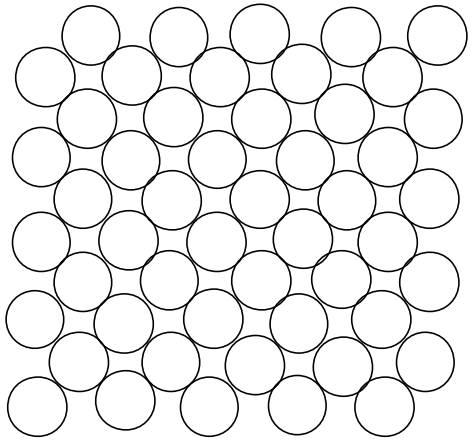
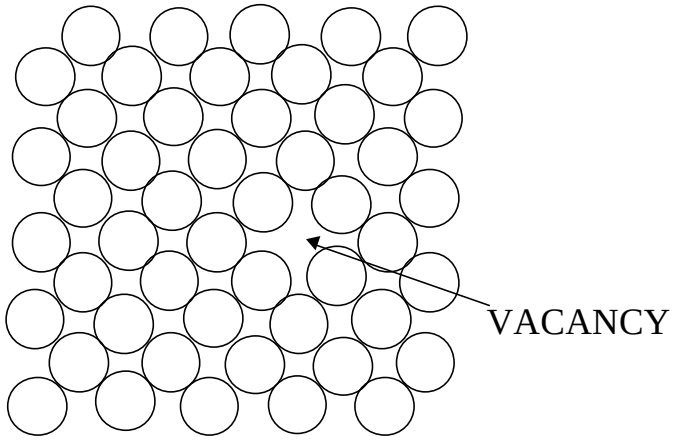
“DEFECTS” (Disruption of perfect order)



“HAPPY”



Number of vacancies depends on temperature:

$N_v = N \exp(-Q_v / kT)$

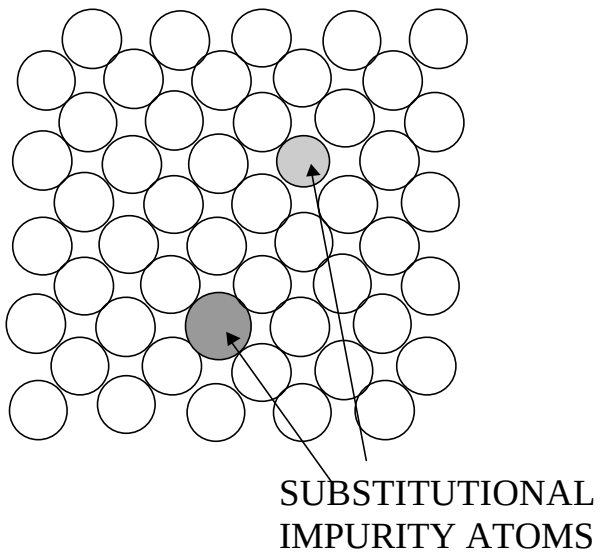
Q_v = energy required to form a vacancy

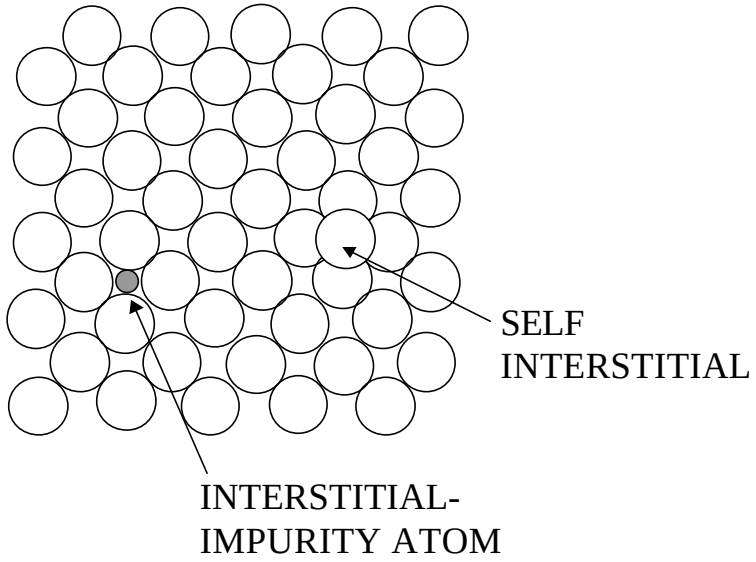
T = absolute temperature (Kelvin)

k = Boltzmann’s constant = $1.38X10^{-23}$ J/(atom K)

