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Study of refrigerant circulation system and cryofan for cooling high temperature superconducting coils.

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As an industrial application of the high-temperature superconducting coils (HTS coils), for example, an induction heating device that rotates a metal in a DC magnetic field by a superconducting coil have been studied. For that purpose, when operating the HTS coils, it is necessary to remove the heat from the coils and keep those at about 50K or less. In addition, assuming application to production equipment, it is desirable to be able to cool multiple coils away from a cryo-cooler at the same time. In this study, circulation cooling system have been studied that satisfies these conditions. By using the circulation cooling system, the coil installed away from the cryo-cooler to some extent can be cooled. We also investigated the effect of using the cryofan on the cooling performance of the circulation cooling system. By using the cryofan, it is not necessary to cool the refrigerant from room temperature of the steady state. Along with this, there may be merits such as being able to remove the precooled heat exchanger. Its total length is 60m, and it occupies more than 80% of the entire flow path in the cryostat of the current experimental equipment. On the other hand, the heat leakage from the cryofan and the energy input in the impeller part. It is conceivable that a part of the heat will be converted into heat. Based on these facts, it is necessary to verify the practicality of cryofans. In this study, we will discuss the results of experiments and numerical analysis on a circulating cooling system. In addition, the analysis results in case of using the cryofan will be discussed, including a comparison with the case where a conventional compressor is used.

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