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Current Status and Future Expectation of HTS Rotating Machines in Korea

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Recently, many researchers have been actively researching superconducting rotating machines, in particular, superconducting generators for wind turbines and superconducting motors for propulsion aircraft. In Korea, research on the superconducting rotating machines has been ongoing. In the case of the superconducting motor, much attention has recently been paid to localization of electric propulsion systems for aircraft. Research on the superconducting motors for propulsion aircraft using liquid hydrogen has been conducted. In this paper, the world and Korea R & D trends of superconducting motors were discussed.

In the case of the superconducting generator, a large-scale floating offshore wind turbine with a superconducting wind power generator was suggested to achieve the renewable energy target which is 20% renewable energy achievement by 2030 in Korea. This paper introduces a new wind project for developing 10 MW class high-temperature superconducting (HTS) magnet, test facility, offshore floating system, and network connection technologies sponsored by Korea Electric Power Corporation. First step is a design of a 10 MW floating offshore wind power system with the superconducting generator. The design process of the 10 MW superconducting generator are developed, and the modeling method for the large-scale wind farm is suggested using real time simulator. Second step is the detail design of the 10 MW floating platform in which the floating system of the wind power system is designed considering the superconducting generator. Algorithms for control systems of the superconducting wind farm are developed. Korean type large scale floating offshore wind power system platform is suggested in the last-step. The fabricated superconducting pole is tested using a performance evaluation device. The mechanical stress and electric characteristics by Lorenz force are analyzed, and economic analysis result of the floating offshore wind power system is provided. As a result, we will discuss the possibility of large scale floating offshore wind power system, and Korean type large scale floating offshore wind power system platform with the HTS wind power generator will be proposed.

Keywords: Aircraft, HTS generator, HTS motor, Rotating machine, Wind turbine