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HTS coil cooled with liquid hydrogen and fuel cell power source

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As the use of renewable energy increases in the future, hydrogen production is predicted to increase significantly. As the amount of hydrogen used increases, it is more cost-effective to transport in liquid hydrogen state than to transport in high pressure gas form. So, the more liquid hydrogen is used, the greater the opportunity for the high-temperature superconducting coil to cool the liquid hydrogen with a refrigerant. In the case of mobility, such as drones, automobiles, and ships, fuel cell systems that use liquid hydrogen can increase efficiency by reducing the size and weight. In addition, if a superconducting motor is used instead of a general motor, there is an advantage of reducing the weight. If a fuel cell is used as a power source for the superconducting coil, the mobility of the system can be improved.
In this study, first, a hydrogen liquefier was built, and an experiment was performed on the cooling of a high-temperature superconducting coil through helium gas using liquid hydrogen. In order to use the fuel cell as a power source for the high-temperature superconducting coil, the operating conditions for supplying current up to 40A to the high-temperature superconducting coil were investigated by controlling the flow rate of hydrogen and oxygen in the fuel cell.

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