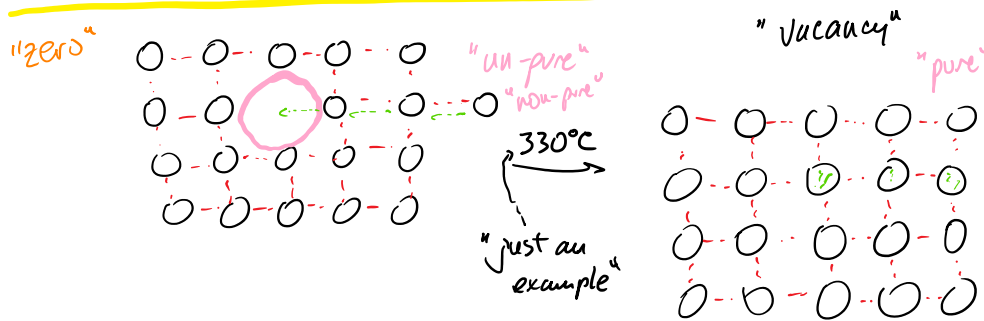
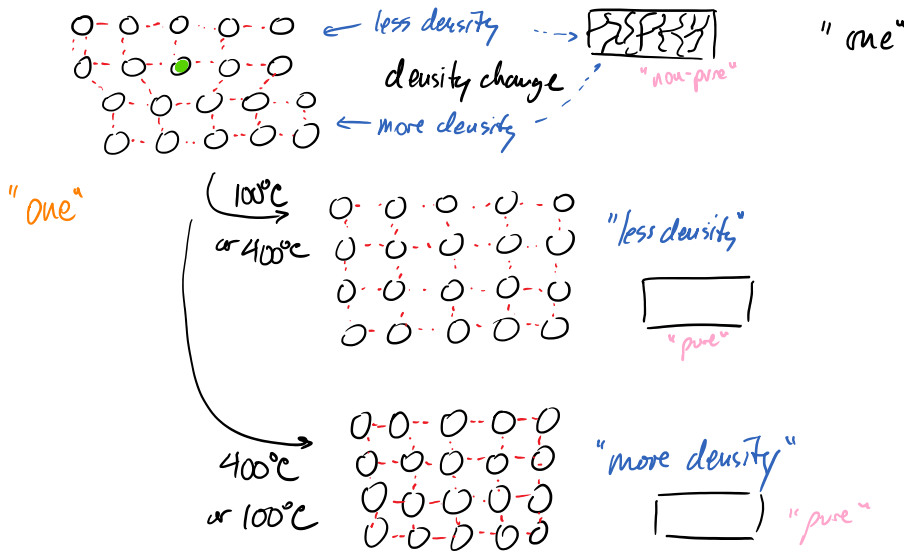


# Thermodynamics and Kinetics

## Crystalline Imperfections

→ nano-engineering of the structures

- Zero - dimensional - vacancy, impurity
- One - dislocation
- Two - grain, boundary



# of vacancy

energy

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

temperature

Boltzmann number

total

