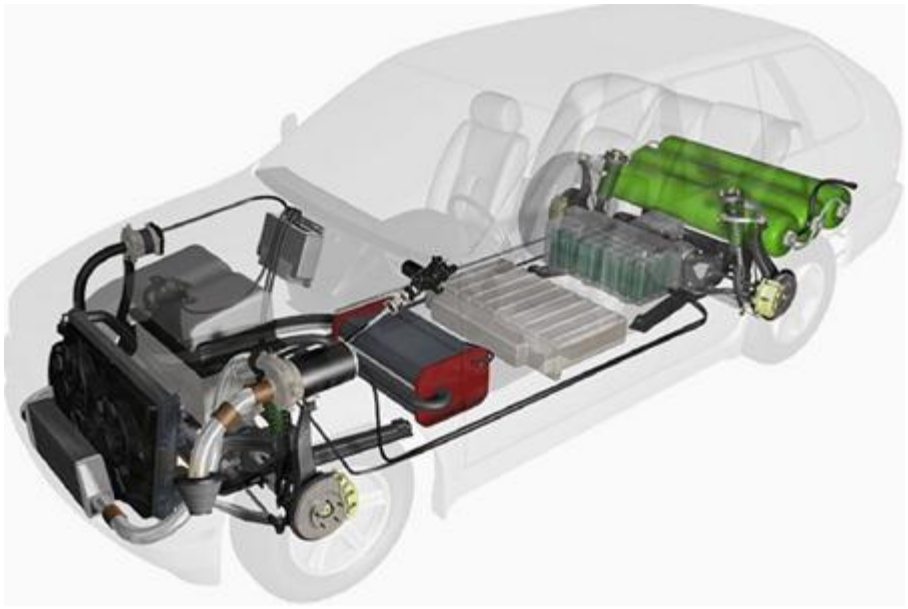
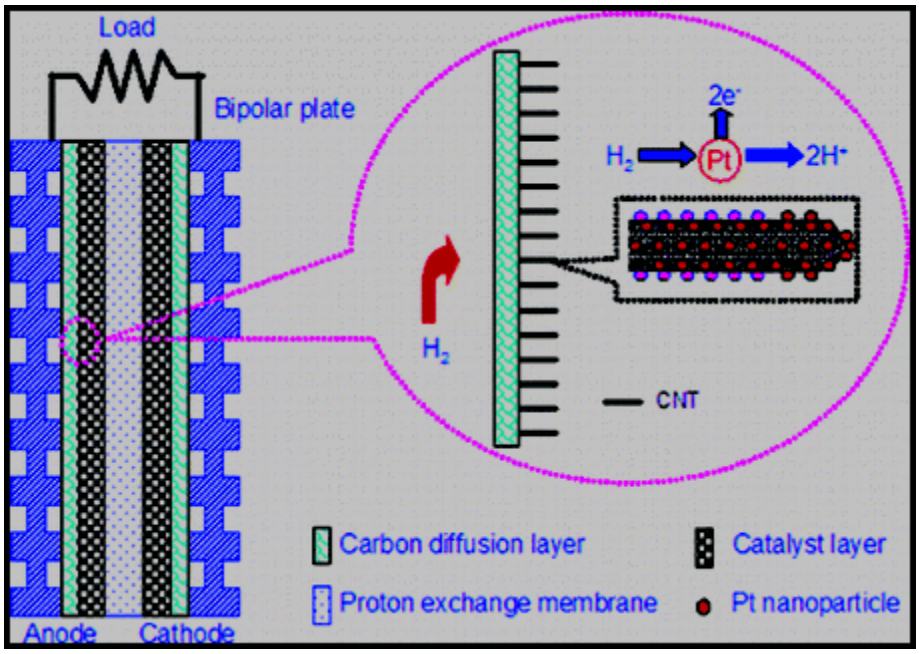
Polymer Electrolyte Membrane (PEM) Fuel Cells (PEFC) | Proton Exchange Membrane (PEM) Fuel Cells



Polymer electrolyte membrane (PEM) fuel cells—also called proton exchange membrane fuel cells—deliver high-power density and offer the advantages of low weight and volume, compared with other fuel cells. PEM fuel cells use a solid polymer as an electrolyte and porous carbon electrodes containing a platinum catalyst. They need only hydrogen, oxygen from the air, and water to operate and do not require corrosive fluids like some fuel cells. They are typically fueled with pure hydrogen supplied from storage tanks or on-board reformers.

