Lab 1 Report

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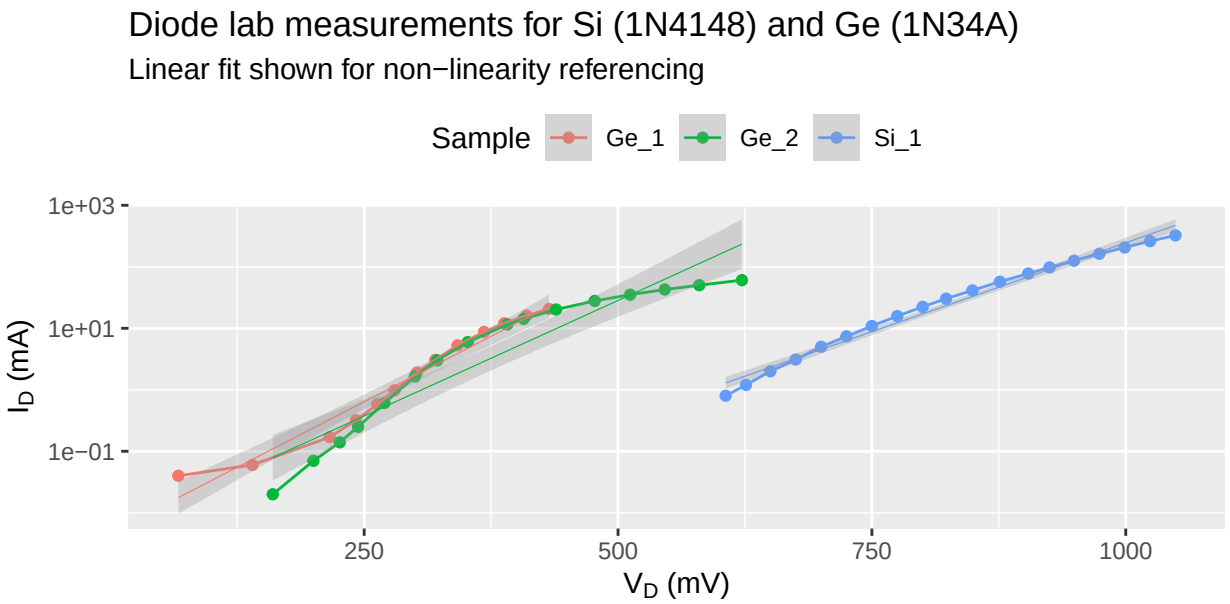
Introduction

This lab explores basic properties of the Si and Ge diodes, including temperature effects on diode current. SPICE simulations validate lab measurements.

Diode measurements

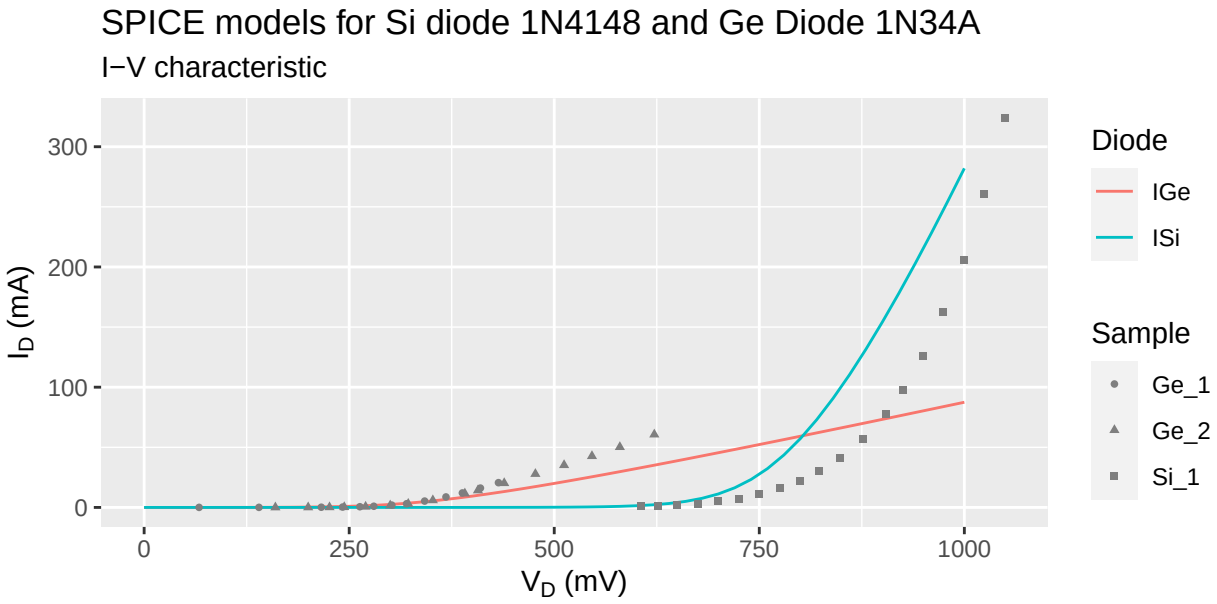
The following I vs. V measurements come from a 1N4148 Si rectifier diode and for the 1N34 Ge rectifier diode. SPICE simulations confirmed that the 1N4148 performs similar to a 1N914 diode, as no SPICE model for the 1N916 could be located.



