

Chapter 11

Principles of Metallurgy

Extraction of moderately reactive metals:

- Moderately reactive metals are available in the form of their oxides, sulphides, carbonates, hydroxides etc.
- Oxide ores can be reduced as such but other ores must be converted into their oxides either by calcination or roasting.

Calcination:

The pyrochemical process in which ore is heated at very high temperatures below its melting point in the absence or limited supply of air.

- Carbonates, hydroxides and other ores get dissociated and converted into their oxides.

Ex. Zinc carbonate (ZnCO_3) or Iron carbonate (FeCO_3) can be calcinated and converted into their oxides.

Roasting:

The pyrochemical process in which ore is heated to high temperatures below its melting point in the presence of excess of air.

- Sulphide ores will be converted into crude metal by reduction using suitable reducing agents like carbon, carbon monoxide or auto reduction (or) more reactive metals.

Reduction using carbon:

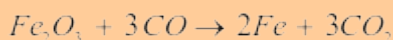
The oxide of the metal is heated with coke or carbon monoxide. The oxide gets converted into metal.

Ex. Reduction of Zinc oxide or lead oxide can be done by using coke as reducing agent.



- Carbon monoxide can also be used as reducing agent.

Ex. CO is used for reduction of iron oxide into iron.



Auto reduction (or) Self-reduction:

This is generally practiced for sulphides ores.

Ex. Copper pyrite ($CuFeS_2$) is converted into its oxide by roasting. The copper oxide produced combines with copper sulphides and undergoes self-reduction to give crude copper.



For reduction of few metals more reactive metals can be used. Because more reactive displace less reactive metals from its compounds. The process is highly exothermic metal produced is available in molten state.

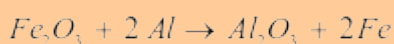
Ex.

Thermite process:

This is the process of reduction of moderately reactive metal by using aluminium as reducing agent.

Thermite process is used for the reduction of iron.

Iron oxide is heated with aluminium and iron oxide gets reduced to iron.



The reaction is highly exothermic iron metal is available in its molten form. This molten iron is used in repairing or joining the railway tracks (or) in repairing worn out parts of machinery etc.

Thermite process can also be used for reduction of chromium.

