imperfections in solids

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$\rho = \frac{n \cdot A}{V_c N_A}$ $\quad \frac{N_A \cdot \rho}{A} = \frac{n}{V_c}$ ↘ number of atoms per unit cell volume

point defects:

1. vacancy, vacant lattice site

   no material without vacancies. if an atom is missing in the point where it supposed to be.

   number of vacancies increases exponentially with temperature

$$N_V = N \exp\left(-\frac{Q}{kT}\right)$$

   number of vacancies is Nv.

   k is boltzman constant or gas constant.

   Q is the energy required for formation of vacancy

2. self interstitial:

   case where an atom changes place and creates a vacancy, but goes between the ordered atoms within the same material.

3. impurities in solids:

   solid solution:

   solvent=host: highest concentration

   solute: minor concentration

for two atoms to create solid solutipn:

1. atomic size factor
2. similar crystal structure
3. dissimilar electronegativity
4. dissimilar valences

3.1 substitutional: solute atoms replace the host atoms

3.2 interstitial: solute atoms fill the voids among host atoms

%wt

$$C_1 = \frac{m_1}{m_1 + m_2} \times 100$$

atom%

$$C_1' = \frac{n_{m_1}}{n_{m_1} + n_{m_2}} \times 100$$

$$n_{m_1} = \frac{m_1'}{A_1}$$

$$C_1' = \frac{C_1 A_2}{C_1 A_2 + C_2 A_1} \times 100 \quad / \quad C_1 = \frac{C_1' A_1}{C_1' A_1 + C_2' A_2}$$

%atom caprazlar / %wt paralel.

(A atomic weight

point defects:

1. **vacancy defect:** when an atom is missing from its regular lattice
2. **interstitial defect:** when an extra atom occupies space between refular lattice
3. **substitutional defect:** a different atom replaces the host atom
4. **schottky defect:** equal number of cations and anions are missing
5. **frenkel defect:** combination of a cation vacancy and cation interstitial

linear defects:

1. **edge dislocation:** extra half plane of atoms ocurrs in the crystal lattice
2. **screw dislocation:** caused by external shear force, formed when a part of crystal lattice is twisted
3. **mixed dislocation:** combination of edge and screw dislocation

interfacial defects:

1. **grain boundaries:** occur due to the differences in the orientation of adjacent grains
2. **twin boundaries:** two regions of the crystal are mirror images of each other
3. **stacking faults:** common in close packed structures, stacking faults are mistakes in the regular stacking sequence, like ABABAB, when there is a stacking fault, it could be AABABA etc.