

Session #35: Homework Solutions

Problem #1

(a) For each of the following Ag-Cu alloys state all phases present at the specified compositions and temperatures. Phase diagram given below.

- (i) $c = 20$ atomic per cent Cu, $T = 900^\circ\text{C}$
- (ii) $c = 20$ atomic per cent Cu, $T = 800^\circ\text{C}$
- (iii) $c = 20$ atomic per cent Cu, $T = 700^\circ\text{C}$
- (iv) $c = 5$ atomic per cent Cu, $T = 700^\circ\text{C}$
- (v) $c = 80$ atomic per cent Cu, $T = 800^\circ\text{C}$

(b) For the Ag-Cu alloy, $c = 70$ atomic per cent copper, calculate the relative amounts of all phases present at $T = 600^\circ\text{C}$.

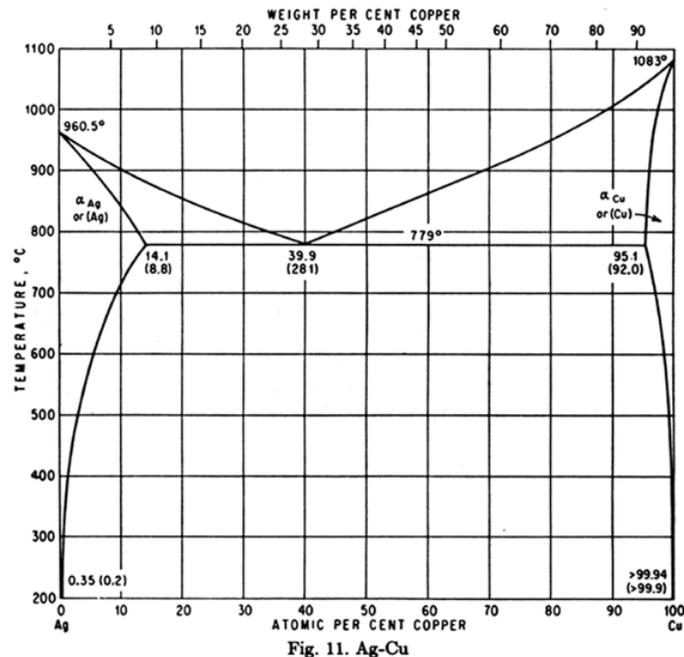


Fig. 11. Ag-Cu

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Solution

- (a) (i) all liquid
- (ii) liquid + Ag-rich solution of Ag-Cu (denoted α_{Ag})
- (iii) Ag-rich solid solution of Ag-Cu (denoted α_{Ag})
+ Cu-rich solution of Ag-Cu (denoted α_{Cu})
- (iv) Ag-rich solid solution of Ag-Cu (denoted α_{Ag})
- (v) liquid + Cu-rich solution of Ag-Cu (denoted α_{Cu})

$$(b) \quad \% (\text{Cu-rich solution of Ag-Cu}) = \frac{70 - 5}{98 - 5} \times 100\% = 70\%$$

$$\% (\text{Ag-rich solution of Ag-Cu}) = \frac{98 - 70}{98 - 5} \times 100\% = 30\%$$

Problem #2

(a) For each of the following Pb-Sn alloys state all phases present at the specified compositions and temperatures. Phase diagram given on the following page.

- (i) $c = 10$ atomic per cent Pb, $T = 300^\circ\text{C}$
- (ii) $c = 10$ atomic per cent Pb, $T = 200^\circ\text{C}$
- (iii) $c = 10$ atomic per cent Pb, $T = 100^\circ\text{C}$
- (iv) $c = 90$ atomic per cent Pb, $T = 200^\circ\text{C}$
- (v) $c = 60$ atomic per cent Pb, $T = 200^\circ\text{C}$

(b) For the Pb-Sn alloy, $c = 60$ atomic per cent lead, calculate the relative amounts of all phases present at $T = 200^\circ\text{C}$.

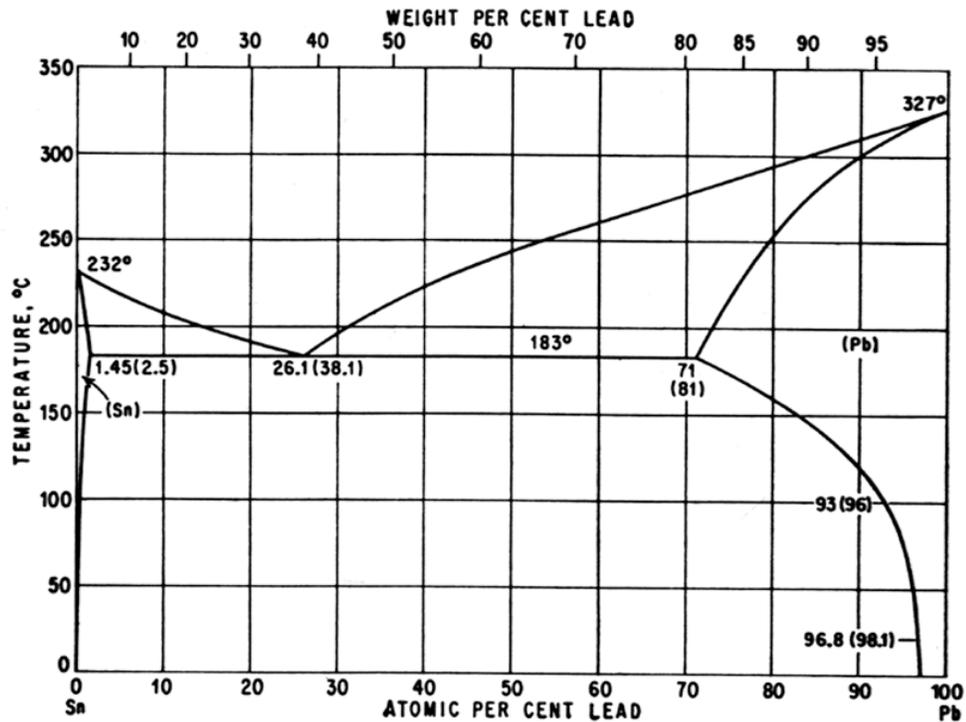


Fig. 601. Pb-Sn

Solution

(a) (i) all liquid

(ii) liquid + Sn-rich solution of Sn-Pb

(iii) (Sn-rich solid solution of Sn-Pb)
+ (Pb-rich solid solution of Sn-Pb)

(iv) Pb-rich solid solution of Sn-Pb

(v) liquid + (Pb-rich solid solution of Sn-Pb)

$$(b) \text{ \% liquid} = \frac{73 - 60}{73 - 31} \times 100\% = 31\%$$

$$\text{\% (Pb-rich solid solution of Sn-Pb)} = \frac{73 - 60}{73 - 31} \times 100\% = 31\%$$

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