The exponential effect of the current is amplified at low voltages and dampened at high voltages. The former effect may be due to milliamp-meter low current errors. The latter effect may again be due to internal diode resistance.

There is something preventing the Schottky exponential behavior for the Ge diode (1N34A). I don't know why, but posit that it is due to the current limitations of this diode. Its rated amperage is 50 mA though.

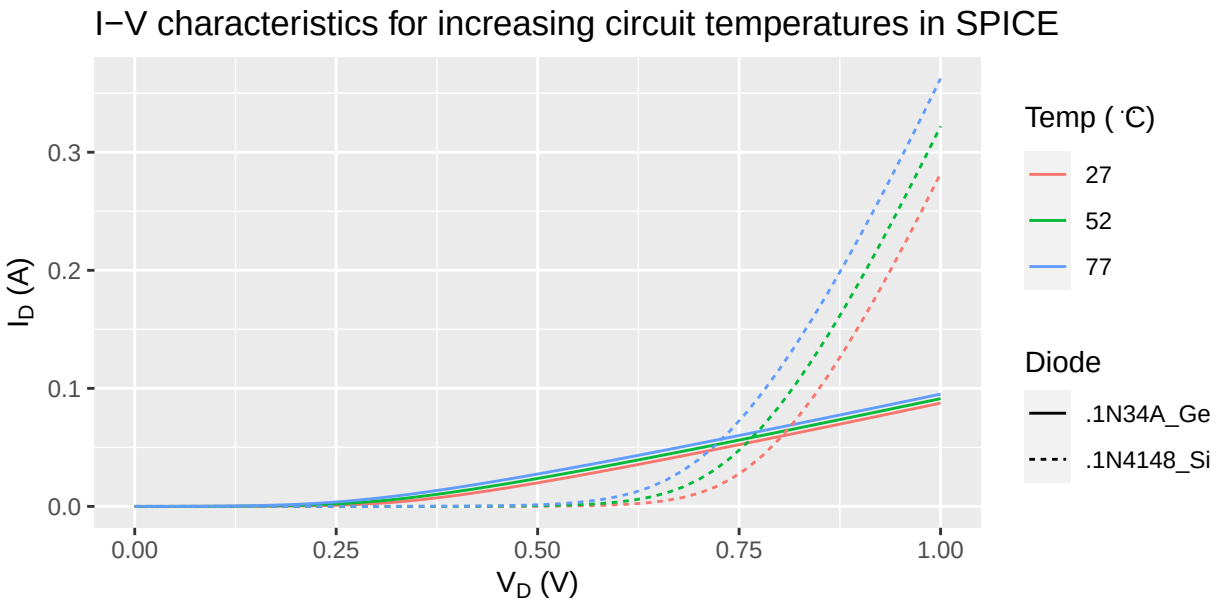
Comparing with SPICE models



The SPICE model roughly agree with the measurements.

