Press Publication Materials

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Akita University

Contributed to the demonstration of World's Highest-Capacity Hydrogen Recirculation System for Aircraft Fuel Cells, Delivering Compactness and High Durability.

Akita University (President: Dr. Fumio Yamamoto) established the Joint Research Center for Electric Architecture to be operated jointly with the support of the Cabinet Office under the Subsidy for Regional University & Regional Industry Creation Project in April 2021.

The Center is promoting research and development with the main target of the aircraft system electrification market (motor, inverter).

IHI Corporation has developed and successfully demonstrated an electric hydrogen turbo-blower, a large-capacity hydrogen recirculation unit that achieves the world's highest hydrogen circulation volume in its class. This equipment was developed for use in aircraft fuel cells, and has succeeded in achieving a large capacity by employing an ultra-high-speed motor with a proprietary gas bearing (see note 1).

The Center was in charge of the characteristic evaluation for this demonstration, and contributed to this success together with Sanei Machine Co., Ltd., an aircraft body manufacturing equipment manufacturer located in Akita Prefecture.

The electric hydrogen turbo-blower (see Figure 1) is equipment that collects a large amount of hydrogen containing water vapor(exhaust gas from the hydrogen supply side), which is discharged unreacted during fuel cell power generation, and recirculates it to the fuel electrode (cathode and anode).

IHI increased the hydrogen gas recirculation capacity of this equipment appropriately for aircraft fuel cells by employing a proprietary ultra-high-speed motor (see Figure 2) with a gas bearing using hydrogen. It thus significantly boosted output and efficiency while reducing the size and weight of recirculation equipment.

The gas bearings do not use lubricating oil. This eliminates the risk of oil contaminating hydrogen. In addition, the non-contact condition of the rotating shaft allows for high durability.

Furthermore, the equipment system features a sealed design for use in a hydrogen environment. IHI enhanced motor exhaust heat performance to reduce heat damage to the motor. This system will enable hydrogen recirculation for large fuel cells with a power output exceeding 400 kW, which is required for aircraft fuel cells. Conventional small-volume blowers have had to operate multiple units in parallel.

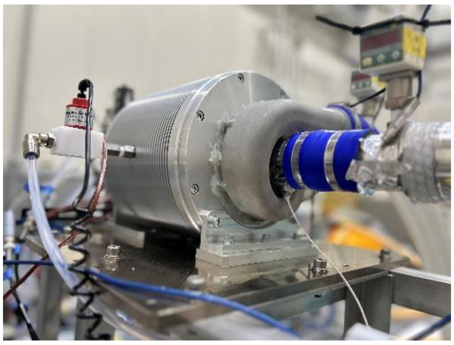

Figure 1: Testing large-capacity hydrogen turbo-blower for fuel cell cathode and anode

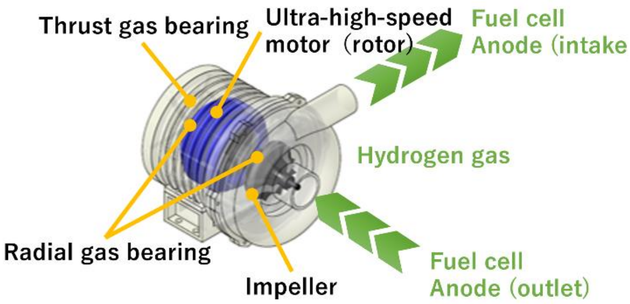

Figure 2: Ultra-high-speed motor for hydrogen turbo-blower

Performance evaluations of the completed prototype were conducted at the Soma IHI Green Energy Center and the Joint Research Center for Electric Architecture. As a result, it was confirmed that the required performance could be obtained. Previously it has been hard to achieve performance in environments with hydrogen gas from fuel cell cathode exhaust gases and in high humidity environments containing water vapor. Applications for this breakthrough will extend beyond aviation to include developing high-output fuel cell mobility setups for ships and large trucks.

We will continue to work on research, development, and demonstration tests for aircraft electrification.

Note

1. A gas bearing hydrodynamically draws in ambient gas to form a gas film when a shaft rotates at high speed, with the film allowing the rotor to float or levitate and achieve self-supporting rotation.

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