Magnesium :

Minerals of Magnesium :

Magnesite - $MgCO_3$

Dolomite - $MgCO_3.CaCO_3$

Epsom salt - $MgSO_4.7H_2O$

Carnallite - $KCl.MgCl_2.6H_2O$

Asbestos - $CaMg(SiO_3)_4$

Kieserite - $MgSO_4.H_2O$

Kainite - $K_2SO_4.MgSO_4.MgCl_2.6H_2O$

Brucite - $Mg(OH)_2$

- Mg is present in sea water in the form of $MgCl_2$.
  Mg is also found in chlorophyll, in animal blood.

Extraction of Mg from Magnesite :

1) When magnesite ore is calcinated at 450^0c, MgO is formed. $MgCO_3 \rightarrow MgO + CO_2\downarrow$
2) Magnesia (MgO) is mixed with small amounts of molten MgF_2, NaF, BaF_2 to increase conductivity.

- Electrolysis is carried out at $900 - 950^0$ C in Iron tank.
- Cast iron rods are cathodes and carbon rods are anodes.
- Mg is collected at the top.
- Oxidation of Mg is prevented by electrolyte scum.

3) Mg can be obtained by the reduction of MgO with Si or Fe Si or CaC_2.

$2MgO + Si \rightarrow 2Mg + SiO_2$

$3MgO + FeSi \rightarrow 3Mg + FeSiO_3$

$3MgO + CaC_2 \rightarrow 3Mg + CaO + 2CO$

4) **Hansging method:** MgO is mixed with coke and heated to above 2000^0C.

$MgO + C \xrightarrow{2000^0 C} Mg + CO$

5) **From sea water:**

- Sea water contains $MgCl_2$ and $MgSO_4$ in dissolved state.
- Sea water is first treated with milk of lime to give $Mg(OH)_2$.

$MgCl_2 + Ca(OH)_2 \rightarrow Mg(OH)_2\downarrow + CaCl_2$

$MgSO_4 + Ca(OH)_2 \rightarrow Mg(OH)_2 + CaSO_4$

- $Mg(OH)_2$ when is heated with HCl gives $MgCl_2$ and without HCl gives MgO.

$Mg(OH)_2 \xrightarrow{\Delta} MgO + H_2O$

$Mg(OH)_2 + 2HCl \rightarrow MgCl_2 + 2H_2O$

MgO or $MgCl_2$ obtained above is electrolysed to give Mg.

6) **From carnallite :**

- Carnallite is heated to give $MgCl_2.2H_2O$

$KCl.MgCl_2.6H_2O \rightarrow KCl + MgCl_2.2H_2O + 4H_2O\uparrow$

- Other two water molecules are removed by heating it in dry HCl. at 350^0 C.

- If $MgCl_2.2H_2O$ is heated strongly, with out HCl, it undergoes hydrolysis instead of dehydration.

  $MgCl_2 + H_2O \rightarrow Mg(OH)Cl + HCl$
- The compounds formed during hydrolysis will act as insulators. Anhydrous $MgCl_2$ is mixed with small amounts of KCl or NaCl to prevent any chance of hydrolysis and to increases conductivity.
- Molten $MgCl_2$ is electrolysed to give Mg at cathode and Cl_2 at anode.
- Iron cell itself acts as cathode.
- Anode is graphite rod coated with lead.
- Anode is surrounded by poracelain hood to prevent the mixing of products.
- Initially air in the cell is replaced by H_2 or coal gas.
- 99.9% pure Mg is formed and it floats over the electrolyte.
- Temperature is maintained at 700^0C to keep the electrolyte in molten state.

Physical properties of Mg:

It is light metal. It is soft, silvery white metal.

It is malleable and ductile.

Chemical properties of Mg:

i) Mg does not react with dry air.

ii) Mg tarnishes in moist air, a thin layer of MgO or $MgCO_3$ is formed.

iii) Mg burns in air with dazzling white light to form MgO and Mg_3N_2.

iv) Mg reacts with steam (or) boiling water to form MgO and H_2, but does not react with cold water.

v) Mg reacts with dil. or conc. HCl to liberate H_2.

vi) Mg reacts with dil H_2SO_4. liberating H_2 gas.

vii) Mg reacts with very dilute nitric acid forming $Mg(NO_3)_2$ and NH_4NO_3.

viii) Mg reacts with conc. HNO_3 giving NO_2 gas.

ix) Mg reacts with conc. H_2SO_4 giving SO_2 gas.

x) Mg displaces less electro positive metals (Ag, Pb, Hg etc.) from their salt solutions.

xi) Mg is a strong reducing agent, it reduces the oxides of metals and non metals.

$3Mg + B_2O_3 \rightarrow 3MgO + 2B$

xii) Mg reacts with alkyl halide in presence of ether to form alkyl magnesium halides.

$Mg + RX \rightarrow R - Mg - X$ (Grignard reagent)

Magnesium is used :

i) To remove N_2 from air.
ii) As reducing agent in the extraction of B & Si.
iii) As a source of flash light in photography.
iv) As fuse wire in alumino thermit process.
v) To remove the last traces of O_2 in radiotubes.
vi) As deoxidiser in metallurgy.
vii) In the preparation of Grignard reagent.

Alloys of Mg :

i) Magnalium : 1 – 15% Mg and 85 – 99% A1. It is used in the preparation of aero plane parts, motor parts, balance beams, etc.
ii) Electron – 95% Mg and 5% Zn. It is used in the manufacture of aero plane parts.