Near melting temp there is about 1 vacancy per 10,000 sites

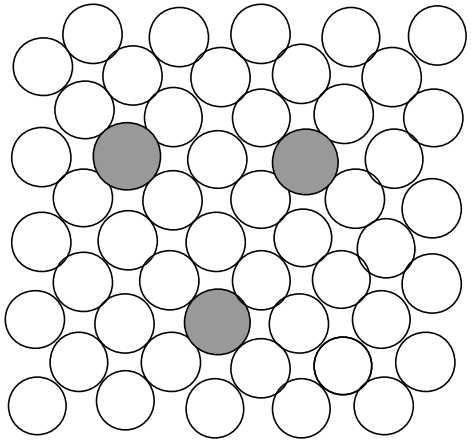
IMPURITIES





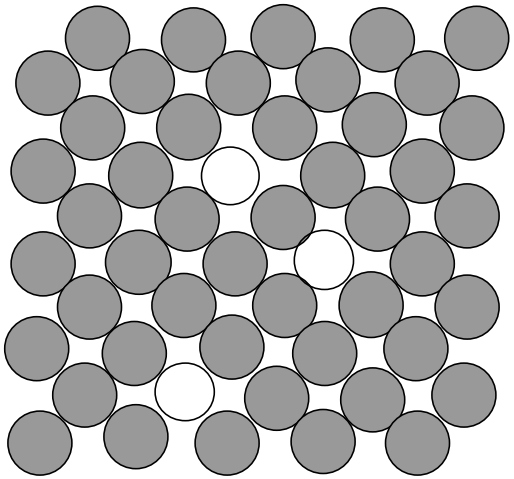
IMPURITIES (intentional or not)
-never 100% pure
- Alloys
-substitutional or interstitial

SUBSTITIONAL SOLUBILITY OF IMPURITIES



SOLUTE

SOLVENT



SOLUTE

SOLVENT

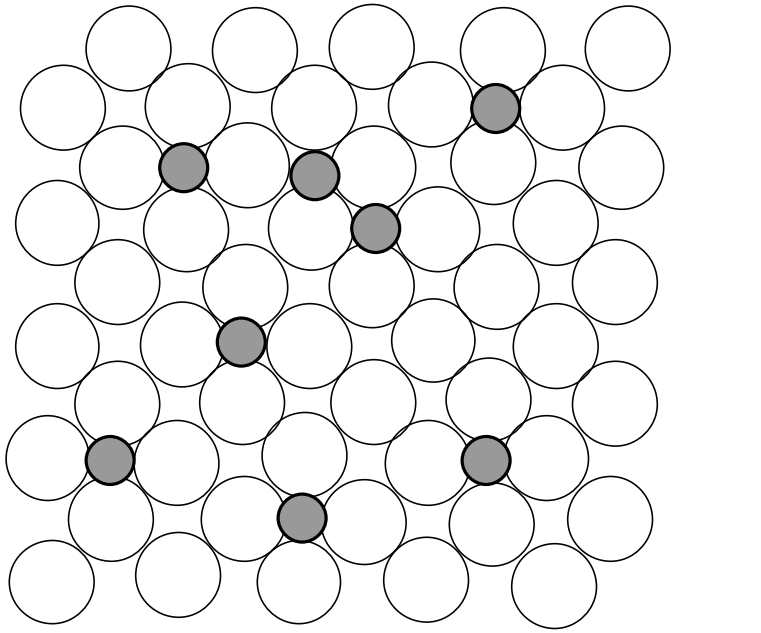
DEGREE OF <u>SUBSTITIONAL</u> SOLUBILITY:

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 disolve easier.



Carbon (0.071 nm radius)

Iron, (0.124 nm radius)

Poisson's Ratio