Prop.

① Strong omnidirectional [illegible]

High m.p & B.p due to Strong ~~Hardness~~ electro static force b/w the Ions.

② Hardness

Electrostatic force make the crystal Hard

③ Solubily

Dissolved easily Polar Solvents of high dielectric Constant.

④ Conductance

In Soln molten - conduct

In Solid state low conductance

Ionic Bond. அயனிப் பிணைப்பு.

Cations & anion are present in ionic cpds.

Prop. ~~It~~ ~~is~~ ~~are~~ differ fm covelent cpds.

Maximum cation - anion attraction

Minimum Cation - cat & ani - anion repulsion.

It is called Ionic cpds.

Radius Ratio rule. Cations & anions of an crystal Ion try to arrange themselves in geometrical ~~b/w~~ same ions repulsion b/w is minimum attraction b/w opp ion is maximum

The geometry & C.N of Ions is depends upon relative size of the Ions. It is called Radius Ratio Rule.

$$= \frac{r^+ \text{ (Radius of Cation)}}{r^- \text{ (" " anion)}}$$

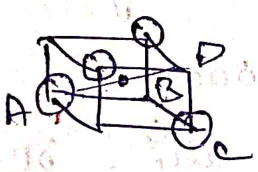
* To predict the C.N

* " " Shape of Ionic Crystals.

* determining the C.N & Shape i of the Ionic Crystal is known as Radius ratio effect.

Calculation of radius ratio!

Tetrahedral.



a - length of each side

The face diagonal $AC = \sqrt{BC^2 + AB^2}$

$= \sqrt{a^2 + a^2} = \sqrt{2}a$ — ①

Anions are touching one another

$AC = r^- + r^- = 2r^-$ — ②

Compare ① & ②

$2r^- = \sqrt{2}a = \qquad r^- = \frac{1}{\sqrt{2}} a$ — ③

Body diagonal.

$AD = \sqrt{AC^2 + CD^2}$

$= \sqrt{(\sqrt{2}a)^2 + a^2} = \sqrt{3}a$ —— ④

Cation present at the centre of the body diagonal AD

$\frac{1}{2} AD = r^+ + r^-$ —— ⑤

Compare ④ & ⑤

$\frac{\sqrt{3}a}{2} = r^+ + r^-$ —— ⑥

Dividing ⑥ by ③

$$\frac{\frac{\sqrt{3}a}{2} = r^+ + r^-}{r^- = \frac{1}{\sqrt{2}}a}$$

$$\frac{r^+ + r^-}{r^-} = \frac{\sqrt{3}\cancel{a}}{2} \times \frac{\sqrt{2}}{\cancel{a}} = \frac{\sqrt{3}}{\sqrt{2}}$$

$$\frac{r^+}{r^-} = \frac{\sqrt{3}}{\sqrt{2}} - 1 = 0.225$$ for Td.

Ionic crystals.

Stability of Ionic crystals

Maxi Cat - ani attracti

Mini Cat - Cat ani - ani - repulsive.

Oppo., Charged ions close to one another

Same " " far away " "

depends upon size of Ion

AX type.

Ions are same

C.N also same.

Nacl.

fcc

Cl^- ions face centered cubic arrangement.

Na^+ occupy all oh sites

Only one oh site per atom. closed packed lattice

Each Na^+ ion is surrounded by six Cl^-

Each Cl^- " " " " six Na^+

Therefore CN is same.

Radius ratio 0.524 fm Na^+

" " 0.95 fm Cl^-

ZnS.

Cubical close packing

S^{2-} ions are arranged ccp.

Ions are present at corner & faces of cube

S^{2-} has two td sides.

Zn^{2+} occupy 1 half of the td site

4 : 4 arrang, (ie) Each ion surrounded by four

Radius ration 0.40 fm Zn^{2+}

" " 0.74 S^{2-}

wurzite

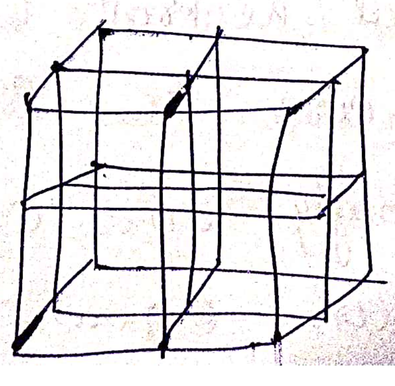
S^{2-} hcp hexagonal close packing.

