UNIT-7

-: METALLURGY :-

Introduction ⇒

The earth thurth is the main source of the metal. The occurence of the state metal in earth curth in netive state and in combined state metals which are less electro +ve. in nature occurence in netive state.

metals which are highly electro +ve occure in nature in combined state. The combined state of metal in the earth curth is known as minerals. Those menirals which can give the metal in large Persentage economically and scinceti cully, known as ore.

NOTE all the ore are minirals but all the minirals can't be ore.

The process which is used for the extraction of metal. from its ore scintiphically and economically know as metallurgy.

The most important ore of the metals ore.

Sr.No	Metal	Ore	chemical formulas
1-	Al	Bauxide	$Al_2O_3 \cdot 3H_2O$
	Al	cryocite	Na_3AlF_6
2-	Fe	Hemetide	Fe_2O_3
	Fe	megnetite	Fe_3O_4
	Fe	Ironpyride	FeS_2

Metal	Ore	chemical formula
Cu	Copper Pyride	$CuFeS_2$
Cu	Copper gelence	Cu_2S
Zn	Zing Blende	ZnS
Zn	Calamine	$ZnCO_4$
Pb	Galena	PbS
Pb	Anglesite	$PbSO_4$
Mg	epsom Sold	$MgSO_4 \cdot 7H_2O$
Mg	dolomite	$MgCO_3 \cdot CaCO_3$
Ag	Silver glanse	Ag_2S
Ag	Ruby Silver	Ag_3SbF_3

The process of metallurgy carriedout by the help of following four steps :-

Step - 1 . mining and Curushing of the Ore

Step - 2 . dressing and Consertration of the Ore.

Step - 3 - Conversion of Ore into metal.

Step - 4 - Purification and Refyning of the metal.

Step - 1 mining and Curushing of the Ore.

IN this step we will Octent Ore from the earth cursth by mining and Converted into Power from by Jow. Cressure.

The Converssion if Inpure Ore into Powor formed by Jow Cresser in know Pulverization.

Step - 2 Dressing and Consertration of the Ore :-

There Ore meny method for the Purification of Ore. but the most important method Ore.

