

Material Science
Homework 6
Due Tuesday Dec 18, 2018

1. Cite the phases that are present and the phase compositions, and then determine the relative amounts (in terms of mass fractions) of the phases for the following alloys:
 - (a) 55 wt% Ag-45 wt% Cu at 900°C (1173 K)
 - (b) 80 wt% Hf-20 wt% V at 1400°C (1673 K)
 - (c) 2.12 kg Zn and 1.88 kg Cu at 500°C (773 K)
 - (d) 4.5 mol Sn and 0.45 mol Pb at 200°C (473 K)
2. Is it possible to have a copper–nickel alloy that, at equilibrium, consists of a liquid phase of composition 20 wt% Ni–80 wt% Cu and also an α phase of composition 37 wt% Ni–63 wt% Cu? If so, what will be the approximate temperature of the alloy? If this is not possible, explain why.
3. A 50 wt% Pb–50 wt% Mg alloy is slowly cooled from 700°C to 400°C.
 - (a) At what temperature does the first solid phase form?
 - (b) What is the composition of this solid phase?
 - (c) At what temperature does the liquid solidify?
 - (d) What is the composition of this last remaining liquid phase?
4. For an iron–carbon alloy of composition 5 wt% C–95 wt% Fe, make schematic sketches of the microstructure that would be observed for conditions of very slow cooling at the following temperatures: 1180°C, 1150°C, and 700°C. Label the phases and indicate their compositions (approximate).
5. Answer the following problems,
 - (a) Briefly describe the phenomenon of coring and why it occurs. And then, cite one undesirable consequence of coring.
 - (b) What is the principal difference between congruent and incongruent phase transformations?
 - (c) What are the ferrite, perlite, and austenite in Fe-C system? Please also compute the mass fractions of ferrite and austenite.
 - (d) What is the distinction between hypoeutectoid and hypereutectoid steels?
 - (e) In a hypoeutectoid steel, both eutectoid and proeutectoid ferrite exist. Explain the difference between them. What will be the carbon concentration in each?