of semi-directors [1, 2] like Hall Effect, transporter thickness, band hole estimation is being considered. Lobby Effect try had been another exceptionally noteworthy commitment to investigations of semiconductor. Utilizing the Hall Effect, magneto-obstruction [3] of materials is examined and induced as just reliant on transporter thickness of the material, while, it is tentatively watched, that transporter fixation as well as it relies upon temperature and the attractive field too. This paper talks about another test arrangement which considers the conduct of a semiconductor under an attractive field when it is exposed to a mechanical power. Not at all like Hall Effect test where applied electric field and applied attractive field are opposite to one another, in this test set-up we are not holding a candle to the current situation any electric field, consequently utilizing just one wellspring of electrical field, for example the electrical field created because of the movement of free electrons. In this manner, some other power on electrons is stayed away from, however the applied outer attractive and the inner nuclear and atomic powers. This idea cannot just measure the most significant part of semiconductor, similar to, number of conduction band electrons, energy band hole, however magneto-obstruction and reliance of it on the variables of outer attractive field moreover. Drude's model has been utilized to dissect the framework up until this point.

Design of Experimental Setup
The exploratory arrangement comprises of a semiconductor bar (of length '2L' and cross-sectional region 'A') mounted on the pole of an engine, a grounded metal ring upheld on mount stand and an attractive field. Fig (1a) and Fig (1b) shows the front view and the top perspective on the exploratory arrangement. The electric engine has a metal shaft on which the semiconductor bar is mounted. The metal shaft goes about as a point for estimating the voltage. The other point for estimating the voltage is the grounded metal ring. The semiconductor bar is pivoted in an attractive field (B) pointing downwards in Fig (1a).

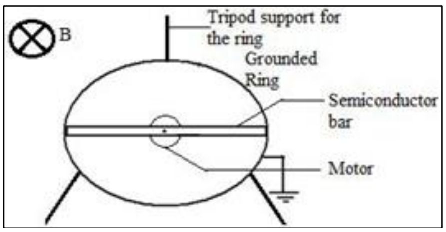

Fig 1(a): Front view of the experimental setup

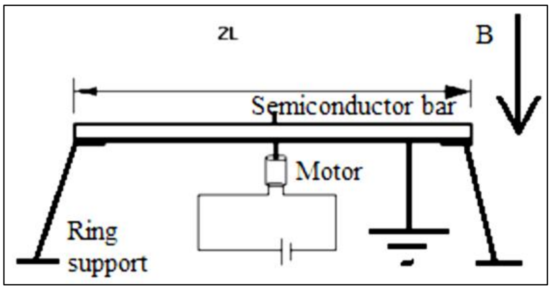

Fig 1(b): Top view of the experimental setup

Calculation and Analysis

Open Circuit Condition (Case 1): By open circuit it is implied that the metal shaft is protected from the semiconductor bar and the ring underpins are protected too. In this way, the power from the attractive field will Novel Experimental Setup to Study the Magneto-Resistance of Semiconductors and Its Industrial drive the electrons to create an electric field inside and an emf can be seen with the assistance of figure appeared.

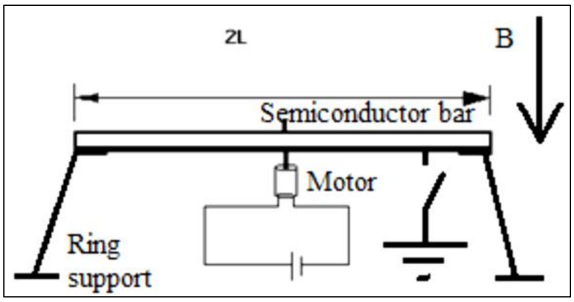

Fig 2: Open circuit condition

The open circuit condition can be equivalent to a chemical cell where the emf is generated from the chemical energy. Similar to the Hall Effect where the components of velocity of electrons due to random motion cancel each other over a period of time [4], here also we employ the consideration. Thus the electrons have velocity due to angular motion. If the angular velocity is ω, then the velocity of an electron at a distance x is

$$|v| = \omega x \tag{1}$$

The electrons will start to move from the end (due to highest velocity) and as they vacate their position there will be ions which will attract the next layer of electrons. Thus, the next layer of electrons are pushed by the magnetic force and pulled by the local electric field.

$$-e\,(dV/dx) = e\omega x B\,\hat{\imath}$$
$$E_i = (-dV/dx) = -\omega x B\,\hat{\imath} \tag{2}$$

The force on one electron will be due to this local electric field (Ei) and external magnetic field (B)

$$|F_x| = 2e\omega x B \tag{3}$$

We have two possibilities now-

Subcase 1: If the valance band electrons do not come to the conduction band then the central position gradually will be left out of electrons and only ions will be there. These ions will be positively charged and hence will pull the electrons which were moving outward previously. Due to this new electric field all the electrons will cease their motion and come to equilibrium.

