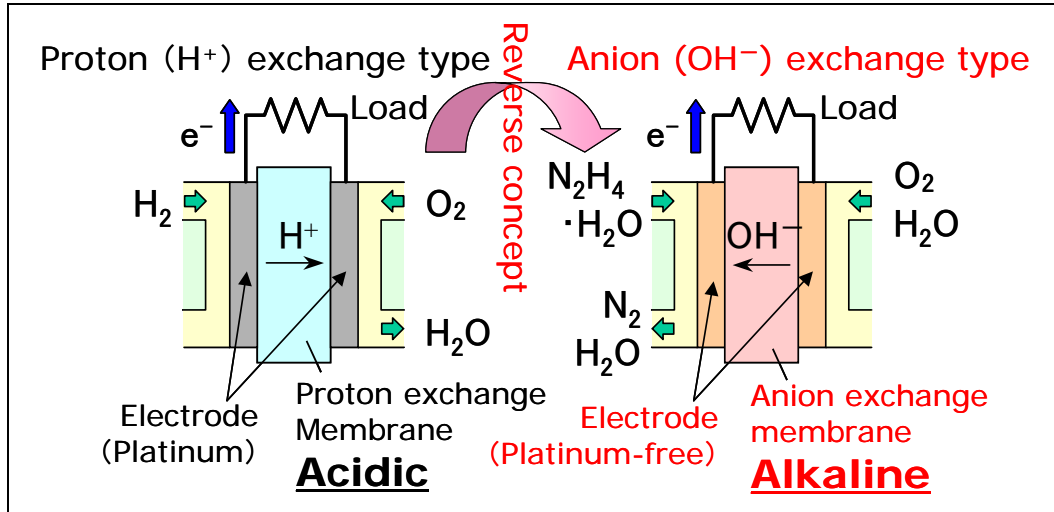


Attachment

### 1. Platinum-free electrode catalyst

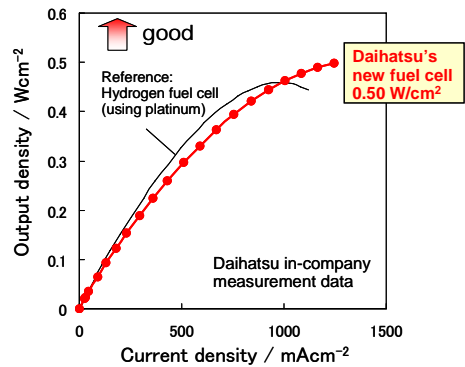
Since conventional fuel cells (proton-exchange type) use strongly acidic electrolyte membranes, platinum, which possesses excellent corrosion resistance, is the only material that can be used as the electrode catalyst. By reversing this conventional model and utilizing an alkaline anion-exchange fuel cell Daihatsu succeeded in eliminating platinum from the electrode catalyst, replacing it with an inexpensive metal (cobalt, nickel, etc.), which could not be used before due to low corrosion resistance.



### 2. High output

In conventional fuel cells that generate electricity directly from a liquid fuel such as methanol, the carbon monoxide generated from the fuel damages the electrode catalyst. Consequently, these fuel cells are unable to provide an output large enough for use in automobiles.

By using hydrazine hydrate, which consists of only hydrogen and nitrogen, as the fuel, and developing new materials for the electrode catalyst, Daihatsu achieved both an output density of  $0.50\text{W}/\text{cm}^2$ , which is comparable to the output of a hydrogen fuel cell, and zero emissions, with water and nitrogen being the only substances emitted.



### 3. Fixing and releasing the fuel (hydrazine hydrate)

Fixing hydrazine hydrate:

The fuel tank is filled with a granulated polymer embedded with carbonyl group ( $>\text{C}=\text{O}$ ) for capturing the hydrazine hydrate ( $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{O}$ ). When the hydrazine hydrate enters the tank, it reacts with the carbonyl group (dehydration-condensation reaction) and bonds with the polymer, becoming a solid called hydrazone ( $>\text{C}=\text{N}_2\text{H}_2$ ), which can be safely stored.

Releasing hydrazine hydrate from hydrazone:

Circulating warm water ( $\text{H}_2\text{O}$ ) through the hydrazone ( $>\text{C}=\text{N}_2\text{H}_2$ ) causes hydrolysis. And this reaction returns the hydrazone to the original carbonyl group ( $>\text{C}=\text{O}$ ), and releases liquid hydrazine hydrate ( $\text{N}_2\text{H}_4 \cdot \text{H}_2\text{O}$ ), which is then supplied to the fuel cell.