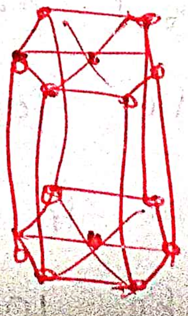
Ions are present in corner & face of hexagon

S^{2-} has two td site

Zn^{2+} one half of the td site.

4 : 4





AX_2

Flourite str.

Ca^{2+} ions ccp arrange

Ions present at corners & face of a Cube

Ca^{2+} has two td sites.

F^- occupy all td site hce 1:2

4 : 8 arrange,

Ca^{2+} surrounded by 8 F^-

F^- " " 4 Ca^{2+}.

Rutile str.

1. distorted.
2. Ti^{4+} surround by 6 O^{2-}

O^{2-} " by 3 Ti^{4+}

6:3

Lattice egy.

Born - Lande eqn

Importance of Born - Lande.

Vander Waal's or London forse.

CaC_2 similar to NaCl

CdI_2 → 1) hcp Layerd lattice.

2) Cd → lie on oh sites

I-Cd-I Cd^{2+} suround by I⁻ ions I^- has 3 Cd^{2+}

I year Book.

Crystal defect

1 Schottky 2. Frenkel.

① Schottky

* Some of lattice points are unoccupied

It is called Lattice Vacancies or holes

existence two holes one - missing +ve ion

- " -ve ion.

It noted crystal neutral. bcoz +ve & -ve ions are the same.

It appears in strongly ionic cpds having C.N No., & ions are equal size.

Ex: Nacl & Cscl

geiger muller counter

Radio active reactor.

$[Cu(CS)_3]SO_4$

Cu

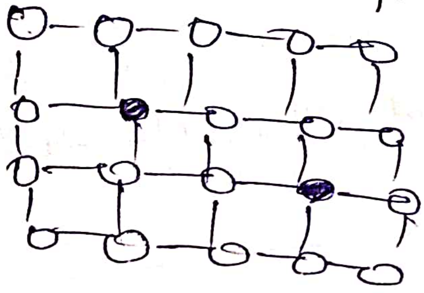
Scattering.

Projectile particle are scattered by target.

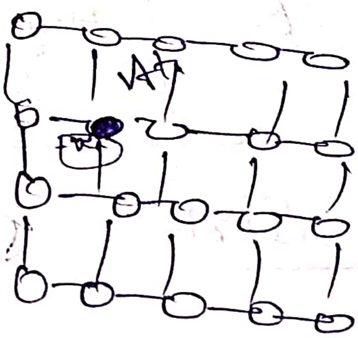
Elastic

Exchange of kinetic egy

Schotty.



Frenkel.



hole -v
+ve
netwok

Frenkel.

It occupies Interstitial +ve b/w lattice points.

+ve ion is interstitial space.

It appear less ionic cpds. -ve ions larger than +ve ions.

Ex. AgBr, ZnS.

Intrisic Semiconductors.

Si, Ge => 4 e⁻

Extrinsic ⑤ Ar added to ④ Ge.

Remaining one e⁻ to produce elect current.

It is n-type Semi conductors.

② In added to ④ Ge

electron vacant site is known as +ve ho

p-type Semi conductors.

∴ hcp Ni – transition metal.

β – Sn, Sb, S, Se, Te.

2. all the Oh holes occupied by Ni

3. Ni Surrounded by 6 As

4. As " " 6 Ni

6 : 6

β - Cristobalite
High temp ~~of~~ form of silica. like Zn blende
Si–O–Si

Layered Strt- CdI_2

1) hcp

Cd^{2+} ion lie in Oh site

Cd^{2+} Surrounded by six I^-

I^- " " 3 Cd^{2+}

6 : 3.

Super conductivity is defined as transition temp.

~~Transition temp~~

Critical temp

Ex: Ag, Pb below 23.2 K

Rutile. (TiO_2)

1. Distorted bcc
2. Ions present at all corner & at body centre of the distorted cube.
3. Ti^{4+} surrounded by six O^{2-} ions
   O^{2-} " " three Ti^{4+}
4. CN of Ti & O are 6 & 3

aC$_2$ Similar to NaCl

Na replaced by Ca
Cl " " C_2

CdI$_2$

I^- ion hcp arrangement
Cd^{2+} surrounded by six I^-
I^- has 3 Cd^{2+}
Arrangement I - Cd - I I - Cd - I