4.2.2 Essentials to Chapter 4.2: Experimental Techniques for Studying Point Defects in Non-Equilibrium

- Non-equilibrium can be obtained in several ways; one always tries to have point defect concentrations far above equilibrium.
  - *Quenching*, i.e. freezing-in some equilibrium concentration (or some non-equilibrium concentration) at the low temperature T_{quench} that was present at the temperature T.
  - Irradiation (e.g. with electrons) that mostly produce vacancy - interstitial pairs in a concentration given by the irradiation intensity and thus will be above thermal equilibrium.
- After the point defects have been frozen-in, i.e. immobilized, you measure a property that is sensitive to point defects, most prominently the conductivity at low temperatures, and then study how this property changes upon annealing, i.e. letting your point defects achieve equilibrium (= disappear).
  - If you started from equilibrium, you will get equilibrium concentration and diffusion data that must be separated "somehow".
  - If you started from a non-equilibrium concentrations, you will *only* get diffusion data, i.e. migration enthalpies and entropies.

What happens during cooling down - rapidly or otherwise?

Question to ponder:

How far can a point defect move during cooling or what is the total diffusion length L_{total}?

Exercise 4.2-1

L_{total} determines

- How well quenching works
- Density of agglomerates
- Size of agglomerates