

Session #19: Homework Problems

Problem #1

Calculate the vacancy fraction in copper (Cu) at (a) 20°C and (b) the melting point, 1085°C. Measurements have determined the values of the enthalpy of vacancy formation, ΔH_V , to be 1.03 eV and the entropic prefactor, A, to be 1.1.

Problem #2

In iridium (Ir), the vacancy fraction, n_v/N , is 3.091×10^{-5} at 1234°C and 5.26×10^{-3} at the melting point. Calculate the enthalpy of vacancy formation, ΔH_V .

Problem #3

A formation energy of 2.0 eV is required to create a vacancy in a particular metal. At 800°C there is one vacancy for every 10,000 atoms.

- (a) At what temperature will there be one vacancy for every 1,000 atoms?
- (b) Repeat the calculation, but this time with an activation energy of 1.0 eV. Note the big change in the temperature interval necessary to obtain the same change in vacancy concentration as was the case with an activation energy of 2.0 eV.

Problem #4

On appropriate schematic drawings show the generation and characteristics of Schottky defects in (a) a closed-packed metal, (b) an ionic crystal and (c) a semiconductor.

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