Magnesium is the sixth most abundant element in the earth’s crust.

The main sources of magnesium compounds are:

- Seawater (magnesium chloride, MgCl$_2$) and minerals:
  - Dolomite (CaCO$_3$•MgCO$_3$), contain 13%.
  - Magnesite (MgCO$_3$), contain 29%.
  - Brucite Mg(OH)$_2$, contain 42%.

There are two principal magnesium extraction processes: silicothermic process and electrolytic process.

I. Silicothermic process (Pidgeon process)

The process involves reducing molten magnesium oxide slag by ferrosilicon under low gas pressure at a temperature of about 1400$^\circ$C.

The metallic magnesium, formed in the process, evaporates and then condensates away from the hot region.

The condensed magnesium, having purity of 99.95% is then remelt and cast.

The Three Steps of the Pidgeon Process

1. **Calcination of Dolomite**, at 1300$^\circ$C, Highly Endothermic Reaction, CO$_2$ Released both from the reaction, and from Fuel Burned for Process Heat.

   \[
   \text{CaMg(CO}_3\text{)}_2 \rightarrow \text{CaO + MgO + 2CO}_2
   \]

2. **Ferrosilicon Alloy Production**, the Ferrosilicon Alloy Production by Electric Arc through Mixture of Hematite, Quartz Sand, and Coal. Extremely Endothermic Reaction; Emits Toxic CO.
\[
\text{Fe}_2\text{O}_3 + 4\text{SiO}_2 + 11\text{C} \rightarrow 2(\text{Fe})\text{Si}_2 + 11\text{CO}
\]

3. **Silicothermic Reduction of MgO by Ferrosilicon**, at \(~1400^\circ\text{C}\) under Vacuum for 8-10 hrs. Highly Endothermic Reaction, the ratio of feed are 6 calcine dolomite: 1 ferrosilicon as briquettes.

\[
2\text{MgO} + 2\text{CaO} + (\text{Fe})\text{Si} \rightarrow 2\text{Mg}(g) + \text{Ca}_2\text{SiO}_4(s) + \text{Fe}
\]

### II. Dow Process (Electrolysis)

The Dow Process is generally applied for extraction of Magnesium from Sea water. In this process first we add lime for thickening then mix with 10% HCl.

The electrolytic cell consists of a brick-lined vessel, divided into anode and cathode compartments by a semi-wall. Air- or water-cooled Graphite plate anode and steel cathode are submerged in electrolyte composed of
alkaline chlorides with addition of magnesium chloride. The operating temperature is 680°C to 750°C. Magnesium chloride decomposes in the electrolytic cell according to the reaction:

\[ \text{MgCl}_2 \rightarrow \text{Mg} + \text{Cl}_2 (g) \]

Metallic magnesium is formed at the cathode. It floats up (it is lighter than electrolyte) collecting in the cathode compartment. Chlorine, which is by-product of the process, is collected in the anode compartment.

In this method CaCl2 and NaCl are added to anhydrous MgCl2 to decrease its melting point.