FUEL CELLS

Definition

Fuel cell is a voltaic cell, which converts the chemical energy of the fuels directly into electricity without combustion**.** It converts the energy of the fuel directly into electricity. In these cells, the reactants, products and electrolytes pass through the cell.

Fuel + Oxygen ––––> Oxidation products + Electricity .

Examples

Hydrogen-oxygen fuel cell; Methyl alcohol-oxygen fuelcell.

Hydrogen-Oxygen fuel cell

Hydrogen-oxygen fuel cell is the simplest and most successful fuel cell, in which the fuel-hydrogen and the oxidiser-oxygen and the liquid electrolyte are continuously passed through the cell.

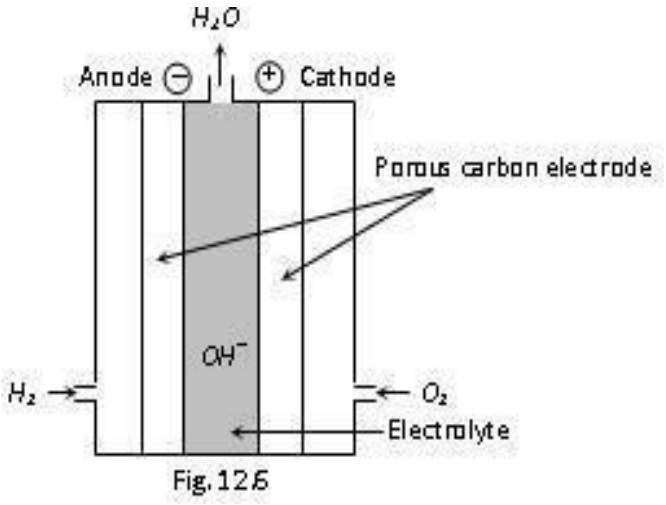

Fig. 12.6

Description

It consists of two porous electrodes anode and cathode.These porous electrodes are made of compressed carbon containing a small amount of catalyst (Pt, Pd, Ag). In between the two electrodes an electrolytic solution such as 25% KOH or NaOH is filled. The two electrodes are connected through the voltmeter.

Working

Hydrogen (the fuel) is bubbled through the anode compartment, where it is oxidised. The oxygen (oxidiser) is bubbled through the cathode compartment, where it is reduced.

At anode

Hydrogen molecules are oxidised at the anode with the liberation of electrons, which then combine with hydroxide ions to form water.

$$H_2 \longrightarrow 2H^+ + 2e^-$$
$$2H^+ + 2OH^- \longrightarrow 2H_2O$$

$$\mathbf{H_2 + 2OH^- \longrightarrow 2H_2O + 2e^-}$$

At cathode

The electrons produced at the anode pass through the external wire to the cathode, where it is absorbed by oxygen and water to produce hydroxide ions.

$$\mathbf{1/2O_2 + H_2O + 2e^- \longrightarrow 2OH^-}$$

Cell reaction

At anode: $H_2 + 2OH^- \longrightarrow 2H_2O + 2e^-$

At cathode: $\mathbf{1/2}O_2 + H_2O + 2e^- \longrightarrow 2OH^-$

Overall cell reaction: $H_2 + 1/2O_2 \longrightarrow H_2O$ (or)

$$2H_2 + O_2 \longrightarrow 2\ H_2O$$

The emf of the cell = 0.8 to 1.0V

Fuel battery

When a large number of fuel cells are connected in series, it form fuel battery.

Applications

1. H_2O_2 fuel cells are used as auxiliary energy source in space vehicles, submarines or other military-vehicles.
2. In case of H_2O_2 fuel cells, the product of water is proved to be a valuable source of fresh water by the astronauts.