

# Unit - 2

# Inorganic

# Chemistry?

## Chapter - 7

## Metallurgy :-

Metallurgy is the art of extracting metal from their ore profitably.

### minerals

minerals are the naturally occurring compounds of metal found in the earth's crust.

### Ore

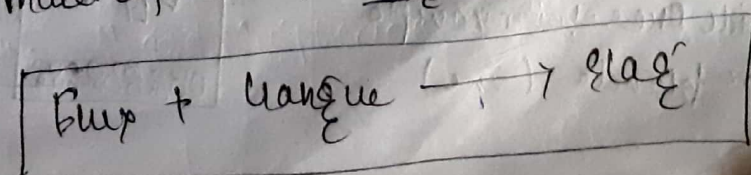
The minerals from which metal can be extracted conveniently and profitably.

### Gangue :-

The impurities present in the mineral are called gangue. For example - Silica ( $SiO_2$ )

### Flux and Slag :-

Flux is the substance which when mixed with the ore combines with the gangue to form easily fusible material called slag.



• Steps of Metallurgy :-

- (i). Ore dressing
- (ii). Concentration of the Ore.
- (iii). Oxidation
- (iv). Reduction of Ore to metal
- (v). Refining of the metal

• Ore dressing :-

most of the ores are found in the form of large lumps. These are then broken into smaller pieces in the crusher and then converted into fine powder with the help of stamp mill.

• Concentration of the Ore :-

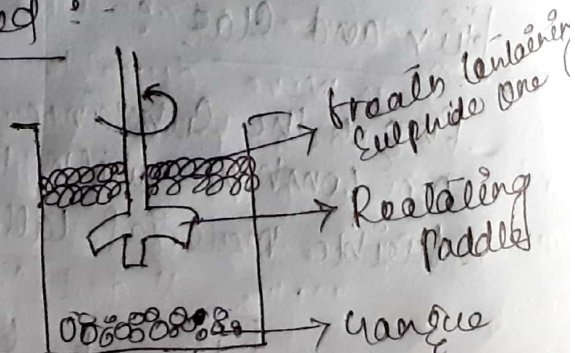
The main objective of this step is to remove maximum gangue particles from the Ore. It can be done by any of the following methods :-

(a) Gravity Separation / Hydraulic washing :-

In this method, the crushed ore is sprayed on long tables. The tables are given rocking motion and a stream of water is passed over them. The gangue being lighter is washed away and the heavier ore particles are left behind.

(b) Froth Flotation method :-

(i) This method is generally used for concentration of sulphide ores. For example -  
Zinc blende ( $ZnS$ )



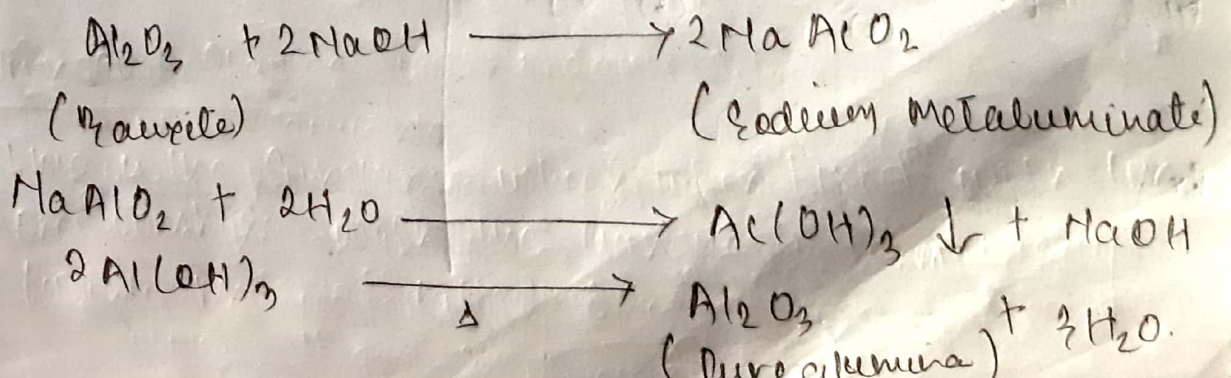
- (ii) This method is based on preferential wetting properties of the ore by oil.
- (iii) The powdered ore is taken in a tank containing water and oil is added to it.
- (iv) It is then rapidly agitated using rotating paddle which produces froth.
- (v) The sulphide ore sticks to the froth and rises to the surface.
- (vi) The froth containing sulphide ore is skimmed off and collected in another container and the gangue particles are left behind in the tank.
- (vii) After some time the froth settles down and concentrated sulphide ore is obtained.

