General Features of Thermal Conductivity

From chapt. 2 and eq. 10.18

$$k_s = \frac{1}{3} \bullet \rho \bullet C_v \bullet u \bullet \lambda$$

phonon speed — **mean free path between collisions** — **Main effect of irrad.**

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The mean free path can be derived from the kinetic theory of gases;

$$\lambda = \frac{1}{\sigma_p \, n_p}$$

Collision cross section — **density of phonons,** α **T**

so

$$\lambda = \frac{1}{T}$$

Constraints;

T-->∞ λ cannot be smaller than a_o

T-->0 λ cannot be larger than distance between defects

- ***The more deviation from stoichiometry,***
- ***The more foreign atoms,***
- ***The more porosity,***

The smaller λ is !

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Typical fix;

$$\lambda = \frac{1}{A' + B' T}$$

Found that one could explain high temperature behaviour by the generation of defects at high T, which modifies the heat capacity as follows

$$C_v = C_{vo} + \frac{dH_{ex}}{dT}$$

Which leads to the temperature dependence of the thermal conductivity;

$$k_s = \frac{1 + (\frac{1}{C_{vo}})(\frac{dH_{ex}}{dT})}{A + BT}$$