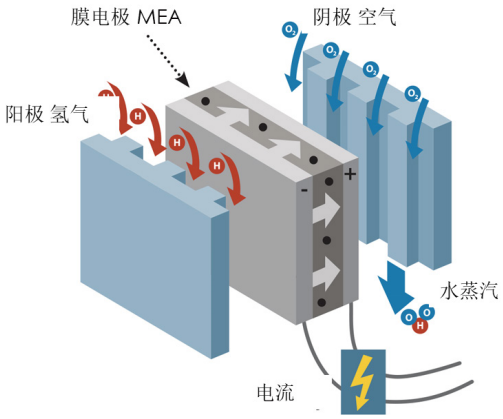
Fuel Cells: A Bridge from Hydrogen to Electric Aviation

The relatively mature low-temperature PEM Hydrogen fuel cell is a clean electrochemical power generation device. The interior does not burn, and the core temperature is generally between 40 and 65 degrees. Few mechanical moving parts, low maintenance costs, and high reliability.

Hydrogen is transported to the inner part of the stack through the anode plate flow channel, and then evenly permeates through the diffusion layer to the catalytic layer and Proton-exchange membrane. Under the action of platinum catalyst, protons are brought to the other side of the Proton-exchange membrane to combine with oxygen atoms of the cathode to form water. The electrons pass through the circuit and return to the cathode through the load to form a current.

The area of the electrode plate determines the magnitude of the current. The number of stacked layers of the plates determines the voltage level. The open circuit voltage of a single cell battery is about 1V, and the working voltage is about 0.65V. In practice, the conversion efficiency has reached 55%, with 45% being released in the form of heat.



Hydrogen power system on unmanned aerial vehicles

The hydrogen power system of UAV consists of Hydrogen fuel cell, controller and hydrogen cylinder. The IV curve of hydrogen electricity is steeper than that of lithium battery. The open circuit voltage of Hydrogen fuel battery is 1V, and the rated working voltage is 0.65V. The Hydrogen fuel battery is stacked by multiple sections, so it is often called "stack".

Customized services for hydrogen power systems

The core business of Hydrogen Aviation Technology is the research and development of fuel cell systems, not a hydrogen powered drone company. We use the development of hydrogen powered UAVs to explore the application of Hydrogen fuel cells in aviation. Hydrogen Airlines is willing to assist its industry partners in developing hydrogen powered drones and carriers together.

We provide free parameter design and project pre evaluation for our partners. We can also provide partners with comprehensive support such as fuel cell systems, hydrogen storage systems, power management systems, and electric drive systems.

Safety of hydrogen: Physical properties of hydrogen

1. The mixture ratio of hydrogen explosion is about 4-75%. As a comparison, gasoline is about 1.4%, and natural gas can explode with a mixture ratio above 4.7%.
2. The density of hydrogen is only 1/14 of air, and it spreads rapidly upwards, about 20m/s, making it difficult to accumulate and form explosive mixture conditions.
In combustible gases, although the specific mass calorific value is the highest, under the same conditions, the specific volume calorific value is the lowest, only 1/3 of natural gas Hydrogen combustion explosion is a scaling reaction, where two hydrogen molecules and one oxygen atom form two water molecules, so the explosion energy is much lower than that of natural gas and gasoline.
4. The ignition energy of hydrogen is low, but it also requires an open flame at 574 ℃ to ignite.
5. Power generation and energy storage are separated, and Thermal runaway like lithium battery will not occur, and the control logic will stop the response of the solenoid valve when it is cut off.
6. It is easy to detect, and currently, ppm level combustible gas alarms can detect it, which is very popular.

If gasoline and natural gas can be widely used, hydrogen will eventually become widely used.

Safety of hydrogen bottles

1. Type III and IV carbon fiber gas cylinders, aluminum alloy or high-density polymer inner liner, with carbon fiber wrapped around the periphery, and the main pressure bearing structure being the carbon fiber itself.
GB/T 35544-2017 provides detailed technical requirements and testing specifications for carbon fiber gas cylinders used in vehicles.
2. Gas cylinders must not explode after being shot, burned, or dropped.
3. During the shooting, the gas cylinder ruptured as a bird's nest, and high-purity hydrogen gas was quickly released without burning or exploding.
4. When the fire is burning, the overheating at around 110 ℃ quickly releases and does not spread or explode.
5.100 meter drop test, vehicle crushing, hydrogen cylinder not exploding, not breaking. The internal pressure is about 350 kilograms per square centimeter, and on the contact surface of dozens of square centimeters, the external impact force/pressure can be ignored compared to the internal pressure.
6. The valve stem breaks, high-purity hydrogen leaks, and the gas cylinder does not fly away or burn. The aperture of the breakpoint is only about 2 square millimeters, and the thrust is about 0.7 kilograms, which is not enough to launch a 4-kilogram gas cylinder into the sky. High purity hydrogen gas leaks instantly.
7.The hydrogen cylinder used on hydrogen powered drones is a type III carbon fiber cylinder produced by a state-owned enterprise, Sinoma Technology, that meets the national pressure vessel standard GB/T15385-2011. The enterprise has obtained a special equipment (pressure vessel) manufacturing license issued by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China. The safety of a three type carbon fiber gas cylinder for storing hydrogen gas has been verified through various experiments, with an aluminum alloy inner liner and high-strength carbon fiber wrapped around the outside.

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