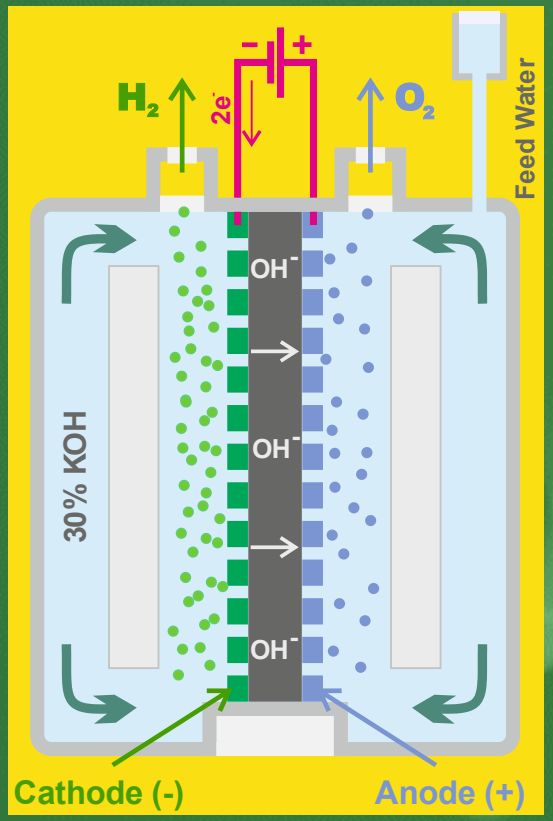
LOW-TEMPERATURE WATER ELECTROLYSIS

Low-temperature water electrolysis operates at temperatures slightly above ambient. It has been developed through several methods, the most important being **alkaline electrolysis**, which has long since reached the industrial scale. Today, it accounts for **5–10%** of global hydrogen production.

The principle of decomposition is illustrated using a schematic representation of an alkaline electrolyzer. Its main components—aside from the vessel itself—include the **electrodes** (cathode and anode), typically made of nickel mesh; an **ion-permeable membrane** that is impermeable to gases and liquids; the **electrolyte** (usually a 30% aqueous solution of potassium hydroxide, KOH) that surrounds all internal components; and the **electrical power supply**.

The electrochemical processes in the electrolyzer are enabled by the spontaneous dissociation of KOH in water. This provides the necessary ions for charge transport and supports the reactions at the electrodes that produce hydrogen and oxygen.

SCHEMATIC



Dissociation of KOH:

$2KOH = 2K^+ + 2OH^-$

Anodic process:

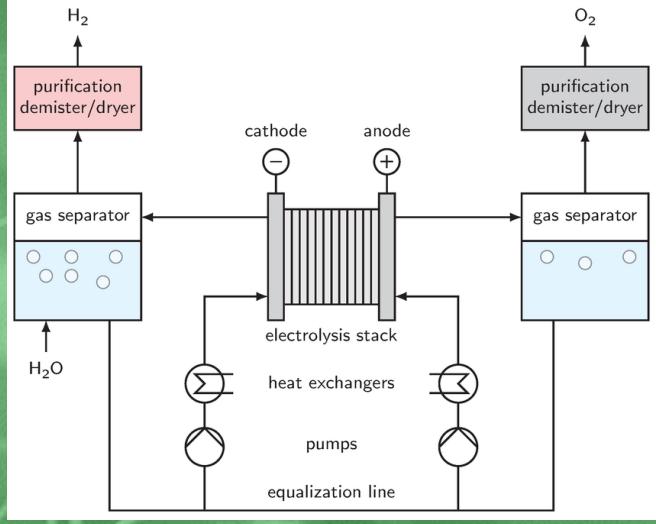
$2OH^- \rightarrow \frac{1}{2}O_2\uparrow + H_2O + 2e^-$

Cathodic process:

$2K^+ + 2e^- \rightarrow 2K$

$2K + 2H_2O \rightarrow H_2\uparrow + 2KOH$

$$H_2O \rightleftarrows H_2\uparrow + \frac{1}{2}O_2\uparrow$$



A schematic flow-diagram of an industrial alkaline water electrolyzer.

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