At the beginning let the voltage be V_i

$$e(dV/dx) = e\omega x B$$
$$or,\ dV = \omega x B\,dx$$
$$\Delta V = \int dV = \omega x B L^2/2 \tag{4}$$

And finally when all the electrons cease their motion it can be considered equivalent to an equipotential wire where at each point the voltage is V_f. This final potential rise V_f is due to the work done by the magnetic field and the internal electric field. Thus the work done by the force F_x, if carrier density is n-

$$\int_0^L F_x(L-x)(nAdx) = e\omega nABL^3/3 \tag{4}$$

This is equal to the voltage rise, thus

$$e\omega nABL^3/3 = en(AL)V_f \ or,$$
$$Vf = \omega BL^2/3 \tag{5}$$

Subcase 2: If n' number of electrons per unit volume get energy from the magnetic field and jump from valance band to conduction band then in that case the initial voltage will be exactly like previous case but the final voltage will be different. In this case the work done by F_x is –

$$\int_0^L F_x(L-x)(nAdx) + n'E_g(AL) \tag{6}$$

This is again equal to voltage rise -

$$\int_0^L F_x(L-x)(nAdx) + n'E_g(AL) = en(AL)V_f n'E_g = en[(\omega BL^2/3) - V_f] \tag{7}$$

if n'=0 then $V_f = \omega BL^2/3$ else $V_f = \omega BL^2/3 - (n'E_g/ne)$

Thus the final voltage will be less by a factor $(n'E_g/ne)$

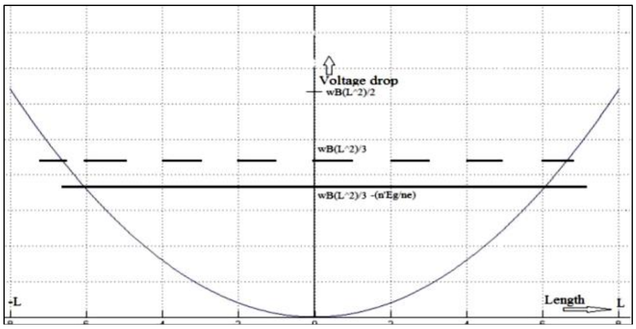

Fig 3: Variation of voltage along the length from the shaft Closed Circuit Condition (Case 2)

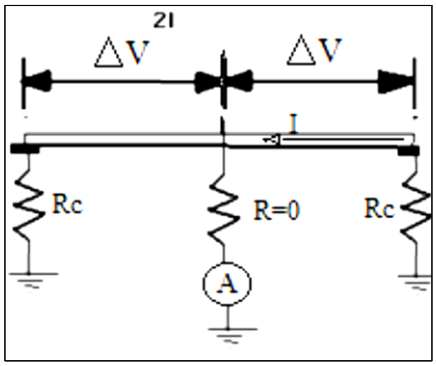

Fig 4: The closed circuit condition

For this condition shaft will be connected to the bar and supports for the metallic ring will be conducting as well. From the shaft a conducting wire is grounded through a microammeter as shown in the figure.

Now from the figure it can be easily said that

$$I = \Delta V/(Rb+Rc) \tag{8}$$

where, *Rb*=magneto-resistance
Rc= total contact resistance

$$(Rb+Rc) = \Delta V/I \quad (9)$$

Now as the gap created by the mobile conduction band electrons are filled from the metallic shaft, thus

$$\Delta V = \omega BL^2/2 \quad (10)$$

This is again equal to voltage rise-

$$I=n(AL)e/t \quad (11)$$

And the current will be

$$I= n(AL)e/t \quad (12)$$

where t is the time over which the bar has been rotated. Thus,-

$$(R_b+R_c) = \omega BLt/(2nAe) \quad (13)$$

Or, Hall Co-efficient is proportional to $\omega Bt/2ne$
Presently it very well may be seen that magneto-obstruction relies upon the transporter fixation n as well as the attractive field B. The attractive field influences the obstruction alongside ω. In this manner on the off chance that precise force is related alongside Drude's direct movement, at that point the impact of attractive field on Hall co-effective can be dissected.

Conclusion

The new trial arrangement examined in the paper not just aides in the portrayal of properties of semiconductor yet additionally considers a few new viewpoints. This likewise prompts simple estimation of properties without muddled systems.

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