Types of fuel cells

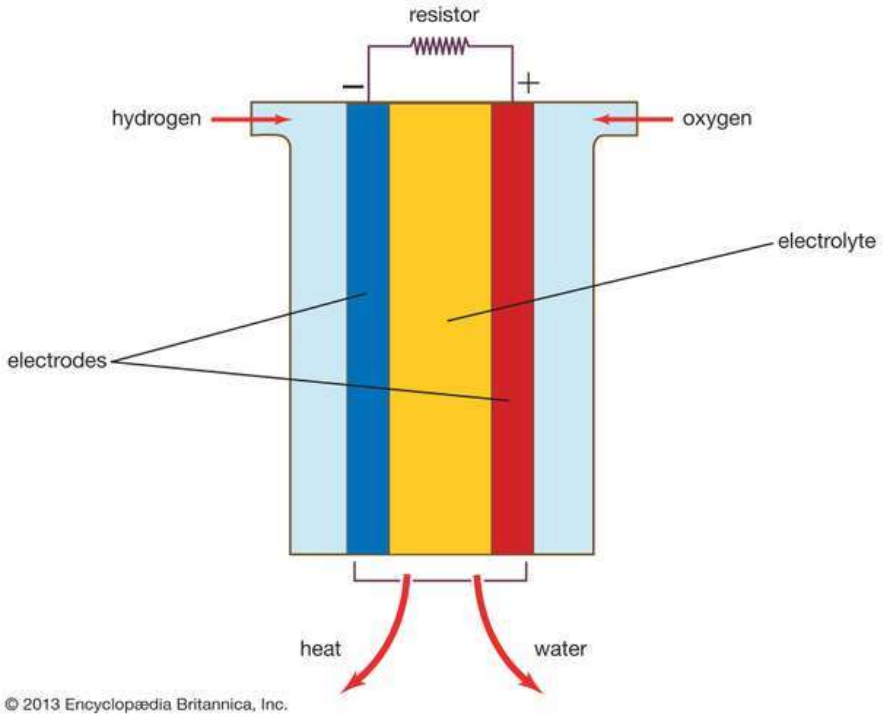
•Fuel cells are made up of three adjacent segments: the anode , the electrolyte and the cathode.

•The electrolyte substance, which usually defines the *type* of fuel cell, and can be made from a number of substances like potassium hydroxide, salt carbonates, and phosphoric acid.

•The fuel that is used. The most common fuel is hydrogen.

•The anode catalyst, usually fine platinum powder, breaks down the fuel into electrons and ions.

•The cathode catalyst, often nickel, converts ions into waste chemicals, with water being the most common type of waste.



Classification of fuel cells

Alkaline fuel cells

These are devices that, by definition, have an aqueous solution of sodium hydroxide or potassium hydroxide as the electrolyte. The fuel is almost always hydrogen gas, with oxygen as the oxidizer.

Zinc or aluminum could be used as an anode if the by-product oxides were efficiently removed and the metal fed continuously as a strip or as a powder. Fuel cells generally operate at less than 100 °C (212 °F) and are constructed of metal and certain plastics. Electrodes are made of carbon and a metal such as nickel.

Phosphoric acid fuel cells

They can use a hydrogen fuel contaminated with carbon dioxide and an oxidizer of air or oxygen. The electrodes consist of catalyzed carbon and are arranged in pairs set back-to-back to create a series generation circuit. The framing structure for this assembly of cells is made of graphite, which markedly raises the cost.

Molten carbonate fuel cells

The fuel consists of a mixture of hydrogen and carbon monoxide generated from water and a fossil fuel. The electrolyte is molten potassium lithium carbonate, which requires an operating temperature of about 650 °C.

Solid oxide fuel cells

Solid oxide fuel cells would be designed for use in central power-generation stations where temperature variation could be controlled efficiently and where fossil fuels would be available.

Solid polymer electrolyte fuel cells

The electrodes are catalyzed carbon, and several construction alignments are feasible.

Working of fuel cells

•Fuel Cell is an electrochemical device that is used to convert an open source fuel into electricity. An electrolytic process has to take place inside a cell in which there is an open source fuel [hydrogen] and an oxidant [oxygen].

•Both the fuel and oxidant reacts in the presence of an electrolyte. Both the fuel and oxidant are introduced into the cell, where they react and the output product is carried out of the cell and stored.

•The electrolyte is left as it is inside the cell. This process can take place non-stop for a long time as long as the flow of resources are maintained.

•The result obtained by combining hydrogen and oxygen is water. As a result of this process, electricity is formed. Although batteries are also electrochemical devices, they are different from a fuel cell. They use reactants from an external source and the chemicals have to be stored inside the battery.

•These chemicals react to each other to produce the electricity. Thus they use closed source fuel. As the device stores the required energy in a chemical form, the battery has to be recharged at intervals or have to be replaced.

Need of Fuel Cells

The main reason for the use of fuel cell is the increasing dependency on the use of fossil fuels. The whole world has burnt so much fossil fuel like oil to such an extent that they have become one of the main reasons for the pollution. This pollution has eventually resulted in the global warming and extreme climate change. Other than the environmental problems, the use of oil has become large enough that the sources of production have become less. As a result more challenging expeditions will have to be made for oil deposits which results in a very high oil price.

Advantages and Limitations of Fuel Cells

Advantages of fuel cells

i) **High efficiency** – Most fuel cells are 60%-80% energy efficient. However, this efficiency can increase to 85%, when these fuel cells are used in a cogeneration system.

ii) **Clean** – Fuel cells work with little to no emissions, the only byproducts being electricity, heat and water. They are thus, much cleaner than traditional power generation, producing 97% less nitrogen oxide emissions than the thermal power plants.

iii) **Scalable** – can be stacked onto one another

iv) **No Noise** – More silent in operation when compared to the conventional sources of power generators. There are no moving parts in a fuel cell stack, making them quieter.

v) **Low Maintenance** – Though the initial cost is higher, fuel cell technology does not involve much maintenance. Fuel cells do not degrade over time, unlike batteries, and can, therefore, provide electricity continuously.

Limitations of fuel cell

- Expensive to manufacture due the high cost of catalysts (platinum)
- Lack of infrastructure to support the distribution of hydrogen
- A lot of the currently available fuel cell technology is in the prototype stage and not yet validated.
- Hydrogen is expensive to produce and not widely available