Temperature effects in SPICE

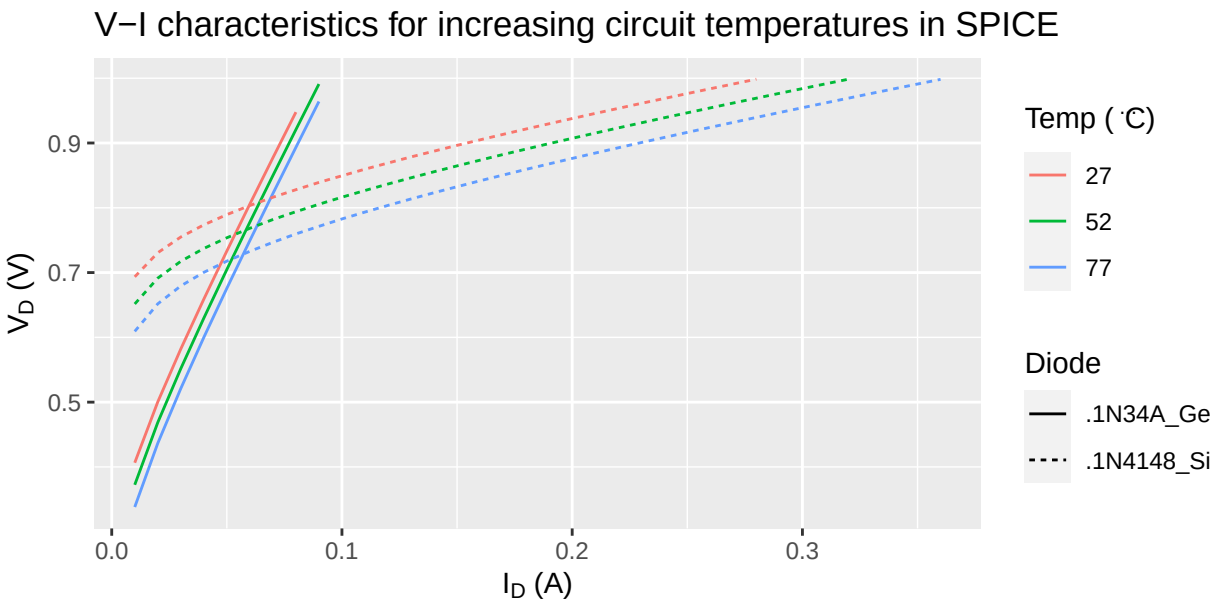
Here are the I-V curves for different temperatures for these two diodes. It's reasonable that the current increases with temperature for a given diode voltage due to the increased carrier excitation and mobility.

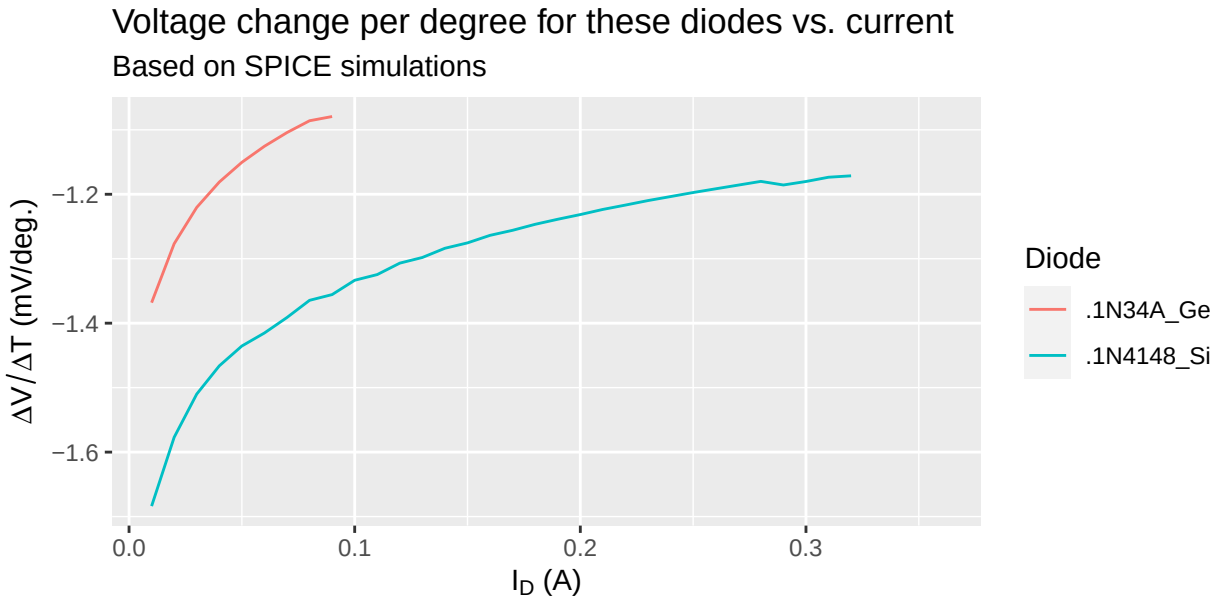


I can get the temperature changes in diode voltage for a given current with the following method:

1. for a given diode, calculate the corresponding voltage for currents $(0.01, 0.02, \ldots, I_{max})$ A for the tested temperatures.
2. plot the changes in voltage for each of the two temperature increases

Here are plots of 25°C changes in voltage.





The voltage sensitivity with temperature seems to increase with diode current. The slopes are similar between diodes, about -1.2 mV/degree for the 1N34A and -1.4 mV/degree for the 1N4148.