Observing the Hall Effect, Part I: Copper (Electrical Transport Option)

http://education.qdusa.com/experiments.html

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The objective of this Educational Module is to measure the Hall voltage V_H to determine the Hall coefficient R_H of Cu, a monovalent metal. V_H in metals is typically quite small (~microvolts for reasonable values of the applied current and magnetic field) but is easily measured using VersaLab/ETO.

The data we obtained is plotted in Figure 1 below:

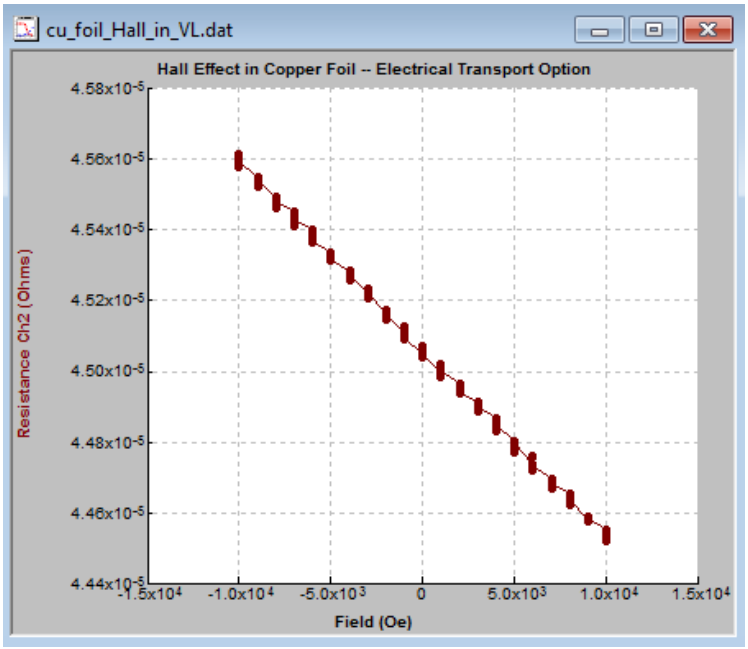

Figure 1: Hall effect of Cu as measured by the ETO

Looking at this data, it is clear that the negative slope is consistent with electrons as the change carriers in copper. The data does not go through zero at zero field. This arises from the imperfect alignment of the Hall voltage contacts. A very slight misalignment from 90 degrees with respect to the direction of the current results in a longitudinal component being present in the transverse data. In the present case, this can be subtracted from the data prior to a more complete analysis.

You may also have your students examine materials with a positive R_H (as described for example in Kittel[1]), such as Zn or p-type Ge which is described in Part II of this educational module.

Potentially useful articles include:

J.E.A. Alderson et al., "Hall Coefficient of Cu, Ag, and Au in the Range 4.2-300 K," *Physical Review* 174, 729 (1968).

C.E. Armentrout, "The Hall effect in copper: an undergraduate experiment," *American Journal of Physics* 58, 758 (1990).