ELECTROLYSIS

Fuel Cell Today – Education Kit 6

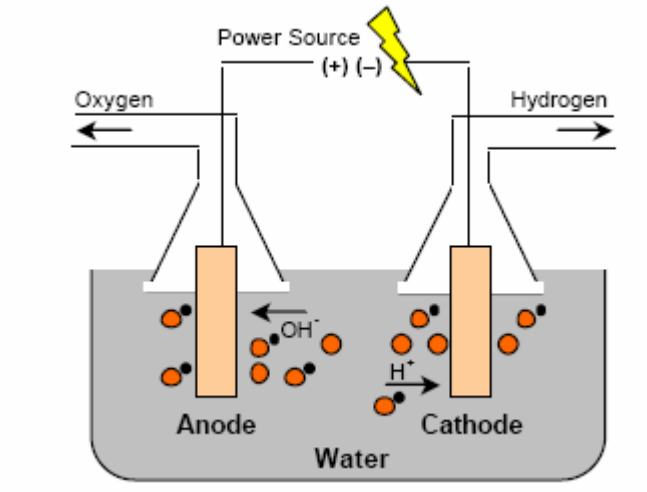
The vast majority of today's hydrogen is generated by steam reforming (see Education Kit: Fuel Reforming). However, this method is still based on the grounds of using non-sustainable, conventional natural resources (natural gas in this case). One way to produce hydrogen sustainably is the electrolysis of water using any renewable energy that produces electricity (such as solar, wind, tidal, etc.).

In principal, electrolysis is the reverse reaction of a fuel cell; electricity is added to split water into its constituent elements resulting in the production of hydrogen and oxygen (H2O à H2 + 0.5 02). However, these processes are more expensive than reforming technologies so far.

Electrolyser technology is well developed and there are a large number of different electrolysers on the market. Two of these seem to be most promising, although working on the same principle:

· **Liquid Alkaline Electrolysers** are the preferred unit for large-scale producers due to the fact that the technology is easily scaled up.

· **Proton Exchange Membrane Electrolysers** are considered to be the long-term option, currently they are ideal for small to medium scale applications, such as vehicle refuelling or smaller applications, where a unit might be used to generate hydrogen using renewable energy such as solar.



Apart from the established way of producing hydrogen through electrolysis, there are others to generate hydrogen, although most of these technologies are more or less in a research stage. The most promising electrolysis methods are:

· **Hydrogen Bromide Electrolysis** is splitting hydrogen bromide into hydrogen and bromine which can be used as a dye or pesticide. (2HBr à H2 + Br2)

· **Steam Electrolysis** adds some of the energy needed to split the water as heat instead of electricity, making the process more efficient than conventional electrolysis.

· **Photoelectrolysis** splits water directly into hydrogen and oxygen using sunlight, without the conversion from sunlight to electricity.

Other, non-electrolysis but sustainable and promising ways of producing hydrogen include:

· **Biological and Photo-Biological Processes** use algae and bacteria to produce hydrogen. Under certain conditions, algae contain an enzyme (hydrogenase) which catalyses the reduction of protons by electrons to form hydrogen. The process mimics photosynthesis.

· **Thermo-Chemical Processes** convert all sorts of biomass into gases which then can be reformed to hydrogen, similar to the conventional reformer processes (see Education Kit: Fuel Reforming).