Engineering Chemistry (KAS-102)

Lecture No - 7

UNIT- I

(Point Defect)

⇒ Imperfection in Solids

"Any deviation from the perfect atomic arrangement in a crystal is said to contain imperfections or defects."

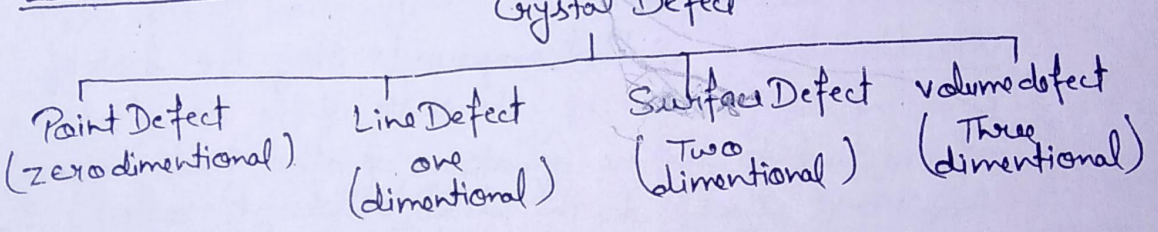
Crystal imperfections have strong influence upon many properties of crystals, thus some properties of crystals such as strength, conductivity are controlled by as much as by imperfections and by the nature of the host crystal.

→ Conductivity of some semiconductors is due to chemical impurities & imperfections

→ Colour of many crystals arises due to imperfections.

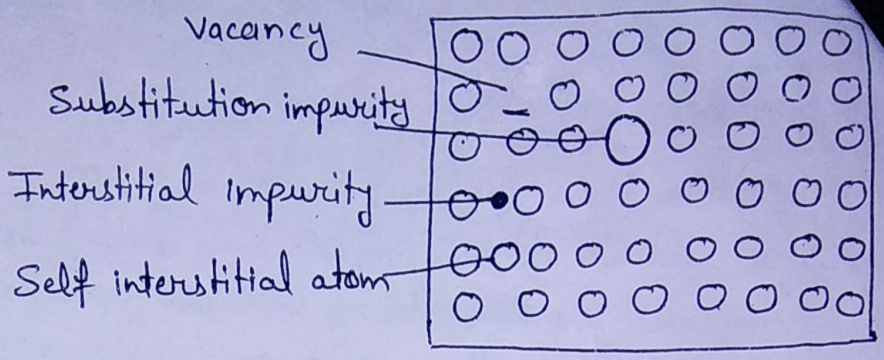
→ Mechanical & plastic properties are controlled by imperfections.

Types of Crystal defect



Point Defect

- It is zero dimentional defect.
- It is either due to the presence of vacancy from where the atom or ion is missing at the atomic site or there may be an impurity atom.
- Point defect can be of following types -



Vacancy - If an atom or ion is missing from regular arrangement.

Substitution Impurity - If impurity atom replaces the parent atom.

Interstitial Impurity - If impurity atom occupy the interstitial position.

Self Interstitial Atom - If parent atom occupy the interstitial position.

⇒ Point defect may be -

Stoichiometric - Such compounds obey the law of constant composition, i.e. the ratio of the no. of atoms of one kind to the no. of atoms of other kind ~~does not~~ correspond exactly to the ideal whole no. ratio. *

Nonstoichiometric - Such compounds do not obey the law of constant composition, i.e. there is no ideal whole no. ratio.

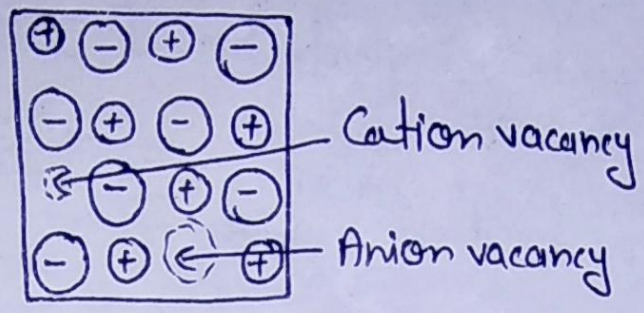
Point defect in ionic crystals are of two types -

Schottky Defect

Frenkel Defect

Schottky Defect

pair is missing a cation & an anion

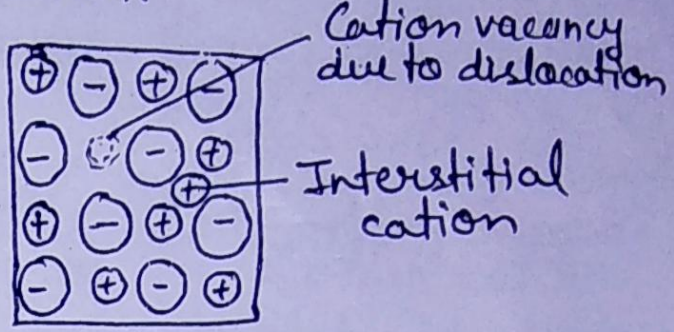


- It occurs in highly ionic compounds, with high co-ordination number.
- In this defect density of crystal decreases.
- Electric conductivity of crystals having this defect increases due to presence of holes.
- Holes are of both types positive and negative.

eg. NaCl, KCl, KBr, CsCl, AgBr (both) etc.

Frenkel Defect

- Small sized cation gets dislocated to interstitial position.



- It occurs when an ion is smaller than other & having low co-ordination number.
- In this defect density remains same.
- Electric conductivity of crystals having frenkel defect slightly increases.
- Holes are only of positive type.

eg. ZnS, AgCl etc.
AgBr (its radius is intermediate)