1 - Hydrolic washing

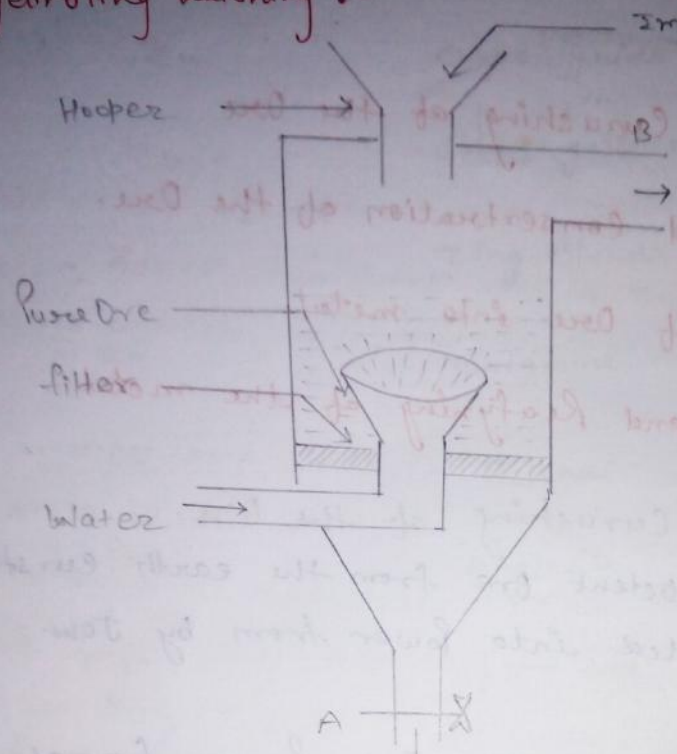
2 - Magnetic seperession method

3 - Froth flotation method

4 - Leaching

1

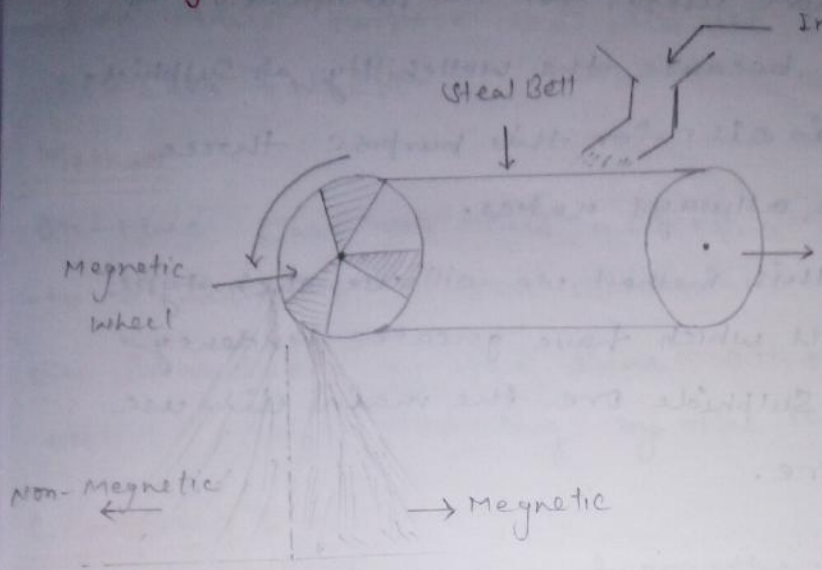
Hyelroling Washing :-



This method is non as gravity sinfrection method and Navigation method.

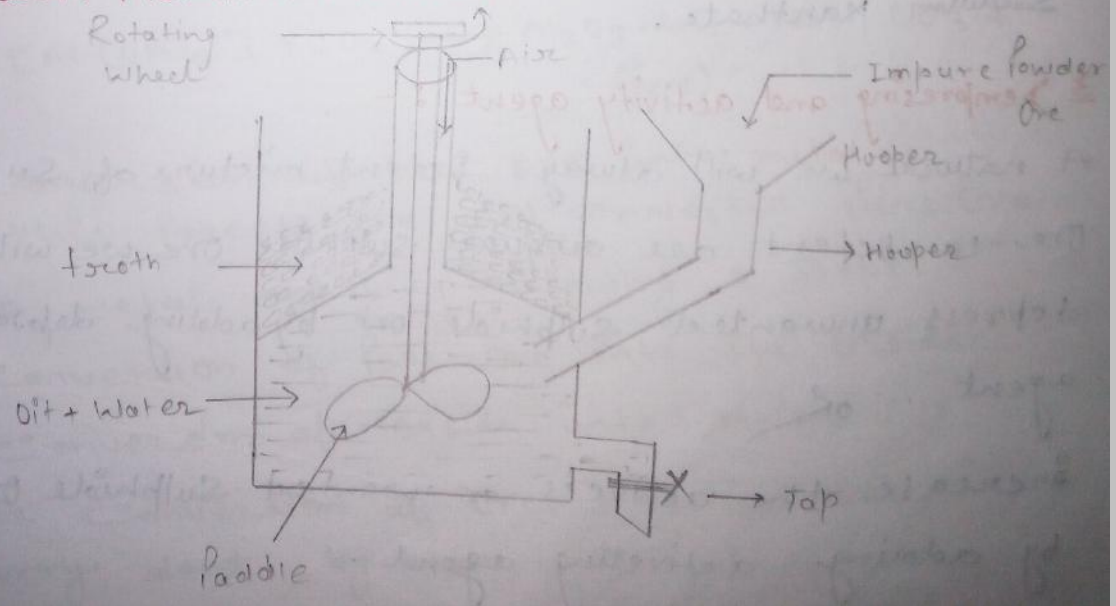
In this method impure Powder Ore interoduce in water due to which water soluble impurity. Seperate out from Point A and water insoluble impurity which is lighter in weight remove Point B. and there the Pure Ore remain filter

2- Megnetic Saperation Method :-



This method is more usefull for saperating such type of ore in which other ore impurity ore in megnetic in nature. The non- megnetic substrance all dways from the megnetic wheel and the megnetic substrance for down the megnetic wheel.

