

# Hydrogen production by PEM electrolysis

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## Hydrogen society

Hydrogen society : Society that makes hydrogen the main energy source, and uses it.

### Advantage

- Hydrogen is an energy source of the zero emission at use and the consumption stage, and it is possible to contribute to the environmental solution.
- The energy problem can be cleared, and the sustainable society be established.

### Problem

- Development and practical use of hydrogen technology (fuel cell etc.).
- Improvement of economics.
- Infrastructure maintenance.
- Manufacturing of hydrogen from renewable energy.

## Feature of hydrogen

### Advantage

- **The raw material is unlimited** (water or organism).
- Only **water** is generated when burning.
- **A large-scale storing and transportation** are easier than the electric power.
- It is generable from **renewable energy**.

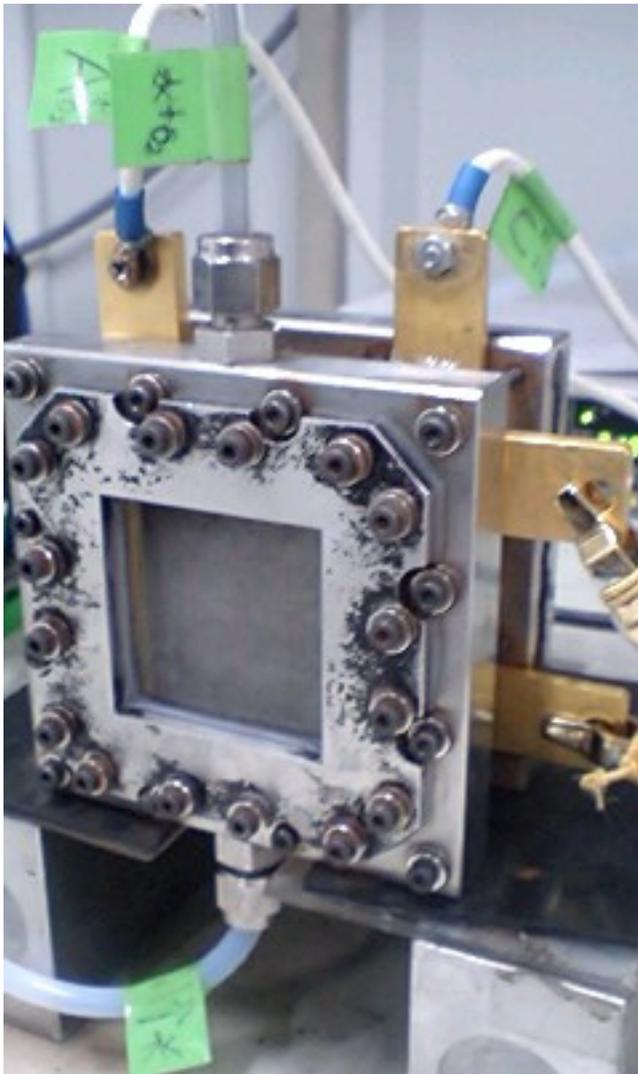
### Fault

- **It is very difficult to liquefy** ( $-253[^\circ\text{C}]$ ).
- **A small-scale storing and transportation** are more difficult than another fuel.
- It is necessary to **manufacture a large amount of hydrogen** because the reasonable amount cannot be secured.
- The related technology is immature.

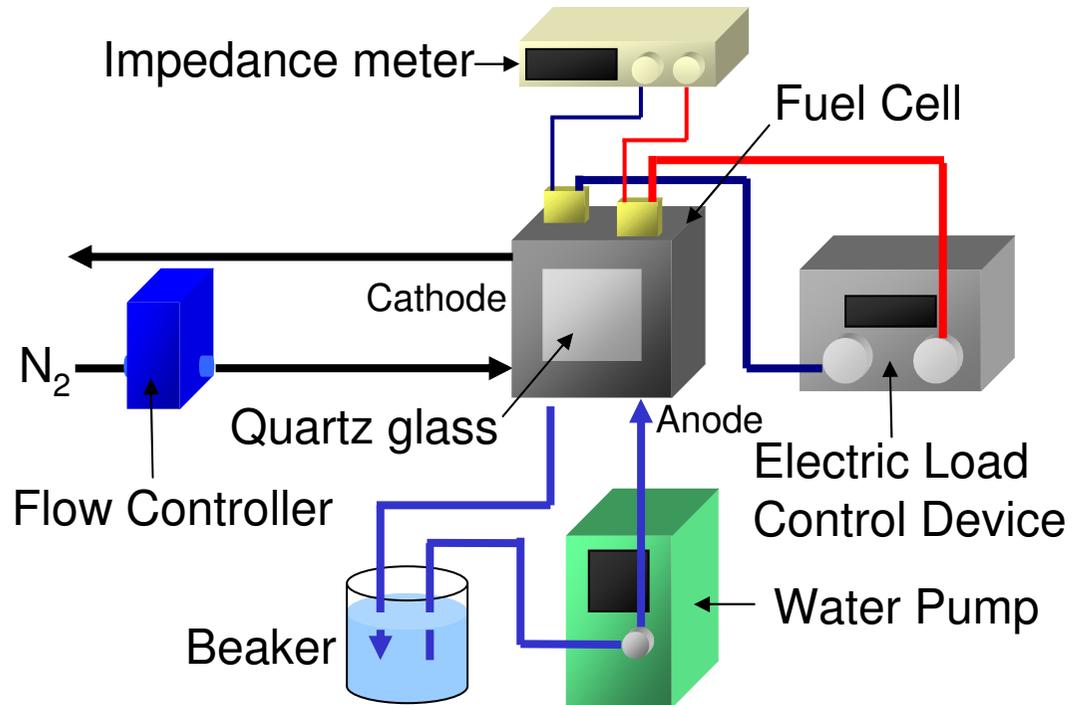
The one that it is possible to become either (advantage and fault)

