

Chapter 11

Principles of Metallurgy

Few important processes during metallurgy:

Smelting:

Smelting is a pyrochemical process in which ore is mixed with fuel, flux and heated strongly in a furnace.

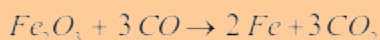
- Due to strong heating, ore is reduced and metal is obtained in its molten form.
- Fuel is used for reduction and flux is used for removal of gangue particles. Flux combines with gangue to form slag.



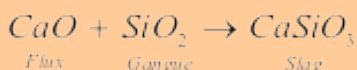
Ex.

Extraction of iron is done from hematite ore, an oxide of iron (Fe_2O_3). Ore is mixed with coke (Used as fuel) and limestone (Used as flux).

- Coke is oxidised to carbon monoxide, which in turn reduces iron oxide to give crude iron metal.



- Limestone added dissociates to give quicklime (CaO). Calcium oxide combines with gangue particles to form calcium silicate slag.



Calcination & Roasting:

Both are pyrochemical process in which ore is heated strongly. Calcination is carried out in the absence or little supply of air. Whereas roasting is carried out in presence of air. Both are used for conversion of other than oxide ores into their oxides.

Flux:

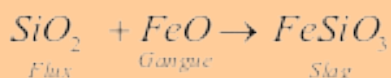
Flux is a chemical, which is added to the ore to remove gangue particles. Flux can be of different types, like acidic flux, basic flux.

- Acidic flux can be used for the removal of basic gangue particles. Similarly, basic flux is used for removal of acidic gangue particles.

Ex. During extraction of iron, silicon dioxide is gangue, which is acidic. To remove this, we use basic flux calcium oxide.



Similarly, during extraction of aluminium, impurity is Iron oxide (FeO). To remove basic gangue, Silicon dioxide (SiO₂) is used as acidic flux.



Furnace:

A place, which is used for pyrochemical processes for reduction ore. Furnaces can be of different types like, blast furnace, reverberatory furnace, retort furnace etc.

- Each furnace contains hearth, chimney and firebox.

- Hearth is a place inside furnace, where ore is kept for heating.
- Chimney is outlet of furnace, where flue gases can go of furnace.
- Firebox is a place where fuel is kept for heating.
- In blast furnace, firebox and hearth are combined. Whereas in reverberatory furnace, they are separated by a partition. But in retort furnace, there is no contact between hearth and firebox.

