MP309

Experiment 13

Hall effect experiment:- Determination of charge carrier density

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List of Figures

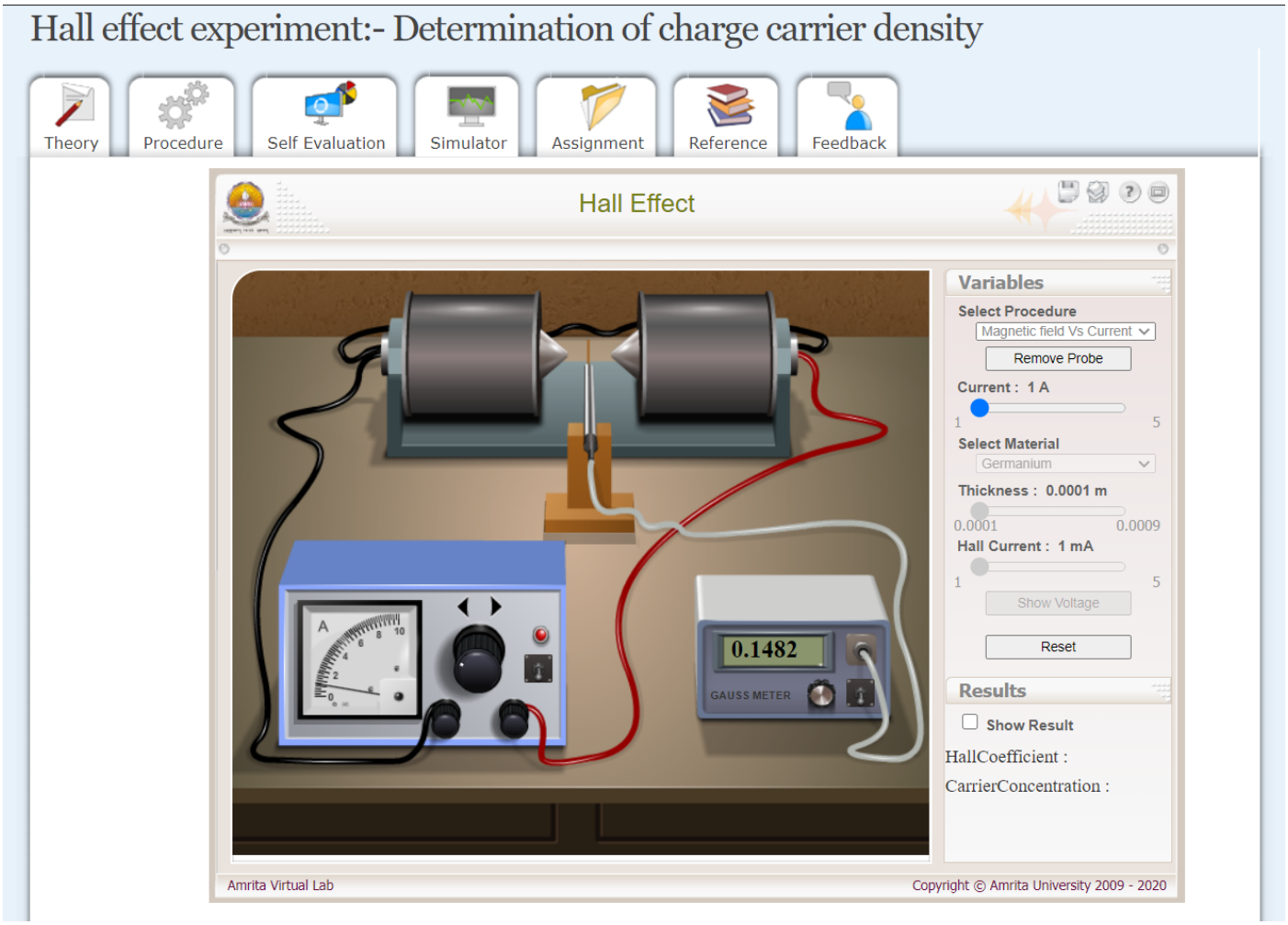

Figure 1: Instument

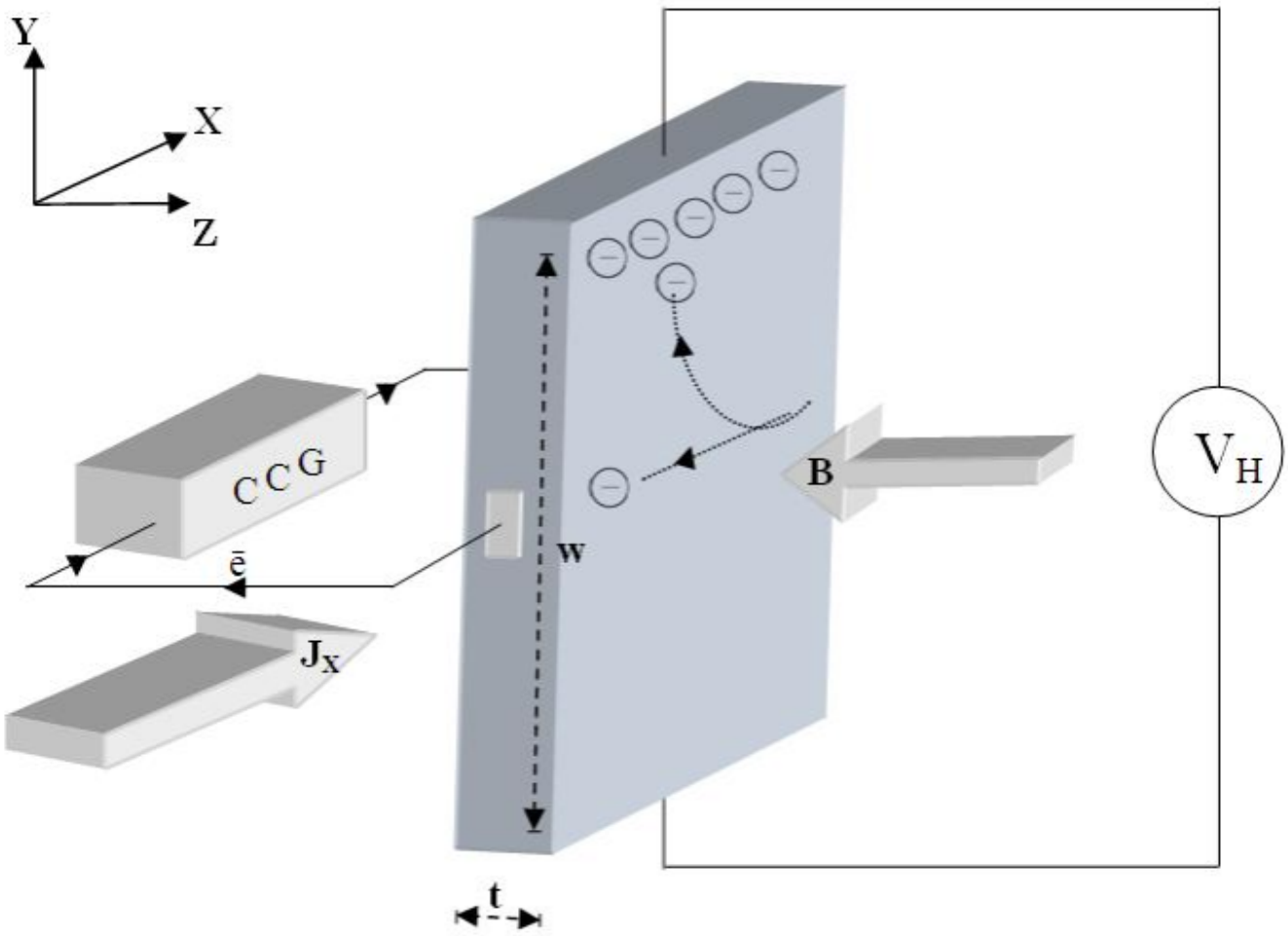

Figure 2: Schematic representation of Hall Effect in a conductor.

