3.091 Solid State Chemistry: Week 12

Logan Pachulski

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Progress Update

Over the past week I have been introduced to:

1. Solutions and chemical equilibrium.

Concentration

This is mostly a review, but a few different measures of concentration exist:

1. Mole fraction: $\cdots = \frac{\text{Moles A}}{\text{Moles A} + \text{Moles B}}$
2. Molarity: $\cdots = \frac{\text{Moles A}}{\text{Liters of solvent}}$
3. Mass concentration: $\cdots = \frac{\text{Mass A}}{\text{Liters of solvent}}$

Cohesive energy

We saw in the past that the total cohesive energy of a mono-atomic crystal is

$$H_A = \frac{1}{2} Z W_{AA} n_A \tag{1}$$

and we learned in this chapter that the change in energy resulting from the dissolving of some A in B is defined

$$2\Delta H_{\text{soln}} = Z(n_A(x_B W_{AB} + x_B W_{BB}) + n_B(x_A W_{AB} + x_b W_{BB}) - (W_{AA} n_A)) \tag{2}$$

Degeneracy, entropy, and Gibb's Free Energy

The degeneracy of a crystal is the number of ways that the atoms of the crystal can be arranged; consider a crystal with atoms A and B; it has degeneracy

$$\phi = \frac{(n_A + n_B)!}{n_A! n_B!} \tag{3}$$

and entropy

$$S = K \ln(\phi) \tag{4}$$

and most importantly, Gibb's Free Energy

$$G = (\text{cohesive energy}) - T \cdot S \tag{5}$$

Any spontaneous reaction seeks to minimize the Gibb's free energy and to maximize entropy; this enables spontaneous reactions, even those endothermic.