ELECTROCHEMISTRY

FUEL CELLS

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It is possible to make batteries in which the reactants are fed continuously to the electrodes. Electrical cells that are designated to convert the free energy from the combustion of fuels such as hydrogen, carbon monoxide or methane directly into electrical energy are called Fuel Cells. One of the most successful fuel cells uses the reaction of hydrogen with oxygen to form water (fig.). This cell has been used for electric power in the Apollo space programmes. The water vapour produced was condensed and added to the drinking water supply for the astronauts.

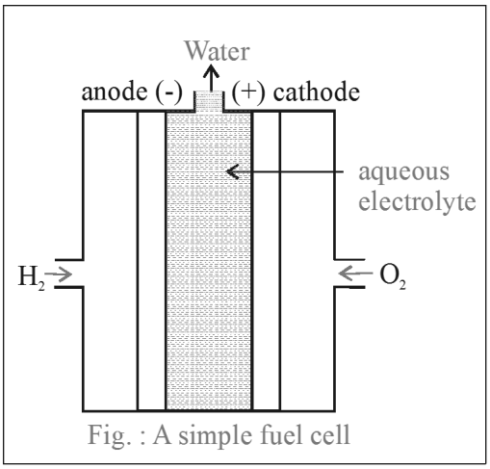

Fig. : A simple fuel cell

In the cell (fig.) hydrogen and oxygen are bubbled through a porous carbon electrode into concentrated aqueous sodium hydroxide. Catalysts are incorporated in the electrode.
The electrode reactions are:

Anode $2[H_2(g) + 2OH^-(aq) \rightarrow 2H_2O(l) + 2e^-]$

Cathode $O_2(g) + 2H_2O(l) + 4e^- \rightarrow 4OH^-(aq)$

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Overall reaction: $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

This cell runs continuously as long as the reactants are supplied.

Advantages of fuel cells over ordinary batteries:

1) High efficiency

The fuel cells convert the energy of a fuel directly into electricity and therefore, they are more efficient than the conventional methods of generating electricity on a large scale by burning hydrogen, carbon fuels. The conventional methods of production of electrical energy involve combustion of a fuel to liberate heat which is then used to produce electricity. The efficiency of these methods is only about 40%.

2) Continuous source of energy

There is no electrode material to be replaced as in ordinary battery. The fuel can be fed continuously to produce power.

(3) Pollution free working

There are no objectionable by-products and, therefore, they do not cause pollution problems.