Parameters:-

1. CCG – Constant Current Generator
2. J_X – Current density
3. $\bar{e}$ – Electron
4. B – Applied Magnetic Field
5. t – Thickness
6. w – Width
7. V_H – Hall Voltage
8. n – Carrier Concentration
9. Hall Current = 1mA
10. Thickness = 0.0001m

Solenoidal Current (in A)	Magnetic Field (in T)
1	0.1482
1.5	0.2223
2	0.2964
2.5	0.3706
3	0.4447
3.5	0.5188
4	0.5929
4.5	0.667
5	0.7411

Figure 3: Magnetic Field generation using Solenoid

Material :- Germanium

Hall Current = 1mA, Thickness = 0.0001m

Current (in A)	Gauss meter reading (T)	Hall Voltage (in mV)	Hall coefficient, Rh(in m^3/C)	Carrier Concentration (m^-3)
1	0.1482	28.756	0.019	3.20E+20
1.5	0.2223	43.133	0.019	3.20E+20
2	0.2964	57.511	0.019	3.20E+20
2.5	0.3706	71.889	0.019	3.20E+20
3	0.4447	86.267	0.019	3.20E+20
3.5	0.5188	100.645	0.019	3.20E+20
4	0.5929	115.023	0.019	3.20E+20
4.5	0.667	129.4	0.019	3.20E+20
5	0.7411	143.778	0.019	3.20E+20

Figure 4: Observation Table for Germanium

$$R_H = 0.019 m^3/C \ , \ n = 3.20 \times 10^{20} m^{-3}$$

Material :- Aluminium

Hall Current = 1mA, Thickness = 0.0001m

Current (in A)	Gauss meter reading (T)	Hall Voltage (in mV)	Hall coefficient, Rh(in m^3/C)	Carrier Concentration (m^-3)
1	0.1482	578.077	0.39	1.60E+19
1.5	0.2223	867.116	0.39	1.60E+19
2	0.2964	1156.155	0.39	1.60E+19
2.5	0.3706	1445.194	0.39	1.60E+19
3	0.4447	1734.232	0.39	1.60E+19
3.5	0.5188	2023.271	0.39	1.60E+19
4	0.5929	2312.31	0.39	1.60E+19
4.5	0.667	2601.349	0.39	1.60E+19
5	0.7411	2890.387	0.39	1.60E+19

Figure 5: Observation Table for Aluminium

$$R_H = 0.39 m^3/C \ , \ n = 1.60 \times 10^{19} m^{-3}$$

Material :- Copper

Hall Current = 1mA, Thickness = 0.0001m

Current (in A)	Gauss meter reading (T)	Hall Voltage (in mV)	Hall coefficient, Rh(in m^3/C)	Carrier Concentration (m^-3)
1	0.1482	741.125	0.5	1.20E+19
1.5	0.2223	1111.688	0.5	1.20E+19
2	0.2964	1482.25	0.5	1.20E+19
2.5	0.3706	1852.813	0.5	1.20E+19
3	0.4447	2223.375	0.5	1.20E+19
3.5	0.5188	2593.937	0.5	1.20E+19
4	0.5929	2964.5	0.5	1.20E+19
4.5	0.667	3335.063	0.5	1.20E+19
5	0.7411	3705.625	0.5	1.20E+19

Figure 6: Observation Table for Copper

$$R_H = 0.5 m^3/C \ , \ n = 1.20 \times 10^{19} m^{-3}$$

Material :- Gold

Hall Current = 1mA, Thickness = 0.0001m

Current (in A)	Gauss meter reading (T)	Hall Voltage (in mV)	Hall coefficient, Rh(in m^3/C)	Carrier Concentration (m^-3)
1	0.1482	1037.575	0.7	8.90E+18
1.5	0.2223	1556.362	0.7	8.90E+18
2	0.2964	2075.15	0.7	8.90E+18
2.5	0.3706	2593.937	0.7	8.90E+18
3	0.4447	3112.725	0.7	8.90E+18
3.5	0.5188	3631.512	0.7	8.90E+18
4	0.5929	4150.3	0.7	8.90E+18
4.5	0.667	4669.087	0.7	8.90E+18
5	0.7411	5187.875	0.7	8.90E+18

Figure 7: Observationn table for Gold

$$R_H = 0.7 m^3/C \ , \ n = 8.90 \times 10^{18} m^{-3}$$