



19CH201 - ENGINEERING CHEMISTRY

UNIT-2 - ENERGY STORAGE DEVICES

Fuel Cell

A **fuel cell** is an electrochemical cell that converts the chemical energy of a fuel (often hydrogen) and an oxidizing agent into electricity through a pair of redox reactions. Fuel cells are different from most batteries in requiring a continuous source of fuel and oxygen (usually from air) to sustain the chemical reaction, whereas in a battery the chemical energy usually comes from metals and their ions or oxides^[3] that are commonly already present in the battery, except in flow batteries. Fuel cells can produce electricity continuously for as long as fuel and oxygen are supplied.

There are many types of fuel cells, but they all consist of an anode, a cathode, and an electrolyte that allows ions, often positively charged hydrogen ions (protons), to move between the two sides of the fuel cell. At the anode a catalyst causes the fuel to undergo oxidation reactions that generate ions (often positively charged hydrogen ions) and electrons. The ions move from the anode to the cathode through the electrolyte. At the same time, electrons flow from the anode to the cathode through an external circuit, producing direct current electricity. At the cathode, another catalyst causes ions, electrons, and oxygen to react, forming water and possibly other products.

Definition

Fuel cell is a voltaic cell. It converts chemical energy of the fuels directly into electricity without combustion. In these cells, the reactants and electrolytes are continuously supplied to the cell.

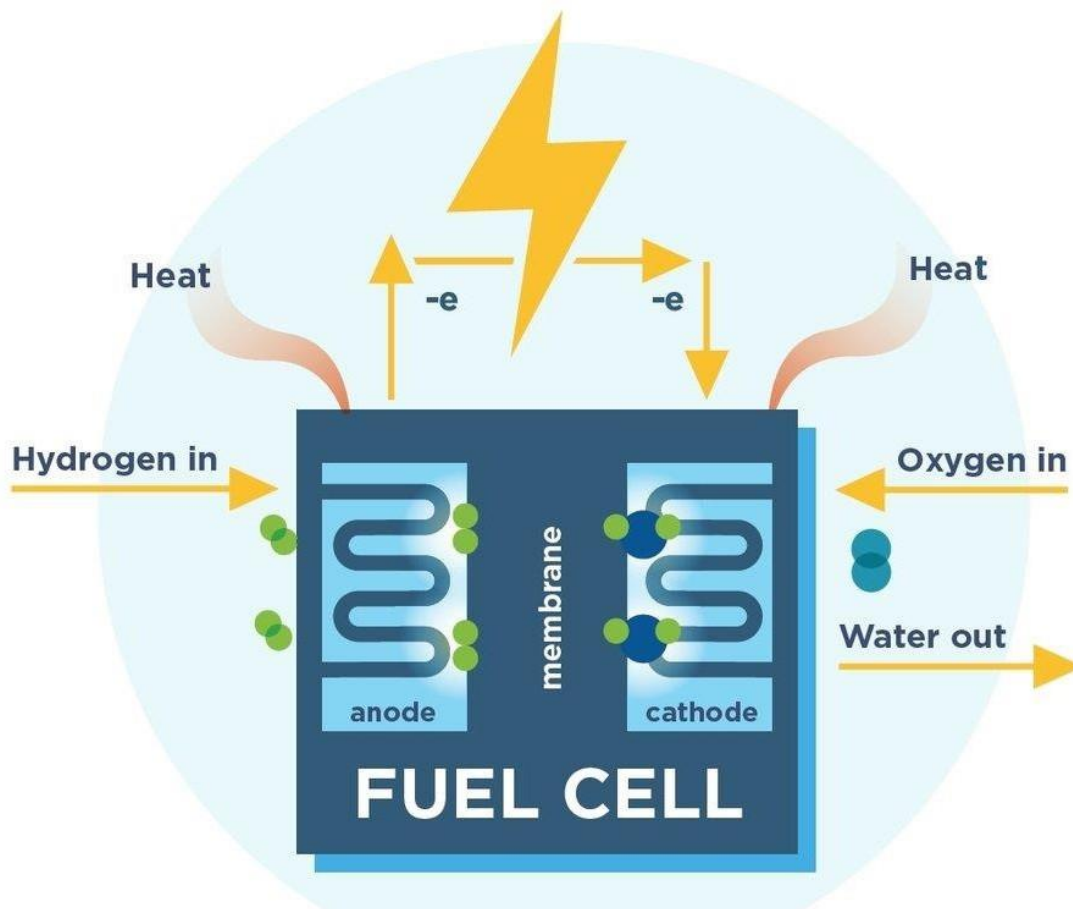




Examples: Hydrogen - oxygen fuel cell.

Hydrogen - oxygen fuel cell

It is the simplest and most successful fuel cell. The fuel-hydrogen and the oxidiser-oxygen and the liquid electrolyte are continuously supplied to the cell.





H₂-O₂ Fuel Cell

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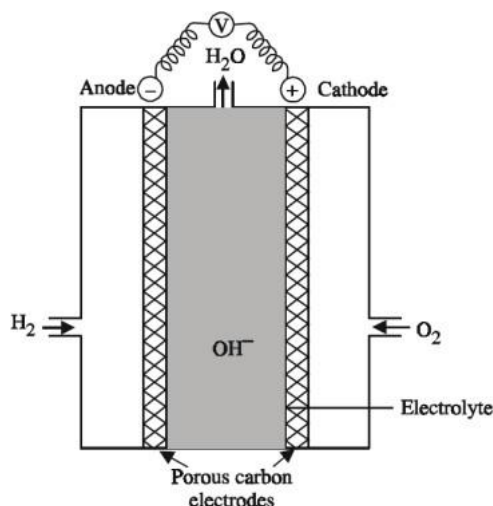
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Description

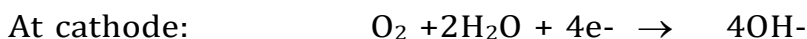
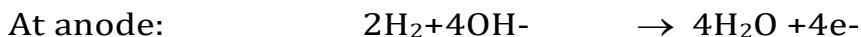
The cell has two porous electrodes, anode and cathode. The electrodes are made of compressed carbon containing a small amount of catalyst (Pt, Pd, Ag). Between the two electrodes an electrolytic solution, 25% KOH is filled.



Working

Hydrogen passes through the anode compartment, where it is oxidized.

Oxygen passes through the cathode compartment, where it is reduced. Cell reactions



.....-Overall cell



Energy

The emf of the cell = 0.8 to 1.0V

Advantages of Fuel Cells

1. They are efficient and instant in operation.
2. They are pollution free.
3. They produce electric current directly from the reaction of a fuel and an oxidizer.
4. They are light in weight

Disadvantages

1. Fuel cells cannot store electric energy.
2. Electrodes are expensive and short lived.
3. H₂ should be pure.

Applications

1. H₂ - O₂ fuel cells are used in space crafts, submarines to get electricity
2. In H₂ - O₂ fuel cell, the product water is a valuable source of fresh water forastronauts