3- Froth Flotation Method :-



This method is more useful for the Purification of the Sulphide Ore. because the wettebility of Sulphide ore is greater in oil. for this purpose three main Point are allways notries.

1-. frouther ⇒ In this method we will use such type of oil which have greater tendency to from for with Sulphide Ore. the main oil use for this Purpose ore.

1- Pine Oil
2- eucaliptus Oil
3- Camphor oil
4-

2→ Cullector Oil ⇒
for maintening the Sulphide Ore. in frouth for long type we will use for a Corrector.
The most important Collector for this Purpose is Sodium xanthate.

3 ⇒ empresing and activity agent :-
A nature we will always Octent mixture of Sulphide Ore. to Octent are requare Sulphide Ore we will depress unwanted Sulphide ore by adding depressing agent. or
increase the activeis or wanted Sulphide Ore. by adding activeting agent.

for Ocleing PbS or we want to depress ZnS for this purpose we will use a depressing agent $Na_2CO_3 + NaCN$.

Methaod

In this case of this method impure Powder ore to containing by the container.
So interduce by the React oil + water and Air after that Rotating by the Paddeling.

Leaching :-

To Safreate Pure ore from the impure ore by the helb of sum chemical Subtance, Know has Leaching The chemical which is used for this Purpose is Know as Leaching agent.

Ex $Al_2O_3 \cdot 2H_2O + NaOH \longrightarrow Na[Al(OH)_4] + \text{Impurity} \downarrow$
impure (aq)

$Na[Al(OH)_4] + CO_2 \longrightarrow Al_2O_3 \cdot 2H_2 + NaOH\,CO_3 \downarrow$
(Pure)

Conversion of Pure Ore into metal.
In this Process we will converted Pure Ore into metal applying following 2 Steps.
1- Conversion of Pure ore into its Oxside.
2- Conversion of oxside into metal.
The Conversion of ore into its Oxside Carry dowt by two way.

1- Calcination ⇒

In this process we will converted the pure ore into its oxidise by limiting supply of air or in the upsence of air.

Ex $Al_2O_3 \cdot 2H_2O \xrightarrow{\Delta} Al_2O_3 + 2H_2O \uparrow$ (Steam)

$ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2 \uparrow$

Calamine

2- Roasting ⇒

in this process the pure ore is heated in the exist of air.

$Ag_2S + O_2 \longrightarrow Ag_2O + SO_2 \uparrow$

$PbS + O_2 \longrightarrow PbO + SO \uparrow$

⇒ Conversion of oxside into metal :-

the conversion of metal oxside into ore carry dout by one of the following method.

1- Smeliting :- in this process metal oxside is heated with carbon atom due to is metal is octent with carbon mono oxside gas.

$ZnO + C \longrightarrow Zn + CO$

$PbO + C \longrightarrow Pb + CO$

2- Highly electro

Reduction of metal oxside (by highly electro +ve metal) ⇒

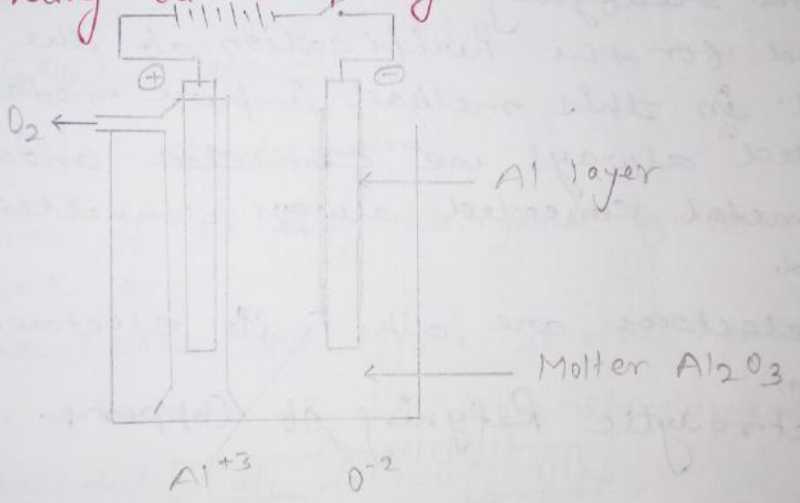
in this process the metal of metal oxside Converted by highly electro +ve metal.

$$Al + Fe_2O_3 \longrightarrow Al_2O_3 + Fe$$

in this method the octent metal always be in molten state.

