Lecture 1

Crystals vs Lattices

Lattices are the empty space that atoms can occupy, and crystals are crystals

Cells in 2D

Primitive: 1 lattice point per cell
Double: 2 lattice points per cell
Triple: 3 lattice points per cell
etc

Crystal families, systems

Families:

- Isometric
- Tetragonal
- Orthorhombic
- Monoclinic
- Anorthic
- Hexagonal

Systems:

- Cubic
- Tetragonal
- Orthorhombic
- Monoclinic
- Triclinic
- Hexagonal
- Trigonal

Hermann-Mauguin Space Lattice Letters

P: primitive
C: base centered
I: body centered
F: face centered
R: simple rhombohedral

Lattice Symbols

a: anorthic
m: monoclinic
o: orthogonal
t: tetragonal

h: hexagonal
c: cubic

Letter combination

E.g. tI6, where t is for tetragonal, I for body centered, and there are 6 atoms per unit cell

Structure Report Designations (Strukturbericht)

A: elements
B: AB compounds
C: AB2 compounds
D: AmBn compounds

A1 fcc
A2 bcc
A3 hcp

B1 Halite Structure, e.g. NaCl, Pearson Symbol cF8, Z: 4{NaCl}
C4 Rutile Structure, e.g. TiO2, Pearson Symbol tP6, Z: 2{TiO2}
C1 Fluorite Structure, e.g. CaF2, Pearson Symbol cF12, Z: 4{CaF2}
Urea Pearson: tP16,Z = 2{CH4N2O}

Density of a Crystal

n_i = number of atoms, m_i = mass of atom

$$\rho = \frac{\frac{\sum_{i=1}^{q} n_i m_i}{1000 \times N_A}}{V}$$

where the `1000` comes from converting grams to kilograms.