“DEFECTS” (Disruption of perfect order)

Number of vacancies depends on temperature:

\[ N_v = N \exp \left( -\frac{Q_v}{kT} \right) \]

- \( N_v \) = energy required to form a vacancy
- \( T \) = absolute temperature (Kelvin)
- \( k = \text{Boltzmann’s constant} = 1.38 \times 10^{-23} \text{ J/(atom K)} \)

Near melting temp there is about 1 vacancy per 10,000 sites
IMPURITIES (intentional or not)
- never 100% pure
- Alloys
- substitutional or interstitial
DEGREE OF SUBSTITUTIONAL SOLUBILITY:

1) atom size: no more than 15% difference in radii, otherwise new phase will form.
2) Crystal structure - both should be the same structure
3) Electornegativity - more “+” one and more “-” other will form intermetallic compound
4) Valences - all else equal, solute of higher valance will dissolve easier.
Carbon (0.071 nm radius)
Iron, (0.124 nm radius)
Poisson’s Ratio