This molten metal use for welding purpose there for this process is know as thermit belding.

Eletro lighting elic composing method ⇒



Al_2O_3

Anode

$$2O^{-2} \longrightarrow O_2 + 4e$$

Cathode :

$$Al^{+3} + 3e \longrightarrow Al$$

⇒ Purification of the impure metal ⇒
By the help of above process the Octent metal will we impure, for the Purification of this impure metal we will use different type of process.

Zone refyning metal, Vapper Phase Reafyning method, electro Refyning methods.

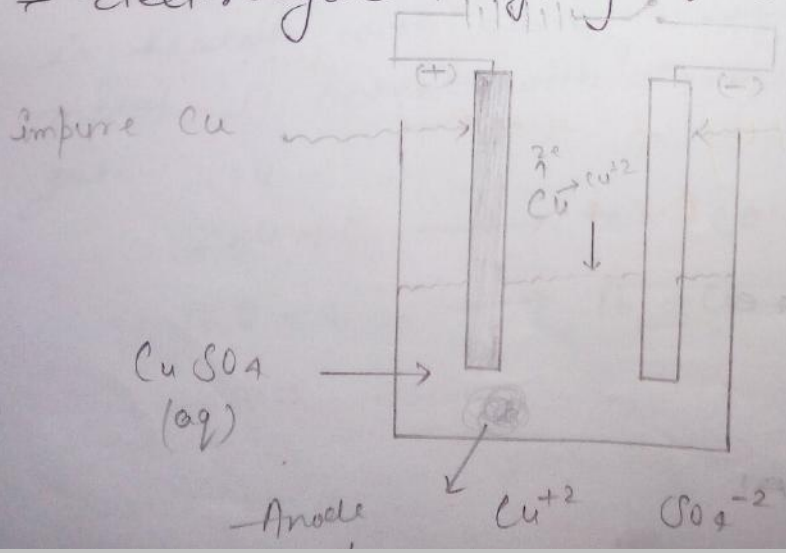
1- Electro refyning method
2- Electro refyning method is more suitable method for the Purification of impure metal.

Electro Reafyning method:-

Electro reafyning method is more use ful method for the Purification of the impure metal. in this method impure metal is connected always we connected anode in pure metal conected always connected with Cathode.

Both electros are dib its electrolyte solution.

⇒ Electrolytic Refyning of Copper:-



Anode :

$$Cu \longrightarrow Cu^{+2} + 2e$$

(impure) (aq)

Cathod :-

$$Cu^{+2} + 2e \longrightarrow Cu$$

(aq) (pure)

Metterlurgy of Li :-

Li does not occure in nature in free state because it is highlly electro +ve metal. The most important ore from which Li can be extreated are

1- $Na_2, Al_2, (SiO_3)_3 (OH_2)$ Lepidolite

2- $Li\,Al\,(Si_2O_5)_2$ Petalite

3- $Li\,Al\,(SiO_3)_2$ Spodumeene

The extression of Li esilly carrydaut by the help of spodumene ore.

in spodumene $FeSO_4$ and $MgSO_4$ is the most marg impurity. The extraction of Li from spodumene carry out by the help of following step.

1- Mining an Creshing of the Ore,

2- Dressing of the Ore :

in this step be will Purify the impure ore by applying difference type of method like hydrolying washing megnetic saforession method and show on.

