

## IMPERFECTIONS IN SOLIDS

- 1) Calculate the activation energy for vacancy formation in aluminum, given that the equilibrium number of vacancies at 500°C (773°K) is  $7.57 \times 10^{23} \text{ m}^{-3}$ . The atomic weight and density (at 500°C) for aluminum are, respectively, 26.98 g/mol and  $2.62 \text{ g/cm}^3$ .
- 2) Which one of the following elements would you expect to form the following with copper:
  - a. A substitutional solid solution having complete solubility?
  - b. A substitutional solid solution having incomplete solubility?
  - c. An interstitial solid solution?

Element	Atomic radius	Crystal Structure	Electronegativity	Valence
Ni	0.1246	FCC	1.8	2+
C	0.071			
H	0.046			
Ag	0.1445	FCC	1.9	1+
Al	0.1431	FCC	1.5	3+
Fe	0.1241	BCC	1.8	2+
Zn	0.1332	HCP	1.6	2+
<b>Cu</b>	<b>0.128</b>	<b>FCC</b>	<b>1.9</b>	<b>1+</b>

- 3) What is the composition, in atom percent, of an alloy that contains 98 gr tin (Sn) and 65 gr of lead(Pb)? ( $A_{\text{sn}}=118,49 \text{ gr/mole}$  ,  $A_{\text{pb}}= 207,2 \text{ g/mol}$ )
- 4) Gold forms a substitutional solid solution with silver. Compute the number of gold atoms per cubic centimeter for a silver-gold alloy that contains 10 wt% Au and 90 wt% Ag. The densities of pure gold and silver are  $19.32$  and  $10.49 \text{ g/cm}^3$ , respectively.
- 5) (a) The surface energy of a single crystal depends on the crystallographic orientation with respect to the surface. Explain why this is so.  
 (b) For an FCC crystal, such as aluminum, would you expect the surface energy for a (100) plane to be greater or less than that for a (111) plane? Why?