- It is possible to use it for the **hydrogen engine** though danger of exploding because of the **broad range of combustion**.
- The combustion temperature is high ( $3000^\circ\text{C}$ ). There is a possibility of generating **NO<sub>x</sub>** while big energy is generated.
- It goes into a metallic lattice because the molecule is extremely small and causes hydrogen embrittlement. But, using this character, the metal hydride is thought.

Improvement of hydrogen generation efficiency by PEM electrolysis.

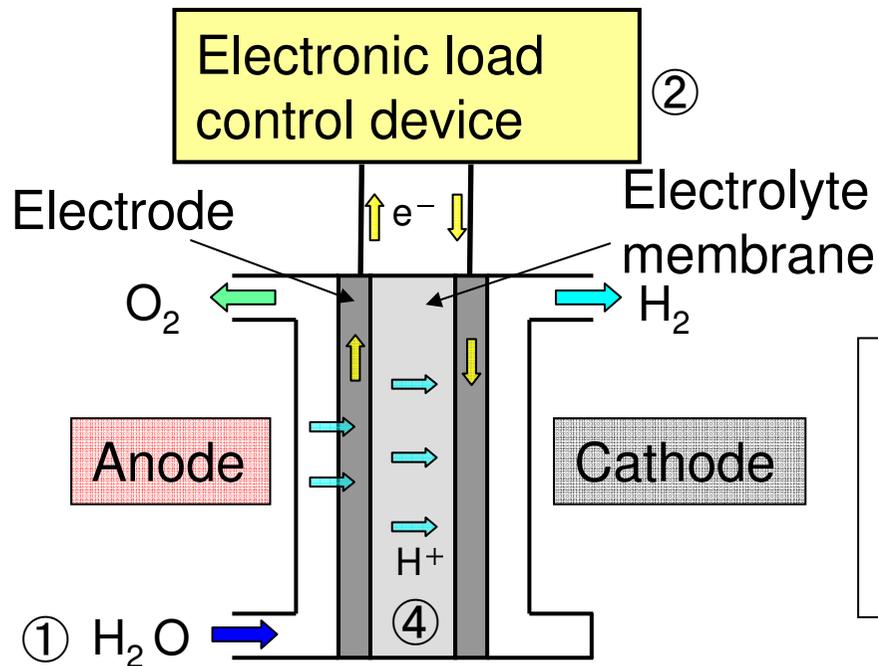


PEM electrolysis cell



PEM electrolysis cell & equipment in surrounding

