SS 2013

Prof. Dr. H. Föll
Chair for general materials science

Exercises " Advanced materials B"

#3

**Exercise 3:** Conductivities

The electrical resistivity of many metals may be approximated by the equation:
$\rho_T = \rho_0 (1 + \alpha_T T)$

Consider contacting a Cu wire of 1 mm in diameter and 10 cm long. Its resistance at 0 °C is 160 µΩ. The temperature resistivity coefficient $\alpha_T$ for Cu is 0.0039 °C$^{-1}$.

1. Calculate $\rho_0$?

2. Calculate the resistivity of the material at -250 and 250 °C. What can you conclude from this?

3. If you have an alloy of 8 mols of Cu and 2 mols of Al, what is its resistivity at room temperature? The resistivity of Al is 2.7 µΩ.

4. What is an intrinsic and an extrinsic semiconductor?

5. The conductivity of semiconductor increases exponentially with temperature. Please explain why.

6. Calculate the electrical resistivity of intrinsic Si at 300 K. At this temperature, $n_i = 1.5 \times 10^{16}$ m$^{-3}$. $\mu_n = 0.135$ m$^2$/Vs and $\mu_p = 0.048$ m$^2$/Vs.