التصحيح النموذجي

Exercise 1 (4)

1. $P_r = \frac{P}{P_c}$ $\quad P_c = \sum x_i P_{c,i} = 0,7 P_{c,1} + 0,3 P_{c,2}$

$P_{c,1} = 4,26$ MPa
$P_{c,2} = 3,8$ MPa
$\Rightarrow P_c = 4,122$ MPa (0,25)

(0,25 × 2)

$T_r = \frac{T}{T_c}$ $\quad T_c = \sum x_i T_{c,i} = 0,7 T_{c,1} + 0,3 T_{c,2}$

$T_{c,1} = 370$ K
$T_{c,2} = 425,2$ K
$\Rightarrow T_c = 386,56$ K (0,25)

(0,25)

$\Rightarrow P_r = \frac{10,3}{4,122} = 2,50$ (0,25) $\quad T_r = \frac{250 + 273,15}{386,56} = 1,35$ (0,25)

2. Specific volume :

a for ideal case : $PV = nRT \Rightarrow P v_{id} = \frac{RT}{M}$ (0,25)

$v_{id} = \frac{RT}{PM} \Rightarrow v_{id} = \frac{8,314 \times (250 + 273,15)}{10,3\,10^6 \quad 48,2} =$

$M = 0,7 \times 44 + 0,3 \cdot 58 = 48,2$ g/mol (0,5)

$v_{id} = 8,76\,10^{-6}$ m³/g (0,5) $\quad v_{id} = 8,76\,10^{-3}$ m³/kg

b. for real behaviour : $Pv = Z \frac{RT}{M}$ (0,25)

$\Rightarrow v = \frac{Z \cdot RT}{PM} = Z\, v_{id}$

from chart : $Z(2,50 ; 1,35) \simeq 0,685$
$\simeq 0,69$ (0,5)

Cor

$\Rightarrow \theta_{mal} = 0,69 \cdot 8,76 \cdot 10^{-3} = 6,04 \cdot 10^{-3}\ m^3/kg$

6

Exercise 2: $V_m = 90x_1 + 120x_2 + x_1x_2(15x_1 - 5x_2)$

$x_2 = 1 - x_1$ (0,5)

$\Rightarrow V_m = 120 - 25x_1 + 5x_1^2 - 10x_1^3$

1. $V_1^* = 90\ cm^3/mol$ (0,5) / $V_2^* = 120\ cm^3/mol$ (0,5)

2. $V_{ideal} = 90x_1 + 120x_2$ (0,5)

3. $\bar{V}_1 = V_m + (1-x_1)\frac{dV_m}{dx_1}$ (0,5) $\bar{V}_2 = V_m - x_1\frac{dV_m}{dx_1}$

$\frac{dV_m}{dx_1} = -25 + 10x_1 - 30x_1^2$ (0,5)

$\bar{V}_1 = 95 + 10x_1 - 35x_1^2 + 20x_1^3$ (0,5)

$\bar{V}_2 = 120 - 5x_1^2 + 20x_1^3$ (0,5)

4. $x_2 = 0,3$; $\Rightarrow x_1 = 0,7$

- $V_m = 101,52\ cm^3/mol$ (0,5)
- $\bar{V}_1 = 91,71\ cm^3/mol$ (0,5)
- $\bar{V}_2 = 124,41\ cm^3/mol$ (0,5)
- $V^E = 101,52 - 99 = 2,52\ cm^3/mol$ (0,25)

0,25

Exercise 3

1. The diagram represents solid-liquid E of non-ideal mixture binary with the Partially miscible components

(0,75)

2 1 – Pb rich solution

2 – Solid – liquid equilibrium (Pb rich)

2' – " " (Sn-rich)

3 – Liquid solution

4 – Solid – solid Mixture (Pb – Sn)

(Pb rich + Sn-rich
solid solid)

1,25

3. $T_A \simeq 325\,°C$ $T_B = 230\,°C$ o.r

$x_B = T$

4. E: Eutectic Point ($\simeq 62\%$, $183\,°C$)

o.r

The composition of the mixture at E:

3 Phases: { Pb rich solid
Sn rich solid o.r
Liquid Pb + Sn

Main properties: { as Pure Matter
melt / solidify at constant T
Liquid composition = x_{mixt}

