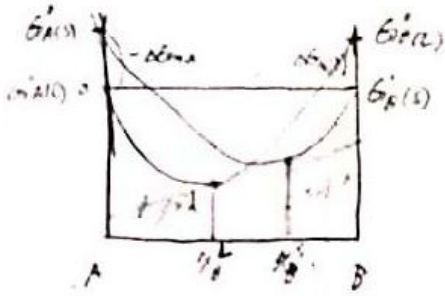


Problem Set 4)



$$\Delta G_{m,A} = G_A^L - G_A^S$$

$$\Delta G_{m,B} = G_B^L - G_B^S$$

regular solution  $\rightarrow \Delta H_{mix} = 0$   $x_A x_B$

$$G = G_{int} + \Omega x_A x_B$$

$$\mu_A = \left( \frac{\partial G}{\partial n_A} \right)_{T,P,n_B} = \left( \frac{\partial G_{int}}{\partial n_A} \right)_{T,P,n_B} + \Omega \left( \frac{\partial x_A x_B}{\partial n_A} \right)_{T,P,n_B}$$

$$\begin{aligned} \left( \frac{\partial n_A n_B / (n_A + n_B)}{\partial n_A} \right)_{n_B} &= \frac{n_B (n_A + n_B) - n_A n_B}{(n_A + n_B)^2} = \left( \frac{n_B}{n_A + n_B} \right) \left( 1 - \frac{n_A}{n_A + n_B} \right) \\ &= x_B (1 - x_A) = (1 - x_A)^2 \end{aligned}$$

$$\mu_A = G_A^S + RT \ln x_A + \Omega (1 - x_A)^2 = G_A^S + RT \ln a_A$$

$$\mu_B = G_B^S + RT \ln x_B + \Omega (1 - x_B)^2 = G_B^S + RT \ln a_B$$

For common tangent line

$$\left. \begin{aligned} \frac{\partial G^L(x_A)}{\partial x_A} \Big|_{x_A=x_A^L} &= \frac{\partial G_A^S}{\partial x_A} \Big|_{x_A=x_A^L} \Rightarrow \mu_A^L = \mu_A^S, \quad G_A^L + RT \ln a_A^L = G_A^S + RT \ln a_A^S \\ \frac{\partial G^L(x_A)}{\partial x_A} \Big|_{x_A=x_B^L} &= \frac{\partial G_B^S}{\partial x_A} \Big|_{x_A=x_B^L} \Rightarrow \mu_B^L = \mu_B^S, \quad G_B^L + RT \ln a_B^L = G_B^S + RT \ln a_B^S \end{aligned} \right\} \text{상평형 조건}$$

reference state에 대한 비열 효과

$$G^L = x_A \mu_A^L + x_B \mu_B^L, \quad G^S = x_A \mu_A^S + x_B \mu_B^S$$

$$\frac{\partial G^L}{\partial x_A} \Big|_{x_A=x_A^L} = \frac{\partial G^S}{\partial x_A} \Big|_{x_A=x_A^L} \Rightarrow \mu_A^L - \mu_B^L = \mu_A^S - \mu_B^S$$

$$\begin{aligned} &= G_A^L + RT \ln a_A^L - G_B^L + RT \ln a_B^L \\ &= G_A^S + RT \ln a_A^S - G_B^S + RT \ln a_B^S \end{aligned}$$

$$\begin{aligned} \therefore (G_A^S - G_A^L) + (G_B^L - G_B^S) + RT \ln \left( \frac{a_A^S \cdot a_B^L}{a_A^L \cdot a_B^S} \right) &= 0 \\ &= -\Delta G_{mix} + \Delta G_{ref} \\ &\Rightarrow \text{reference state에 대한 비열 효과} \end{aligned}$$