Here we will Purity the ore by the help of Concentration H_2SO_4.

$$LiAl(SiO_3)_2 + H_2SO_4 \longrightarrow \underbrace{Li_2SO_4 + Al_2(SO_4)_3 + FeSO_4 + MgSO_4 + H_2O}_{\text{solution from}} + SiO_2 \downarrow$$

Impure

$$\underbrace{Li_2SO_4 + Al_2(SO_4)_3 + FeSO_4 + MgSO_4 + H_2O}_{\text{solution}} + Na_2CO_3 \longrightarrow$$

$$\underbrace{Li_2SO_4}_{\text{solution}} + Al_2(CO_3)_2 \downarrow + Fe_2CO_3 \downarrow + MgCO_3 \downarrow \longrightarrow$$

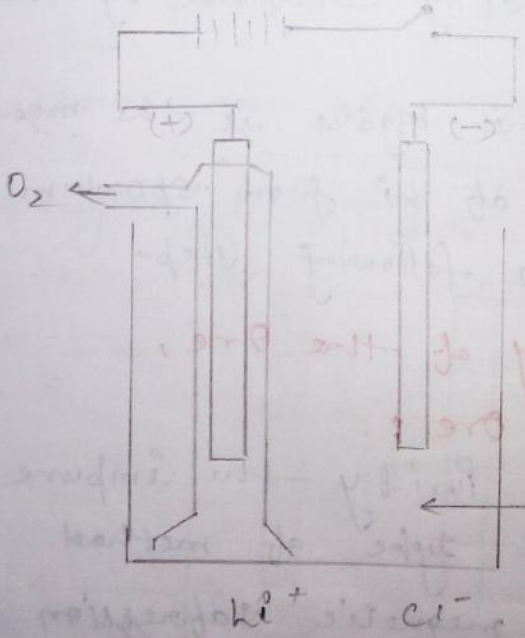
$$Li_2SO_4 + Na_2CO_3 \longrightarrow Li_2CO_3 \downarrow + \underbrace{Na_2SO_4}_{\text{Solution}}$$

a cesses

Conversion of Li_2CO_3 in $LiCl$ ⇒

$$Li_2CO_3 + 2HCl \longrightarrow LiCl \downarrow + H_2O + CO_2 \uparrow$$

Conversion of LiCl into Li ⇒



Anode

$Cl^- \longrightarrow Cl + e$

$Cl + Cl \rightarrow Cl_2 \uparrow$

Cathode:-

$Li^+ + e \longrightarrow Li$

Metterology of Beryllium :- (Be)

Be does not occure in the free state in nature the most important ore of Be. are

* $2BeO \cdot SiO_2$ ~~chirys~~ Beryl Phenocite
* $BeO \cdot Al_2O_3$ chirys Beryl
* $3BeO \cdot Al_2O_3 \cdot 6SiO_2$) Beryl

* Extraction of Be with Beryl →

i) mining of the crushing of the ore.

ii) dreshing of the ore

iii) Leaching of the ore.

$$3BeO \cdot Al_2O_3 \cdot 6SiO_2 + K_2CO_3 \longrightarrow BeO + Al_2O_3 + K_2SiO_3 + CO_2\uparrow$$

Impure.

$$BeO + Al_2O_3 + K_2SiO_3 + H_2SO_4 \longrightarrow BeSO_4 + Al_2(SO_4)_3 + K_2SO_4 + H_2O + SiO_2\downarrow$$

Solution

$$BeSO_4 + Al_2(SO_4)_3 + K_2SO_4 + H_2O \xrightarrow{\text{Crystilyzation}}$$

$$BeSO_4 + K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$$

soln (Alum) ~~फिटकरी~~

⇒ Calsination of $BeCO_3$:-

$$BeCO_3 \xrightarrow{\Delta} BeO + CO_2\uparrow$$

⇒ Conversion of BeO into Be :-

$$BeO + C \longrightarrow Be + CO\uparrow$$

Uses of Li and Be ⇒

Use of Li :-

i) for making alloy

ii) for making glass

iii) Use in medision

iv) for making high quality of lubricents :.

v) Use in Roket fuel.

Use of Be

i) Use for making Steal

ii) Use for making window for x-Ray

iii) Be is use as a modirator in neuclear Reactor.

iv) it is use for making artiphicial fiver.

v) it is use for making split ring in genrator and motor.