

ISRO Tests Polymer Electrolyte Membrane Fuel Cell

Source: TH

Why in News?

The <u>Indian Space Research Organisation (ISRO)</u> successfully tested a **100 W class <u>Polymer</u>** <u>Electrolyte Membrane Fuel Cell (PEMFC)</u> **based Power System** aboard the orbital platform, **POEM3.**

What are the Major Takaways from the Recent PEMFC Test?

- Technology Tested: ISRO tested a 100-watt class PEMFC, which converts hydrogen and oxygen into electricity, water, and heat. This technology offers several advantages over traditional power sources in space, including:
 - **High Efficiency:** PEMFCs **convert fuel directly into** <u>electricity</u>, <u>resulting</u> in significantly higher efficiency compared to batteries.
 - **Clean Operation**: PEMFCs **produce only water as a byproduct**, eliminating the need for complex waste management systems.
 - The water produced by the PEMFC can be used for onboard consumption or for electrolysis to generate additional oxygen.
- **Test Platform:** The PEMFC was tested In orbital platform, **POEM3**, launched aboard <u>PSLV-C58</u> on 1st January, 2024.
 - POEM3 serves as a platform for testing new technologies in space under real-world conditions.
- Implications for Future Missions: The successful test of the PEMFC paves the way for several exciting possibilities for future space missions:
 - Powering the Indian Space Station: The high efficiency and water production capabilities of PEMFCs make them ideal for powering the proposed <u>Indian space</u> station.
 - Deep Space Exploration: PEMFCs can provide a reliable and sustainable source of power for long-duration missions to deep space destinations like Mars.

Note

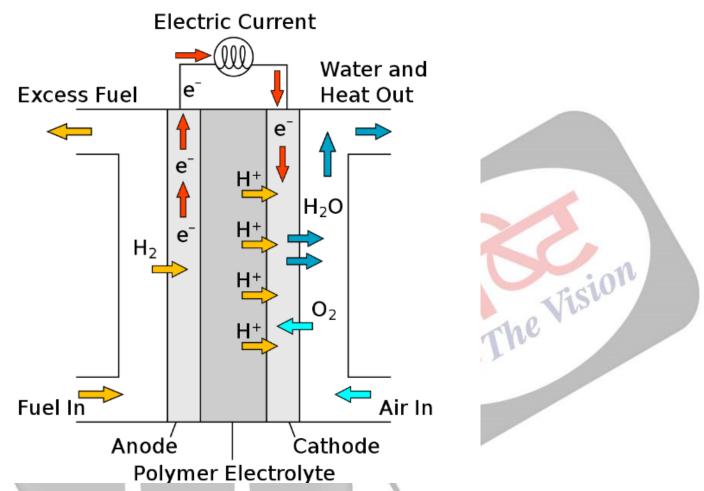
ISRO also noted that it has qualified **10 Ah Silicon-Graphite anode based high energy density Li-ion cells** as a low weight and low cost alternative to present cells being used.

What is a Fuel Cell?

- About: A <u>fuel cell</u> is an <u>electrochemical device</u> that converts the chemical energy of a <u>fuel</u> (like hydrogen) and an oxidant (like oxygen) directly into electricity.
 - Unlike batteries, which store chemical energy that gets converted to electrical energy, fuel
 cells continuously produce electricity as long as they are supplied with fuel and
 oxidant.
- Major Types of Fuel Cells:

- Polymer Electrolyte Membrane Fuel Cells: They use a thin, solid polymer membrane as the electrolyte and are well-suited for portable applications.
- Solid Oxide Fuel Cells (SOFCs): SOFCs use a ceramic electrolyte that can operate at high temperatures. They are highly efficient but are more expensive and complex than PEMFCs.
- Alkaline Fuel Cells (AFCs): AFCs use a liquid electrolyte made of potassium hydroxide (KOH). They are less efficient than PEMFCs and SOFCs but are less expensive and can be more tolerant of impurities in the fuel.

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- Applications of Fuel Cells:
 - Transportation: Fuel cells can be used to power <u>electric vehicles</u>, boats, and even airplanes.
 - Fuel cells can also power space missions, providing electrical power for spacecraft, and a dependable energy source for long-duration missions.
 - Highly efficient with zero emissions, making them ideal for space missions
 - Portable Power: Fuel cells can be used to power laptop computers, cell phones, and other portable devices.
 - **Stationary Power:** Fuel cells can be used to power homes, businesses, and even entire cities.

UPSC Civil Services Examination Previous Year Question (PYQ)

- Q. Hydrogen fuel cell vehicles produce one of the following as "exhaust" (2010)
- (a) NH₃
- (b) CH₄
- (c) H_2O

(**d**) H₂O₂

Ans: (c)

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