o.r

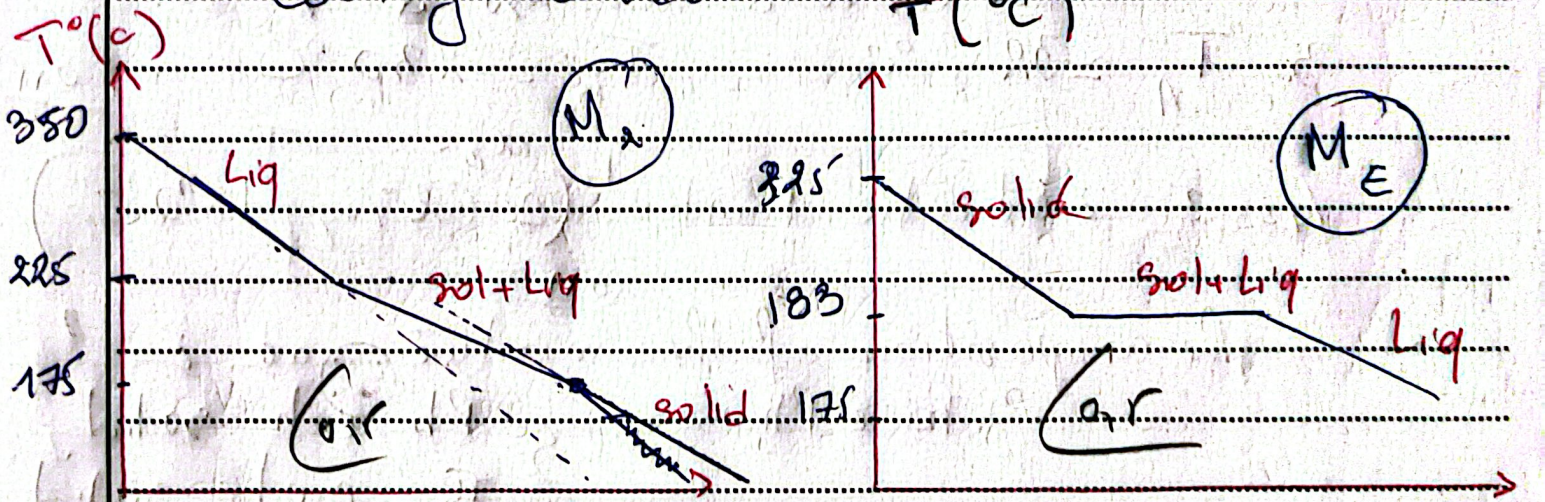
5. Table

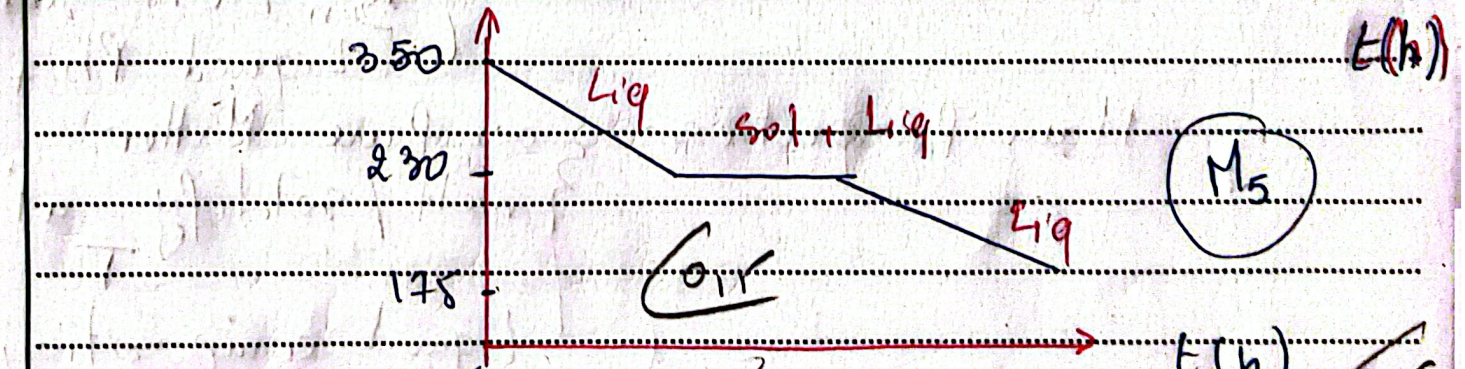
6. for M_E (40% B, 225):

first drop: { 19% Pb rich solid (or)

first solid: { ≃ 13% Sn, 87% Pb (or)

7. Cooling curves: T(°C)





or

Réponse

$x_A = 65\%$, $T = 225$

8/ $n_T = 15$ mole

$$\begin{cases} n^{sol} + n^{Liq} = 15 \\ \frac{n^{sol}}{n^{Liq}} = \frac{46-35}{35-17} = \frac{11}{18} = 0.61 \end{cases}$$ o.r

$$\begin{cases} n^{sol} = 0.61\, n^{Liq} \\ \Rightarrow n^{Liq} + 0.61\, n^{Liq} = 15 \end{cases}$$

$n^{Liq} = 9.32$ mol o.r $\quad n^{sol} = 5.68$ mol o.r

n^{Liq} { $0.17 \times 9.32 = 1.58$ mol of B

$x_A = 7.74$ mol of A

x $x_A = 65\%$ $\quad T = 125°C$

$x_B = 35\%$.

$n^T = 15$ mol $\Rightarrow n^{solid\,A} + n^{solid\,B} = 15$

using Liver rule: $\frac{n^{sol\,A}}{n^{sol\,B}} = \frac{x^{sol} - x_m}{x_m - x^{sol}} = \frac{97-35}{35-8} = \frac{62}{27} = 2.3$ o.r

$$\begin{cases} n^{sol\,A} = 2.3\, n^{sol\,B} \Rightarrow n^{sol\,B} + 2.3\, n^{sol\,B} = 15 \\ \Rightarrow n^{sol\,B} = \text{(o.r)} \end{cases}$$

$n^{sol\,A} =$ (o.r)

we have $x^{solid\,A} = 8\%$ and $x^{sol\,B} = 97\%$.

$n^{sol\,A}$ { $n^B =$, $n^A =$ $\quad$ $n^{sol\,B}$ { $n^B =$, $n^A =$

	0,25	0,25	0,25	0,25	0,25
lixture	M_1	M_2	M_3	M_4	M_5
position of mixture	10% B 90% A	35% B 65% A	70% B 30% A	85% B-~~rich~~ 15% A	100% B 0% A
ing Phases	A-rich solid	solid-Liquid	Liquid	solid A + solid B	Liquid
ıposition of phase I	10% B 90% A	solid: 47% B 83% A	70% B 30% A	A-rich sol	100% B
ıposition of phase II	/	Liquid: 47% B 53% A	/	B rich sol	/
ıperature of melting	275 °C	182° - 250°	≈ 180° - 190°	182° - 217° ≈	≈ 230°C

25 →

1,25