MSE 360: Phase Transformation and Diffusion

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Lecture 4
Gibbs Phase Rule

- $P + F = C + 2$
- $P + F = C + 1$

- Solid solubility as a function of $T$ (see Fig. 1.33)

\[ X_B = A \exp\left(-\frac{Q}{RT}\right) \]
Equilibrium Vacancy Concentration

\[ \Delta G = \Omega X_A X_V - \Delta S_V T X_V + RT(X_A \ln X_A + X_V \ln X_V) \]
Interface Effect on Equilibrium

Higher solubility in smaller particles
Higher solubility in the matrix at the interface
Phase transformation kinetics

\[ \text{rate} = Ce \frac{-\Delta G^a}{RT} = Ce \frac{- (\Delta H^a - T \Delta S^a)}{RT} = C'e \frac{-\Delta H^a}{RT} \]

Arrhenius rate equation
Home Work

• Reading assignment: Ch. 2.1 to 2.2.3
• HW: 1.14,