

## Crystal Imperfection →

- \* Atoms are arranged in well mannered in the perfect crystal.
- \* Any departure from this idealized arrangement of atom ~~at~~ make the crystal imperfect.
- \* Crystalline material have finite dimension and have broken bonds at the boundaries where bonding forces remain unbalanced.

### Disadvantage of imperfection →

- \* It will create several deficiencies in solids.
- \* They decrease the mechanical strength.
- \* Presence of imperfection in crystalline material is generally undesired.

### Advantage

The presence of imperfection is advantageous in certain application.

- \* Doping of phosphorus in silicon changes the behaviour of intrinsic semiconductor.

### \* Classification of Imperfection -

1. Point imperfection. (zero dimensional defects)
2. Line imperfection (one " " )
3. Surface " (two " " )
4. Volume " (three " " )

- \* point, line and surface imperfection may ~~can~~ occur together in crystal.
- \* These defects are not visible to naked eye.
- \* They can visualised by x-ray diffraction techniques.

Sr. No. 3.A  
 APD  
 3. Research P.

Point Imperfection →

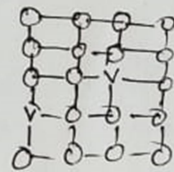
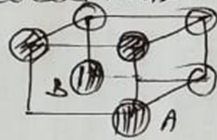
They are imperfect point like regions in crystal.  
 \* These defects are of one or two atomic diameter.

Types of point imperfection.

- ① Vacancy
- ② Substitutional Impurity.
- ③ Interstitial Impurity.
- ④ Frankel's Defect.
- ⑤ Schottky's Defect.

→ Vacancy →

\* Vacancy refers to vacant atomic site in crystal.  
 \* At these sites the atoms are missing.  
 \* One or more atom may remain absent from their respective locations.



FCC

→ Substitutional Impurity →

\* This defect refers to a foreign atom that substitutes a parent atom.  
 \* The substituting foreign atom is called solute and substituted parent atom are known as solvent.  
 \* Solute & solvent are mixed together to form an alloy.



foreign atom.

BRONZE.

For exp. copper and zinc mix together to form α-brass.

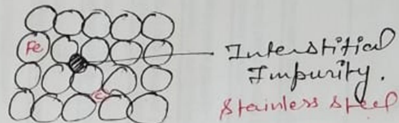
It will create an elastic strain in the surrounding region.  
 proper size of parent & foreign atom.

SHOT ON REDMI 7  
 THE DUAL CAMERA

## Interstitial Impurity →

When a small sized foreign atom occupies a void space in the parent crystal, then the defect is known as interstitial impurity.

- \* Dislodging of parent ~~atoms~~ atom from their site does not occur in this case.
- \* An atom can enter into the interstitial void when it is quite smaller in size than the parent atom.



## → Frankel's Defect →

\* An <sup>Cation</sup> ion displaced from a regular location to an interstitial location, in an ionic solid is called Frankel's defect.

- \* Two ions (cations and anions)
- \* Cations are smaller in size whereas anions are the larger in size.
- \* Cations may easily get displaced into the voids and anions ~~do not~~ do not displace in small sized voids.
- \* The presence of this defect does not change the overall electrical neutrality of crystal.

Exp-  $\text{CaF}_2$ , silver halide,  $\text{AgCl}$   
\* Density of crystal does not change.



## → Schottky's Defect →

When pair of one cation and one anion are absent from an ionic crystal the defect is called Schottky's defect.

- \* The valency of missing pair of ions maintain electrical neutrality in the crystal.

Ex- Such imperfection are dominant in alkali halides such as  $\text{LiCl}$ ,  $\text{LiBr}$  etc.,  $\text{NaCl}$ ,  $\text{KCl}$ .

- \* Hence observe density of crystal is lower than the expected density