17. ~~Flotation~~

(a) Leaching :-

- (i) It is a chemical method for concentration of ore.
- (ii) In this method, the powdered ore is treated with a suitable reagent which dissolves the ore and not the impurities.
- (iii) The ore is then recovered from the solution by suitable chemical method.

(iv) For example - Concentration of Bauxite



## (d). Magnetic Separation :-

(i). This method is used for the concentration of the ore which differs from their impurities in magnetic character.

(ii). Here, the powdered ore is dropped over a belt revolving over two rollers out of which one is magnet.

(iii). The magnetic part of the ore is attracted by the magnet and the non-magnetic part gets deposited away from the magnetic impurities.

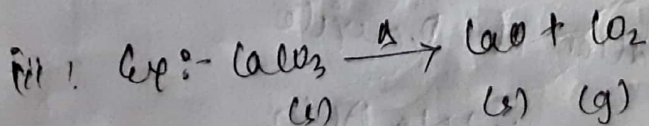
## • Oxidation :- (Imp.)

In this step, the concentrated ore is converted into its oxide.

### Calcination

(i). In this method, the concentrated ore is heated in the absence of air or in the limited supply of air.

(ii). It is applied for carbonate ores.

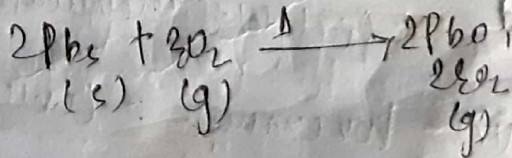


(iv).

### Roasting

In this method, the concentrated ore is heated in the presence of air.

It is applied for sulphide ores.



## • Reduction of metal oxide into metal :-

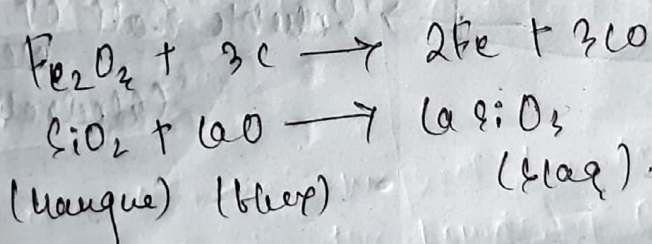
### (i) Smelting :-

(i) In this method, the metal oxide is mixed with ~~sub~~ suitable quantity of coke or charcoal which act as a reducing agent.

(ii) The mixture is then heated to a high temperature above its melting point.

(iii) During this process, another substance is added to the ore which react with the impurities (gangue) still present in the ore to form a fusible product.

(iv) This additional <sup>substance</sup> ~~substance~~ is called flux and the fusible product is called slag. Slag is usually lighter and ~~floats~~ <sup>floats</sup> on the ~~metal~~ molten metal and can be easily removed.



