**動機系材導第五次習題(Chap. 8, 9)**

**106年6月5日繳交**

8.44 In the Pb-Sn phase diagram (Fig. 8.12) answer the following questions:  
(*a*) What is a (explain in detail including atomic structure? What is b?  
(*b*) What the maximum solubility of Sn in a? At what temperature?  
(*c*) What happens to the a in part (*b*) if it is cooled to room temperature?  
(*d*) What is the maximum solubility of Sn in liquid metal at the lowest possible temperature? What is that temperature?  
(*e*) What is the solubility limit of Sn in a when liquid is present? (This will be a range.)

8.45 Based on the Cu – Ag phase diagram in Fig. P8.22, draw the approximate cooling curve for the following alloys with approximate temperatures and explanations: (*i*) Pure Cu, (*ii*) Cu – 10wt% Ag (*iii*) Cu – 71.9 wt% Ag (*iv*) Cu – 91.2 wt% Ag

8.51 Based on the Al2O3-SiO2 phase diagram in Fig. 8.27, the wt% of phases present for Al2O3 – 55 wt% SiO2 over the 1900 to 1500 °C temperature range (use 100 °C increments).

8.59 (*a*) Based on the phase diagram in Fig. P8.59, explain why city workers throw rock salt on icy roads. (*b*) Based on the same diagram, suggest a process that would produce almost pure water from seawater (3 wt% salt).

8.62 Using Fig. P8.39, explain what the phase diagram is showing when the overall alloy composition is Al – 43wt% Ni (below 854°C)? Why is there a vertical line at that point in the phase diagram? Verify that the formula for the compound is Al3Ni. What do you call such a compound?

8.64 (*a*) In the Ti-Al phase diagram, Fig. P8.41, what phases are available at an overall alloy composition of Ti – 63 wt% Al at temperatures below 1300 °C? (*b*) What is the significance of the vertical line at that alloy composition? (*c*) Verify the formula next to the vertical line. (*d*) Compare the melt temperature of this compound to that of Ti and Al. What is your conclusion?

9.74 Thin pieces of 0.3 mm thick hot-rolled strips of 1080 steel are heat-treated in the following ways. Use the IT diagram of Fig. 9.23 and other knowledge to determine the microstructure of the steel samples after each heat treatment.  
(*a*) Heat 1 h at 860 °C; water-quench.  
(*b*) Heat 1 h at 860 °C; water-quench; reheat 1 h at 350 °C. What is the name of this heat treatment?  
(*c*) Heat 1 h at 860 °C; quench in molten salt bath at 700 °C and hold 2 h; water quench.  
(*d*) Heat 1 h at 860 °C; quench in molten salt bath at 260 °C and hold 1 min; air-cool. What is the name of this heat treatment?  
(*e*) Heat 1 h at 860 °C; quench in molten salt bath at 350 °C; hold 1 h; air-cool. What is the name of this heat treatment?  
(*f*) Heat 1 h at 860 °C; water-quench; reheat 1 h at 700 °C.

9.93 (*a*) For a plain carbon steel with 1 wt% carbon content at 900 °C, on average, how many carbon atoms can you find in 100 unit cells? (*b*) If this alloy is cooled to just below 723 °C, on average, how many carbon atoms can you find in 100 unit cells in the ferrite phase, α? (*c*) If at room temperature, the carbon content of ferrite drops to 0.005 wt%, on average, how many unit cells would you have to search to find one carbon atom? Can you explain the differences in the three answers?

9.104 Both 4140 and 4340 steel alloys may be tempered to achieve tensile strengths above 1380 MPa. Which one would you use for manufacturing of an aircraft landing gear? Which one would you use for manufacturing of heavy-duty gears? Explain your answer.

9.117 A machinist threads a cylinder from annealed 1080 steel and makes sure that the threads match that of a nut. He then heat-treats the threaded cylinder by austenitizing, quenching, and tempering to achieve a higher hardness. (*a*) After the heat treatment process, the threads no longer fit those of the nut. Explain why? (*b*) How would you avoid this problem?

另外，9.91, 9.103, 9.106, 9.110習題，請自行練習，不必繳交。