PEM Technology:

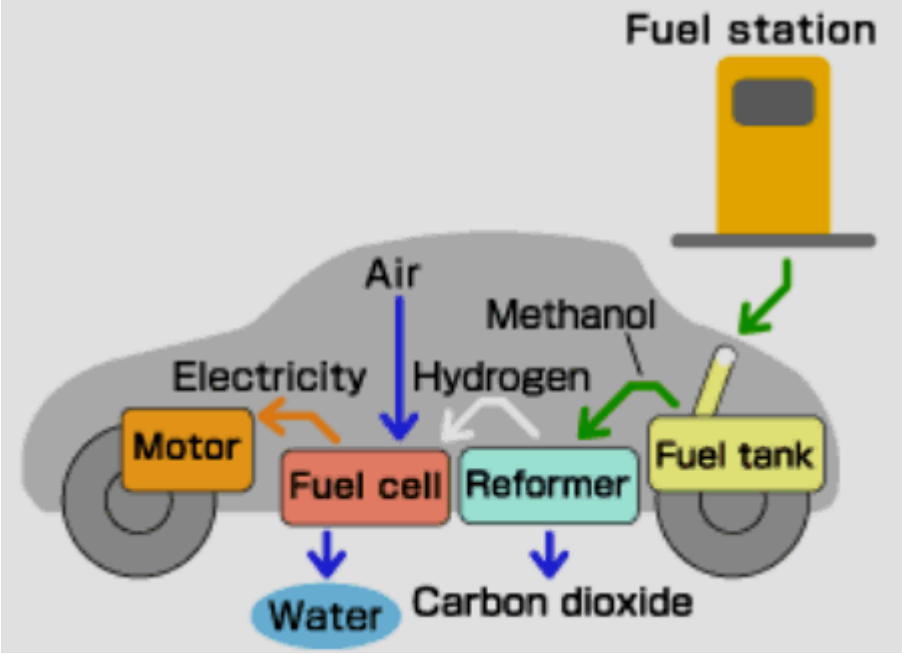


Polymer electrolyte membrane fuel cells operate at relatively low temperatures, around 80°C (176°F). Low-temperature operation allows them to start quickly (less warm-up time) and results in less wear on system components, resulting in better durability. However, it requires that a noble-metal catalyst (typically platinum) be used to separate the hydrogen's electrons and protons, adding to system cost. The platinum catalyst is also extremely sensitive to CO poisoning, making it necessary to employ an additional reactor to reduce CO in the fuel gas if the hydrogen is derived from an alcohol or hydrocarbon fuel. This also adds cost. Developers are currently exploring platinum/ruthenium catalysts that are more resistant to CO.

PEM Fuel Cell Applications:

PEM fuel cells are used primarily for transportation applications and some stationary applications. Due to their fast startup time, low sensitivity to orientation, and favorable power-to-weight ratio, PEM fuel cells are particularly suitable for use in passenger vehicles, such as cars and buses.

Disadvantages of Fuel Cell:



A significant barrier to using these fuel cells in vehicles is hydrogen storage. Most fuel cell vehicles (FCVs) powered by pure hydrogen must store the hydrogen on-board as a compressed gas in pressurized tanks. Due to the low-energy density of hydrogen, it is difficult to store enough hydrogen on-board to allow vehicles to travel the same distance as gasoline-powered vehicles before refueling, typically 300-400 miles. Higher-density liquid fuels, such as methanol, ethanol, natural gas, liquefied petroleum gas, and gasoline, can be used for fuel, but the vehicles must have an on-board fuel processor to reform the methanol to hydrogen. This requirement increases costs and maintenance. The reformer also releases carbon dioxide (a greenhouse gas), though less than that emitted from current gasoline-powered engines.

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