## Diagrammatic illustration of electrolysis (1)

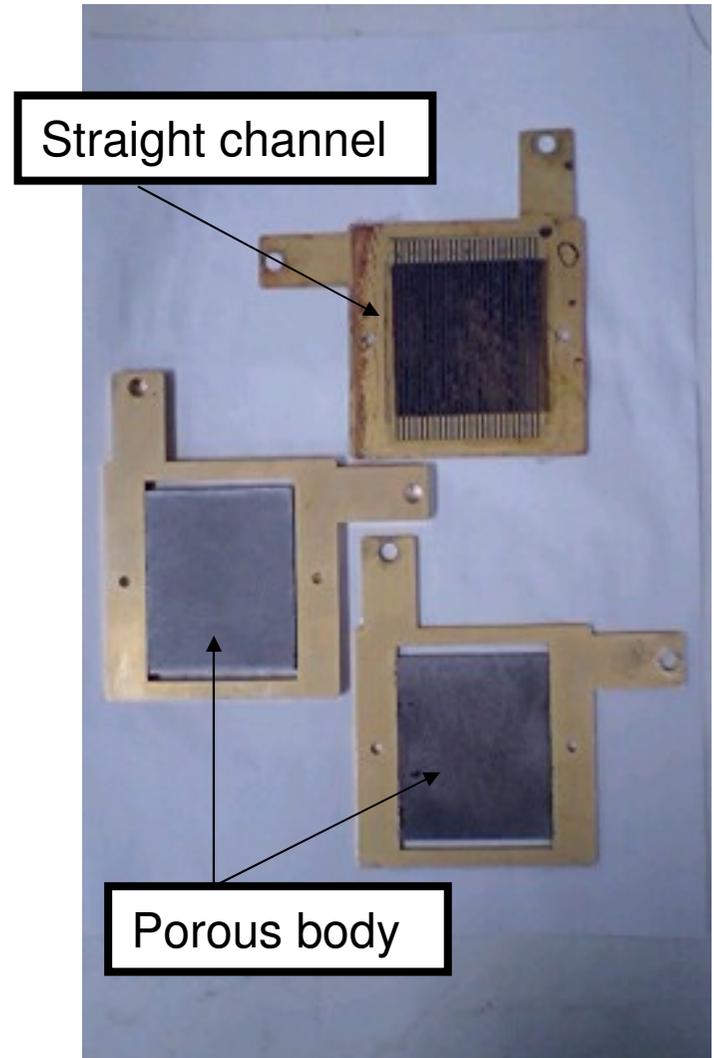
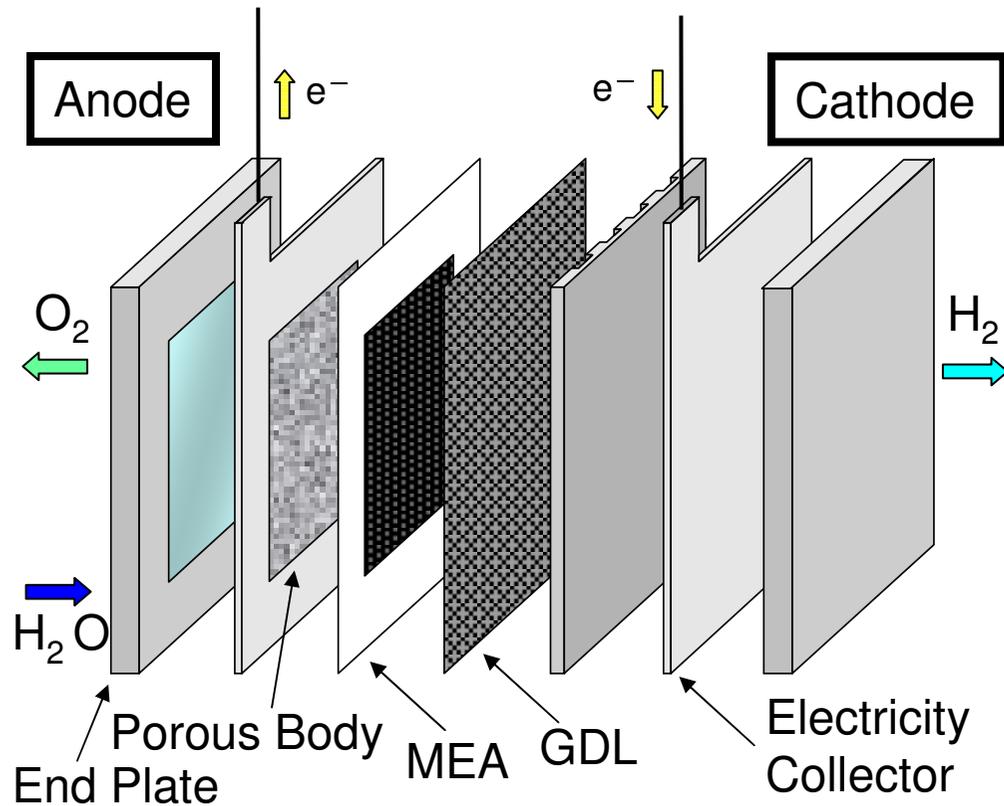


Reaction formula



- ① Water is supplied to the anode side.
- ② The voltage is applied to two poles by the electronic load control device.
- ③ **Water is resolved** on the anode.
- ④ **The hydrogen ion (proton) passes the electrolyte membrane**, and it moves to the cathode side.
- ⑤ The hydrogen ion receives the electron on the cathode side, and it becomes **a hydrogen molecule**.

## Diagrammatic illustration of electrolysis (2)



- It is almost the same as the fuel cell structurally.
- At the current stage, the main research object is a **porous body**.