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M1Or3G-01: [Invited] Current Status of National Project for Electric Propulsion System Development of Aircraft using Superconducting Technologies

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The Japanese team, centered on Kyushu University, is developing a high-temperature superconducting propulsion system for aircraft, taking advantage of its strengths such as low AC loss technology. One of its features is that the motor and generator are developed as fully superconducting rotating machines, which consist of superconducting windings for both field and armature coils. Next, overwhelming thermal stability is being aimed for by realizing high-temperature operation in liquid nitrogen by taking advantage of the characteristics of high-performance wires. In addition to adopting a heat exchange method that uses a low-temperature refrigerant instead of a refrigerator, the heat insulation structure has been greatly improved to reduce the weight of the rotating machine.

First, in FY2019, we succeeded in making a prototype of a fully superconducting motor with a small capacity of 1 kW, confirmed that it was able to show the specified performance, and realized a demonstration of moving the motor on rails by connecting a fan.

After that, a large-scale project started from FY2019 in Japan, and while developing various elemental technologies, we are trying to manufacture a large 500kW-class motor while reflecting the results. Recently, the 500kW-class fully superconducting motor was successfully made, and it is put in the evaluation stage. At least, some rotation was confirmed although it is not enough. Now, the initial defects found in the above evaluation are being repaired, and after completing these, we are planning to conduct a full-scale performance evaluation. Furthermore, an operation test in a low-temperature, low-pressure environment that simulates the flight environment is also planned.

This work is based on results obtained from a project commissioned by NEDO and METI.

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