

**AMSE502 Phase Transformations**

due Date: Mar. 23, 2021

Problem Set #2

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1. Study and summarize CSL(coincedence site lattice) boundary.
2. Assuming a one atomic layer surface phase and considering equilibrium between bulk and surface phases, one can derive the following relation between surface composition and bulk composition. (B means “bulk” and  $\phi$  means “surface”.  $i$  means arbitrary solute elements while  $n$  means solvent element)

$$\frac{X_i^\phi}{X_n^\phi} = \frac{X_i^B}{X_n^B} e^{-\Delta G^{seg} / RT} \quad \text{where} \quad \Delta G^{seg} = [{}^oG_i^\phi - {}^oG_i^B] - [{}^oG_n^\phi - {}^oG_n^B] + RT \ln \frac{\gamma_i^\phi \gamma_n^B}{\gamma_n^\phi \gamma_i^B}$$

Change the above equation into the following, more general multicomponent form:

$$X_i^\phi = \frac{X_i^B e^{-\Delta G_i^{seg} / RT}}{1 + \sum_{j=1}^{n-1} X_j^B (e^{-\Delta G_j^{seg} / RT} - 1)} \quad \text{Hint: use} \quad \sum_{i=1}^{n-1} x_i^\phi x_n^B = \sum_{j=1}^{n-1} x_j^B x_n^\phi e^{-\Delta G_j^{seg} / RT}$$