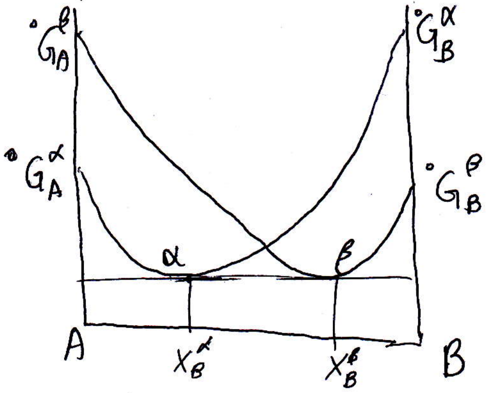
Problem Set # 1 20212000 철강·에너지소재 조영근



정규용액 모델일 경우

$$G^{\alpha} = X_A^{\alpha}\,{}^{\circ}G_A^{\alpha} + X_B^{\alpha}\,{}^{\circ}G_B^{\alpha} + RT\left(X_A^{\alpha}\ln X_A^{\alpha} + X_B^{\alpha}\ln X_B^{\alpha}\right) + \Omega^{\alpha} X_A X_B$$

$$G^{\beta} = X_A^{\beta}\,{}^{\circ}G_A^{\beta} + X_B^{\beta}\,{}^{\circ}G_B^{\beta} + RT\left(X_A^{\beta}\ln X_A^{\beta} + X_B^{\beta}\ln X_B^{\beta}\right) + \Omega^{\beta} X_A X_B$$

α, β 두 상이 평형일 경우 공통접선을 가짐

$$\left.\frac{\partial G^{\alpha}}{\partial X_B}\right|_{X_B=X_B^{\alpha}} = \left.\frac{\partial G^{\beta}}{\partial X_B}\right|_{X_B=X_B^{\beta}}$$

$$\Rightarrow \left.\frac{\partial G^{\alpha}}{\partial X_B}\right|_{X_B=X_B^{\alpha}} = -{}^{\circ}G_A^{\alpha} + {}^{\circ}G_B^{\alpha} + RT\left\{-\ln(1-X_B^{\alpha}) - 1 + \ln X_B^{\alpha} + 1\right\} + \Omega^{\alpha}(1-2X_B^{\alpha})$$

$$\ominus \left.\frac{\partial G^{\beta}}{\partial X_B}\right|_{X_B=X_B^{\beta}} = -{}^{\circ}G_A^{\beta} + {}^{\circ}G_B^{\beta} + RT\left\{-\ln(1-X_B^{\beta}) + \ln X_B^{\beta}\right\} + \Omega^{\beta}(1-2X_B^{\beta})$$

$$\Rightarrow \left({}^{\circ}G_A^{\beta} - {}^{\circ}G_A^{\alpha}\right) + \left({}^{\circ}G_B^{\alpha} - {}^{\circ}G_B^{\beta}\right) + RT\cdot\ln\left(\frac{X_B^{\alpha}}{1-X_B^{\alpha}}\cdot\frac{1-X_B^{\beta}}{X_B^{\beta}}\right) + \Omega^{\alpha}(1-2X_B^{\alpha}) + \Omega^{\beta}(1-2X_B^{\beta}) = 0$$

Reference state에 관계 없이 $({}^{\circ}G_A^{\beta} - {}^{\circ}G_A^{\alpha})$, $({}^{\circ}G_B^{\alpha} - {}^{\circ}G_B^{\beta})$는 일정하며, Ω^{α}와 Ω^{β}는 정규 용액 모델일 경우 일정하다.

· 따라서 상평형 조성은 reference state에 관계없이 unique하게 결정된다.