## • Refining of the metal :-

### (a) Distillation :-

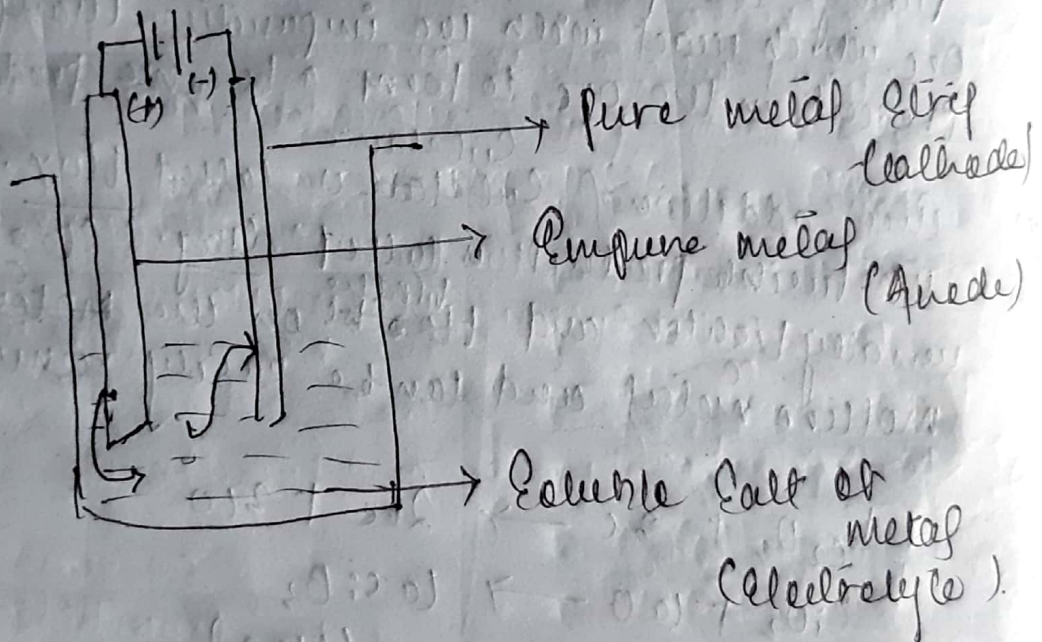
(i) It is applied for the volatile metal like mercury, lead etc containing non-volatile impurities.

(ii) In this method, the metals are heated beyond their melting point so that they volatilized and the impurities are left behind in the retort.

(iii) The vapour of the metal are collected and condensed to get the pure metal.

## (b). Electrorefining :-

- (i) In this method, the impure metal is made anode and a thin strip of pure metal is taken as cathode.
- (ii) A soluble salt of the same metal is taken as electrolyte.
- (iii) When the circuit is closed the pure metal from the electrolyte gets deposited in the cathode and an equivalent amount of the metal from the anode goes into the solution.

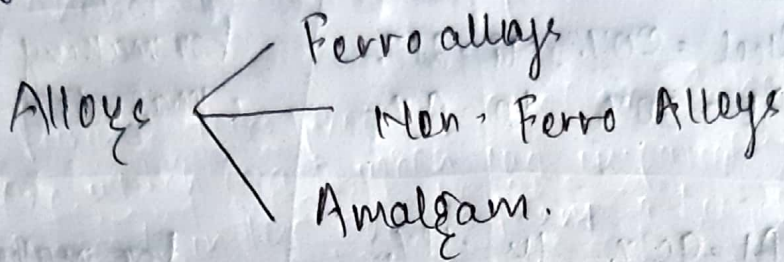


# Chapter - 8

# Alloys

→ An alloy is a homogeneous mixture of two or more metals or metals and non-metals.

• Types of Alloys :-



(i) Ferro alloys :-

These are the alloys which contain iron as one of the constituents. For example :- Steel (It is composed of iron, chromium, Nickel and Carbon).

(ii) Non-Ferro alloys :-

These are the alloys which do not contain iron as one of the constituents. For example - Brass (It is composed of Cu and Zn).

(iii) Amalgam :-

The alloys which contain mercury is called Amalgam of that metal. For example - Sodium Amalgam contains Sodium and Mercury.

| Alloys    | Composition                                | Uses                                      |
|-----------|--|---|
| Brass     | Cu = 60% - 80%<br>Zn = 40% - 20%           | Utensils, Condensers,<br>Catridges, Tubes |
| Bronce    | Cu = 70% - 90%<br>Sn = 20% - 10%           | Utensils, Coils,<br>Statues               |
| Alnico    | Steel = 50%, Ni = 21%<br>Al = 20%, Co = 9% | For making permanent<br>magnets           |
| Duralumin | Al = 95%, Cu = 4%<br>Mn = 0.5%, Mg = 0.5%  | For making<br>air ships                   |