

Termoøving 11

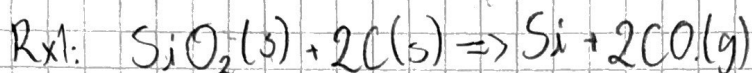
Oppgave 1

$$\gamma_{Si} = 0.017$$

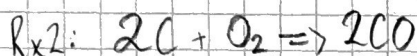
$$\text{vekt \% Si} = 20$$

$$\Rightarrow X_{Si} = 0.33$$

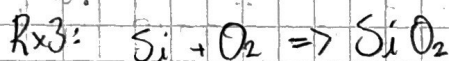
$$\Rightarrow a_{Si} = \gamma_{Si} \cdot X_{Si} = 5.64 \cdot 10^{-3}$$



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

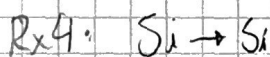


$$\Delta G_2^\circ = -52000 - 41.67 \cdot T \quad (\text{frå tabell})$$



$$\Delta G_3^\circ = -210000 + 43.5 \cdot T \quad (\text{frå tabell})$$

frå LF aner ikke hvilken tabell



$$\Delta G_4^\circ = 0 \quad \text{Samme standard tilstand}$$

$$\Delta G_1^\circ = \Delta G_2^\circ + \Delta G_3^\circ + \Delta G_4^\circ = 158000 - 85.17 \cdot T = RT \ln(K)$$

$$\text{Antar } a_{SiO_2} = a_C = p_{CO} = 1$$

$$\Rightarrow 158000 - 85.17 \cdot T = -RT \cdot \ln(5.64 \cdot 10^{-3})$$

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

Oppgave 2

Fe-C, $T = 1873 \text{ K}$ $X_C = 0.08$

$$\log(\gamma_C) = 0.360 \text{ når } \gamma_C \rightarrow 1 \text{ og } x_C \rightarrow 0$$

Ønsker a'_C når $\gamma'_C \rightarrow 1$ for $\text{wt}\% \rightarrow 0$

$$a'_C = \gamma'_C (\text{wt}\% \text{ C})$$

$$\mu_C = \mu_C^\circ + RT \ln(\gamma'_C (\text{wt}\% \text{ C})) = \mu_C^{\circ'} + RT \ln(\gamma_C \cdot X_C)$$

$$\Rightarrow \mu_C^\circ - \mu_C^{\circ'} = RT \ln\left(\frac{\gamma'_C \cdot (\text{wt}\% \text{ C})}{\gamma_C \cdot X_C}\right)$$

$$\text{For } \text{wt}\% \text{ C} \rightarrow 0 \Rightarrow X_C \approx \frac{(\text{wt}\% \text{ C}) \cdot M_{\text{Fe}}}{100 \cdot M_C}$$

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

$$\text{Altså når } \text{wt}\% \text{ C} \rightarrow 0 \text{ er } \frac{100 M_C}{M_{\text{Fe}}} = \frac{\gamma'_C (\text{wt}\% \text{ C})}{\gamma_C \cdot X_C}$$

$$a'_C = \gamma'_C (\text{wt}\% \text{ C}) = \frac{100 M_C}{M_{\text{Fe}}} \cdot \gamma_C \cdot X_C = 10^{0.36} \cdot 0.08 \cdot \frac{100 \cdot 12.55}{85}$$

$$\Rightarrow \underline{a'_C = 3.94}$$

Oppgave 3

$T = 1600^{\circ}\text{C}$, 18 wt% Vanadium + jern
(V) (Fe)

$a_v = 1,9$ for $\gamma_v \rightarrow 1$ og wt% $v \rightarrow 0$

- Finn a_v dersom standardtilstanden $a_v = 1$ for ren Vanadium ved 1600°C
 $\gamma_v \rightarrow 0,18$ når $x_v \rightarrow 0$

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

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

$$\Rightarrow \Delta G^{\circ} = -RT \ln \left(\frac{a_v}{a_v(\text{wt}\%)} \right) = -RT \ln \left(\frac{\gamma_v x_v}{\gamma_v^{\circ}(\text{wt}\%) \cdot (\text{wt}\% v)} \right)$$

$$\Rightarrow a_v = \frac{\gamma_v \cdot x_v}{\gamma_v(\text{wt}\%) \cdot (\text{wt}\% v)} \cdot a_v(\text{wt}\%)$$

Vet at:

Std rent V $\Rightarrow \gamma_v \rightarrow 1$ når $x_v \rightarrow 1$

$\gamma_v \rightarrow \gamma_v^{\circ}$ når $x_v \rightarrow 0$

Std for $V(\text{i Fe wt}\%)$ $\gamma_v(\text{wt}\%) \rightarrow 1$ når $(\text{wt}\% v) \rightarrow 0$

Ved Eq1:
$$a_v = \frac{\gamma_v \cdot x_v}{1 \cdot (\text{wt}\%)_v} \cdot a_v(\text{wt}\%) \left/ \begin{array}{l} (\text{wt}\%)_x \rightarrow 0 \\ x_v = \frac{(\text{wt}\%)_v \cdot M_{\text{Fe}}}{100 \cdot M_v} \end{array} \right\}$$

$$= \frac{\gamma_v^{\circ} \cdot (\text{wt}\%)_v \cdot M_{\text{Fe}}}{(\text{wt}\%)_v \cdot 100 \cdot M_v} \cdot a_v(\text{wt}\%) \left/ \left\{ a_v(\text{wt}\%) \cdot \gamma_v^{\circ}(\text{wt}\%) \cdot (\text{wt}\%)_v \right\} \right.$$

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

$$a_v = 0,067$$