

- Bauxite $AlOx(OH)_{3-2x}$ where $0 < x < 1$
- Kaolinite $[Al_2(OH)_4 Si_2 O_5]$
- Haematite Fe_2O_3
- Magnetite Fe_3O_4
- Siderite $FeCO_3$
- Copper pyrites $CuFeS_2$
- Malachite $CuCO_3 \cdot Cu(OH)_2$
- Cuprite Cu_2O
- Copper glance Cu_2S
- Zinc blende ZnS
- Calamine $ZnCO_3$
- Zincite ZnO

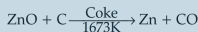
Ores: Minerals from which metal can be extracted chiefly, profitably and easily

Minerals naturally occurring chemical substances in the earth's crust obtainable by mining

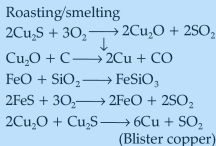
General Principles And Processes Of Isolation Of Elements

Oxidation Reduction
 (extraction of Cl from brine)

Extraction of zink from zink oxide

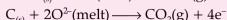
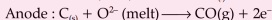
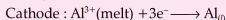


Extraction of copper from cuprous oxide



Fused matrix is electrolysed

Electrolysis (Hall-Heroult process)



Fused matrix is electrolysed

Purified Al_2O_3 mixed with Na_3AlF_6 / CaF_2

Metallurgy of aluminum

Electrochemical principle of metallurgy

Electrolysis: Difference of two E° values equals +ve E° and -ve ΔG° , less reactive metal will come out of solution and more reactive to the solution.

• Plots of $\Delta_r G^\circ$ vs T for reaction.

• Straight line except with some change in phase

• Point in a curve below which ΔG is -ve.

• If ΔG is negative, reaction proceeds.

• If reactions and products of two reactions are put together in a system and net ΔG of the two possible reactions is -ve, the overall reaction will occur

Ellingham diagram

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G^\circ = -RT \ln K$$

Thermodynamic principle of metallurgy

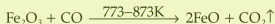
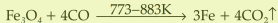
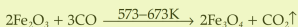
Extraction of Iron from oxide

→ In blast furnace

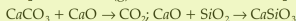


→ Reduction

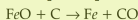
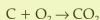
(a) At 500–883 K



(b) At 900–1500K



(c) At 1500–2100 K



Refining

Distillation: Impure metal is evaporated to obtain pure metal as distillate.

Liquation: Low melting metals made to flow on a sloping surface.

Electrolytic refining: Impure metal anode, strip of same metal in pure form—cathode dipped in soluble salt of same metal.

Zone refining: Based on principle that impurities are more soluble in melt than in solid state of metal.

Vapour phase refining: Metal is converted into its volatile compound and collected elsewhere.

Chromatography: Based on principle that different components of a mixture are differentially adsorbed on an adsorbent.

Reduction of Oxide to metal:

Heating metal oxide with substances acting as a reducing agent which combines with the oxygen to get reduced easily.

Conversion to Oxide

Calcination

Heating when the volatile matter escapes leaving behind the metal oxide.

Roasting

Ore is heated in a limited supply of air in a furnace at a temperature below the melting point of the metal.

General Principles And Processes Of Isolation Of Elements

Extraction of crude metal from concentrated ore

Uses

- Fe**
- Cast iron for casting stoves, railway sleepers, gutter pipes, toys etc.
 - Manufacture of wrought iron and steel.

Cu

- Wires
- Water and steam pipes
- Alloys

Zn

- Galvanising iron
- In batteries
- Dust is used as reducing agent

Al

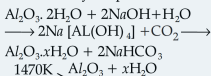
- As wrappers for chocolates
- Fine dust in paints and lacquers
- Extraction of Cr and Mn
- Wires

Metallurgy: Entire scientific and technological process used for isolation of the metal from its ores

- Concentration of ore
- Isolation of metal
- Purification of metal

Leaching: Based on the solubility of ore suitable solvent

Bayer's process :



Hydraulic washing: Based on difference in gravities of the ore and gangue particles

Upward stream of running water is used to wash the powdered ore. Lighter gangue particles are washed away and heavier are left behind.

Concentration of Ores

Magnetic Separation: Based on differences in magnetic properties of ore components

Finely ground ore is carried on conveyor belt which passes over a magnetic roller. Magnetic particles fall nearer to roller and vice versa

Froth floatation process: Based on the difference in wetting properties of gangue and ore particles

Powdered ore is mixed with pine oil and water and agitated with air froth formed carries minerals is skimmed off and dried.