Termoøving 11

Oppgave 1

$\gamma_{Si} = 0{,}017$ velet % Si = 20

$\Rightarrow X_{Si} = 0{,}33$

$\Rightarrow a_{Si} = \gamma_{Si} \cdot X_{Si} = 5{,}64 \cdot 10^{-3}$

Rx1: $SiO_2(s) + 2C(s) \Rightarrow Si + 2CO(g)$

$\Delta G_1 = \Delta G_1^\circ + RT \ln\left(\frac{a_{Si} \cdot P_{CO}^2}{a_{SiO_2} \cdot a_C^2}\right) = 0$

Rx2: $2C + O_2 \Rightarrow 2CO$

$\Delta G_2^\circ = -52000 - 41{,}67 \cdot T$ (fra tabell)

Rx3: $Si + O_2 \Rightarrow SiO_2$

$\Delta G_3^\circ = -210000 + 43{,}5$ (fra tabell)

fra LF aner ikke hvilken tabell

Rx4: $Si \rightarrow Si$

$\Delta G_4^\circ = 0$ Samme standard tilstand

$\Delta G_1^\circ = \Delta G_2^\circ + \Delta G_3^\circ + \Delta G_4^\circ = 158000 - 85{,}17 \cdot T = RT \ln(K)$

Antar $a_{SiO_2} = a_C = P_{CO} = 1$

$\Rightarrow 158000 - 85{,}17 \cdot T = -RT \cdot \ln(5{,}64 \cdot 10^{-3})$

$\Rightarrow T = 1655\ K \Rightarrow \Delta G_1 = 0 \Rightarrow \underline{T \geq 1655\ K}$

Oppgave 2 Fe-C, $T = 1873\,K$ $X_C = 0{,}08$

$\log(\gamma_C) = 0{,}360$ når $\gamma_C \to 1$ og $x_C \to 0$

Ønsker a_C' når $\gamma_C' \to 1$ for $wt\%_C \to 0$

$$a_C' = \gamma_C' (wt\%C)$$

$$\mu_C = \mu_C^\circ + RT \ln(\gamma_C' (wt\%C)) = \mu_C^{\circ\prime} + RT \ln(\gamma_C \cdot x_C)$$

$$\Rightarrow \mu_C^\circ - \mu_C^{\circ\prime} = RT \ln\left(\frac{\gamma_C' \cdot (wt\%C)}{\gamma_C \cdot x_C}\right)$$

For $wt\%C \to 0 \Rightarrow x_C \approx \frac{(wt\%C) \cdot M_{Fe}}{100 \cdot M_C}$

$$\Rightarrow \mu_C^\circ - \mu_C^{\circ\prime} = RT \ln\left(\frac{100 M_C}{M_{Fe}}\right)$$

Altså når $wt\%C \to 0$ er $\frac{100 M_C}{M_{Fe}} = \frac{\gamma_C' (wt\%C)}{\gamma_C \cdot x_C}$

$$a_C' = \gamma_C' (wt\%C) = \frac{100 M_C}{M_{Fe}} \cdot \gamma_C \cdot x_C = 10^{0{,}36} \cdot 0{,}08 \cdot \frac{100 \cdot 12{,}05}{85}$$

$$\Rightarrow \underline{a_C' = 3{,}94}$$

Oppgave 3

$T = 1600°C$, 18 wt% Vanadium (V) + jern (Fe)

$a_V = 1{,}9$ for "γ" $V \to 1$ og $wt\%_0\, V \to 0$ (Standardtilstand)

- Finn a_V dersom standardtilstanden $a_V = 1$ for ren Vanadium ved 1600°C

$\gamma_V \to 0{,}18$ når $X_V \to 0$

Rx: $V(\text{i jern}) \rightleftharpoons V(\text{rent})$

$$\Delta G = \Delta G^\circ + RT \ln\left(\frac{a_V}{a_{V(wt\%)}}\right) = 0 \quad \text{likevekt}$$

$$\Rightarrow \quad \Delta G^\circ = -RT \ln\left(\frac{a_V}{a_{V(wt\%)}}\right) = -RT \ln\left(\frac{\gamma_V X_V}{\gamma^\circ_{V(wt\%)} \cdot (wt\%\, V)}\right)$$

$$\Rightarrow \quad a_V = \frac{\gamma_V \cdot X_V}{\gamma_{V(wt\%)} \cdot (wt\%\, V)} \cdot a_{V(wt\%)}$$

Vet at:

Std rent $V \Rightarrow \gamma_V \to 1$ når $X_V \to 1$

$\gamma_V \to \gamma_V^\circ$ når $X_V \to 0$

std for V(i Fe wt%) $\gamma_{V(wt\%)} \to 1$ når $(wt\%\, V) \to 0$

Ved Eq1: $$a_V = \frac{\gamma^\circ \cdot X_V}{1 \cdot (wt\%)_V} \cdot a_{V(wt\%)} \Big/ \left\{ \begin{array}{l} (wt\%)_x \to 0 \\ X_V = \dfrac{(wt\%)_V \cdot M_{Fe}}{100 \cdot M_V} \end{array} \right\}$$

$$= \frac{\gamma_V^\circ \cdot (wt\%)_V \cdot M_{Fe}}{(wt\%)_V \cdot 100 \cdot M_V} \cdot a_{V(wt\%)} \Big/ \left\{ a_{V(wt\%)} \cdot \gamma^\circ_{V(wt\%)} \cdot (wt\%)_V \right\}$$

$$= \frac{0{,}18 \cdot 55{,}85 \cdot 1{,}9 \cdot 18}{100 \cdot 50{,}94}$$

$$\underline{\underline{a_V = 0{,}067}}$$