Fuel Cell - UPSC Science & Technology Notes

A fuel cell is a device which produces electric energy, through a chemical reaction. Science & Technology is one of the subjects included in the civil services examination. Many questions circling around this subject have been asked both in the UPSC Prelims and the Mains exams.

Fuel Cell is an important chemistry concept in Science & Technology, which is a part of the General Studies Paper-3 in the UPSC Syllabus. In this article, one can learn about the types and working of fuel cells. We have also mentioned topics that are related to Fuel Cells for the UPSC 2020 Exam.

What is a Fuel cell?

A fuel cell is a device which produces electric energy, through a chemical reaction.

- Fuel cells use a positively charged ion (Hydrogen) and an oxidising agent (oxygen).
- There are many types of fuel cells, but they all consist of a cathode, an anode, and an electrolyte that allows positively charged (hydrogen) ions to move between the two sides of the fuel cell.
- They differ from batteries as they (fuel cells) require the continuous supply of fuel.
- Both batteries and fuel cells produce direct current (D.C).

Working of a Fuel Cell

The working of this fuel cell involved the passing of hydrogen and oxygen into a concentrated solution of sodium hydroxide via carbon electrodes. The cell reaction can be written as follows:

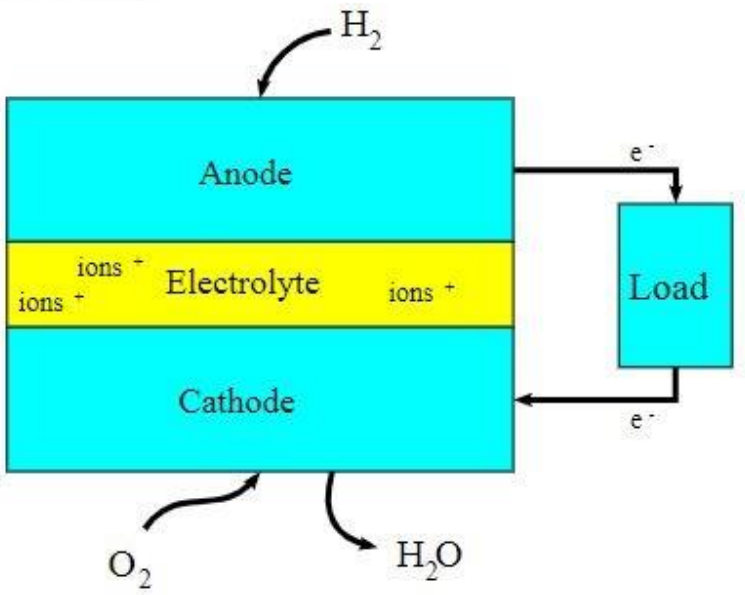
Cathode Reaction: $\mathbf{O_2 + 2H_2O + 4e^- \rightarrow 4OH^-}$

Anode Reaction: $\mathbf{2H_2 + 4OH^- \rightarrow 4H_2O + 4e^-}$

Net Cell Reaction: $\mathbf{2H_2 + O_2 \rightarrow 2H_2O}$

However, the reaction rate of this electrochemical reaction is quite low. This issue is overcome with the help of a catalyst such as platinum or palladium. In order to increase the effective surface area, the catalyst is finely divided before being incorporated into the electrodes.

A block diagram of this fuel cell is provided below.



- The first fuel cell was used by NASA in its satellites and space capsules.
- Fuel cells can be used for power backup in commercial and residential buildings.
- Fuel cells can be arranged in stacks like series and parallel connection depending on the requirement of higher voltage (series) and current (parallel).

National Electric Mobility Mission Plan 2020

The National Electric Mobility Mission Plan (NEMMP) 2020 was launched by the Government of India in 2013 with the objective of achieving national fuel security by promoting electric and hybrid vehicles. The target is to achieve sales of 6 – 7 million in the hybrid and electric vehicles sector from 2020.

The government will provide fiscal and monetary incentives for this industry. The expectation is that crude oil worth Rs.62000 crore will be saved due to this.

FAME and National Electric Mobility Mission Plan

Under the NEMMP, the government has launched the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles, **FAME India Scheme.**

- This scheme had an initial outlay of Rs. 75 crore.
- This scheme is expected to provide a major thrust towards early adoption of electric and hybrid technologies.

Read more about the National Electric Mobility Mission Plan 2020