Hall Effect

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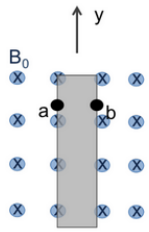
11/8

1 The Hall Effect

1.1 Moving Slab

A metal strip of length L and width w and thickness t is moves with a velocity v through a magnetic field B_0 into the page as shown below. If a potential difference of V_0 is measured between points a and b across the strip, calculate the speed v of the strip.



Source: modified from Halliday, Chapter 34-4, problem 39

1.2 Stationary Slab

Suppose we have a rectangular block with length l, width d, and height h in the x,y, and z directions respectively. A current $\vec{I} = I\hat{x}$ flows through it. There is an external magnetic field $\vec{B} = B\hat{y}$.

(a) Derive the Hall voltage V_H for this setup.

(b) Find an expression for the Hall constant

$$K_H = \frac{V_H}{BI}$$

in terms of the charge carrier concentration n.

(c) Using these results, how can you determine the sign and density of charge carriers in a material?

Source: Dan and Vetri