Self-Assessment: Solid Solutions

Weekly Quiz: Solution Outlines

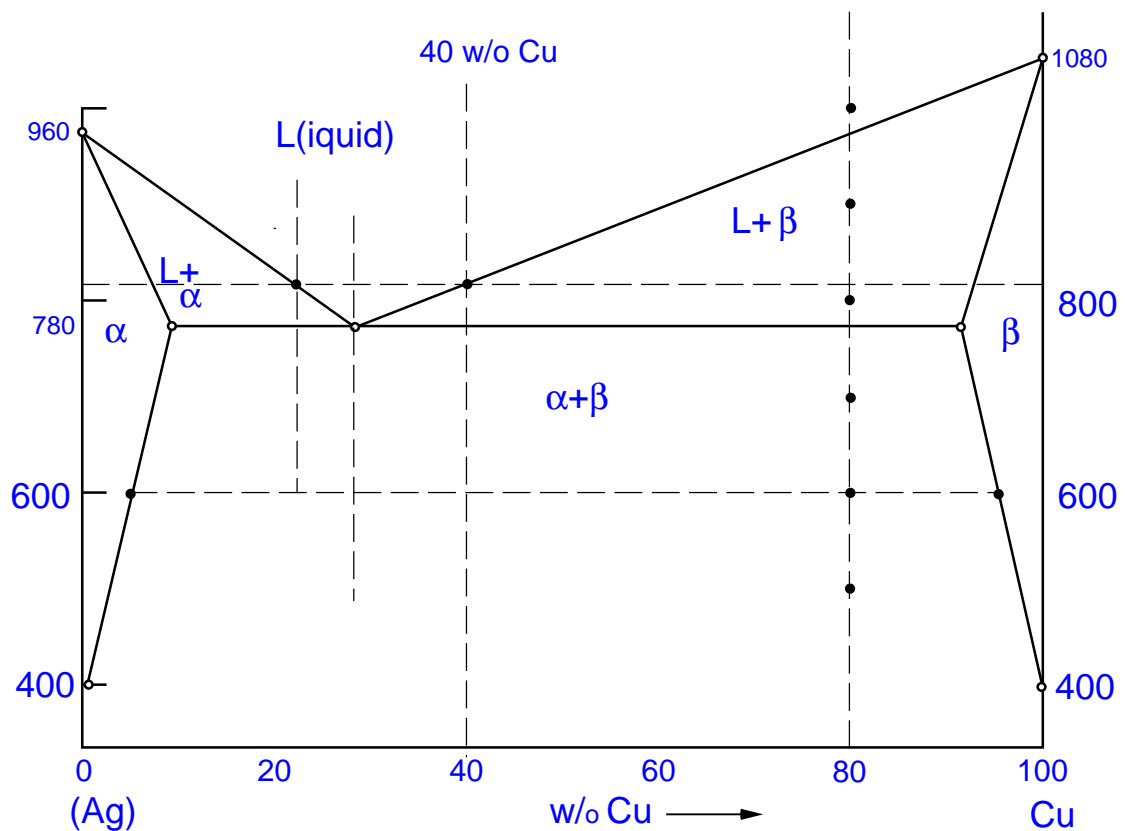(a) Construct the phase diagram (T,c) for Ag-Cu given the following data. (Assume all phase lines to be straight.)

T_M Ag: 960°C

T_M Cu: 1080°C

T_E (Eutectic) 780°C: α [9 wt.% Cu]; β [92 wt.% Cu]; Eutectic comp. 28 wt.% Cu
                        400°C: α [1 wt.% Cu]; β [100 wt.% Cu]

(b) Determine the liquidus temperature for a 60 wt.%Ag – 40 wt.% Cu alloy.

From the phase diagram in (a) liquidus T for 40 wt.% Cu alloy is ≈ 840°C

(c) Determine which other Ag-Cu alloy composition has the same liquidus temperature as the one determined in (b).

From phase diagram in Prob. 3, other composition with same liquidus T is
≈ 20 wt.% Cu

(d) 26 g of sterling silver (92.5 wt.% Ag – 7.5 wt.% Cu) are melted together with 376 g of pure copper (Cu). Given the phase diagram for Ag-Cu, determine:
(i)   the liquidus temperature for the alloy formed;
(ii)   the solidus temperature for this alloy;
(iii) the composition of the alloy formed.

(i)   From phase diagram in part (a), liquidus T ≈1060°C

(ii)   From phase diagram in part (a), solidus T ≈ 870°C

(iii)   26 g of Sterling Silver has (26)(0.925) = 24.05 g Ag and (26)(0.075) = 1.95 g Cu. Total Cu = 1.95 + 376 = 378 g.

$$\text{wt.\% Cu} = \frac{378 \text{ g Cu}}{24 \text{ g Ag} + 378 \text{ g Cu}} = 94$$

3.091SC Introduction to Solid State Chemistry

Fall 2009