

Homework #8

October 26, 2004

1. In iridium, 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 .
2. At 10°C below the melting point of aluminum, 0.08% of the atom sites are vacant. At 484°C only 0.01% are vacant. Determine the energy of vacancy formation (ΔH_v) for aluminum.
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.
4. Give the Miller indices (of planes) and the direction indices of four (4) slip systems in Cu.
5. Identify three (3) types of crystal defects in solids and suggest for each of these one materials property that is adversely affected by its presence and one that is improved.
6. The energy of vacancy formation in palladium (Pd) is 1.5 eV. At 888°C there is one vacancy for every million (10^6) atom sites. Is it possible to achieve a vacancy fraction of one vacancy for every thousand (10^3) atom sites by simply raising the temperature? Be sure to check that the required temperature does not exceed the melting point of Pd.