Calcium hydroxide, Ca(OH)₂, forms colorless crystals (resulting in white powder) and is obtained by mixing calcium oxide with water (calcium hydroxide is also called slaked lime). Calcium hydroxide is produced commercially in enormous quantities by thermal decomposition of limestone and subsequent exothermic reaction of the calcium oxide with water:

\[
\begin{align*}
\text{CaCO}_3 & \rightarrow \\
\text{CaO} + \text{CO}_2 & + 65.2 \text{ kJ} \\
\text{CaO} + \text{H}_2\text{O} & \\
\text{Ca(OH)}_2 & 
\end{align*}
\]

The exothermic reaction with water yields enough energy to evaporate the water.

In the laboratory calcium hydroxide can be prepared by mixing aqueous solutions of calcium chloride and sodium hydroxide:

\[
\begin{align*}
\text{CaCl}_2 + 2 \text{NaOH} & \rightarrow \\
\text{Ca(OH)}_2 + 2 \text{NaCl} & 
\end{align*}
\]

When heating calcium hydroxide to 512 °C the calcium hydroxide decomposes into calcium oxide and water:

\[
\begin{align*}
\text{Ca(OH)}_2 & \rightarrow \\
\text{CaO} + \text{H}_2\text{O} & 
\end{align*}
\]

Ca(OH)₂ is only slightly soluble in water (0.16g Ca(OH)₂/100g water at 20°C) forming a basic solution called lime water. The solubility decreases with increasing temperature. The suspension of calcium hydroxide particles in water is called milk of lime.

Lime water turns milky in the presence of carbon dioxide due to formation of calcium carbonate:

\[
\begin{align*}
\text{Ca(OH)}_2 + \text{CO}_2 & \rightarrow \\
\text{CaCO}_3 + \text{H}_2\text{O} & 
\end{align*}
\]

Usage

Calcium hydroxide is used in the construction industry as part of mortar, since its reaction with carbon dioxide of the air binds the particles of sand and gravel by forming calcium carbonate. Another major applications are the usage of calcium hydroxide as a flocculant in water and sewage treatment, and the recovery of sodium hydroxide in the paper industry.

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