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# Evaluation of operating characteristics of coils wound with no-insulation REBCO bundle conductor for SMES

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Superconducting magnetic energy storage (SMES) has the advantages of high efficiency, longevity, and excellent instantaneous response with high power. However, it has the disadvantage that its storage density is extremely small compared to other power storage devices. The no-insulation coil (hereinafter referred to as "NI coil") is expected to be a winding method that can achieve both high current density and high thermal stability. It is thought that if this NI coil technology can be applied to SMES, it will be possible to improve energy storage density by achieving higher current density. Because SMES is power devices, it is generally desirable for coils to be designed with high current and low inductance. Therefore, in this study, we considered adopting the winding method in which a bundle conductor consisting of multiple no-insulation REBCO tapes is wound without electrical insulation (hereinafter referred to as "bundle NI coil") for SMES coils. However, since the REBCO tapes in the bundle conductors are not electrically insulated each other and the bundles also have no electrical insulation between themselves, the time variation of the current distribution in the bundle NI coil becomes very complicated. Therefore, we developed a computer program to analyze and evaluate the current distribution in a bundle NI coil, and for application to SMES, we numerically investigated the behavior during excitation and demagnetization of a coil wound with a no-insulation bundle conductor composed of two no-insulation REBCO tapes. In addition, a small bundle NI coil was fabricated and tested to confirm the validity of the developed computer program, and the time variation of the current distribution in the bundle conductor was clarified from the analysis results.

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