EE535-Lab3

Hall Effect for measuring carrier type, carrier concentration, mobility

Objectives:

- Getting to know the Hall Measurements.
- Measuring majority carrier type, carrier mobility and concentration.

Sample

Crystalline silicon. Setup as shown in the diagram below.

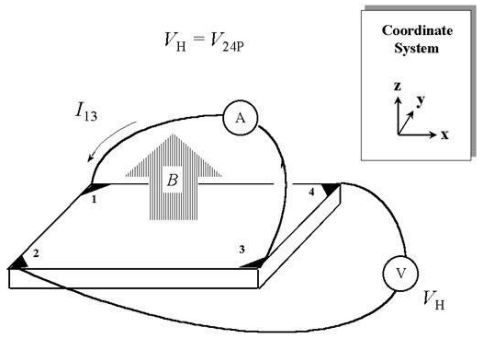

Figure 3

Step1: Study

- Before coming to class, do general reading about Hall Effect.
- Useful resource: https://www.nist.gov/pml/nanoscale-device-characterization-division/popular-links/hall-effect

Step2: Theory and Experiment

- Explain how one identifies the majority carrier type of a DUT (device under test).
- Derive equations for carrier concentration and mobility.
- Explain experimental setup and sample geometry. How to find sheet resistance?
- Explain the procedure and reasoning behind each step.
- Explain error sources and a way to deal with them.

Step3: Data analysis and calculations

In your data analysis include the following:

- Calculate sheet resistance (R_s) for each sample.

- Plot Hall Voltage vs. Magnetic Field for each sample. (using negative and positive currents filter out voltmeter offset and use “clean” data for graphs)
- Find majority carrier type for each sample.
- Calculate carrier concentration of each sample (if thickness unknown, calculate sheet carrier concentration (n_s)).
- Calculate carrier mobility of each sample.
- Summarize all your findings in a table. (Single row for each sample)
- How does your result compare to literature? If different, explain reasons.