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Investigation of AC Loss Characteristics of REBCO Armature Developed for 50 kW-class HTS Induction/Synchronous Motor

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With recent progress of fabrication technology of long length and high critical current high temperature superconducting (HTS) wires, the application of HTS wires to the windings in rotational machines becomes feasible. In most current research and development of HTS rotational machines such as large scale wind turbine generators and ship propulsion motors, the HTS wires are applied only to the DC field windings. However, there are continuing interests in the development of fully superconducting rotating machines, since it is considered that the fully HTS rotating machines with HTS armature windings expand the application range of the HTS technology to middle size AC rotating machines. We have been developing the fully HTS induction/synchronous motor utilizing for transportation apparatuses such as electric vehicles. As a part of this R&D, we have developed a model armature for a 50 kW-class induction/synchronous motor using HTS coils. In this model armature, a toroidal type winding composed of 24 HTS coils and an iron core was used. The HTS coil used in the model armature was the race track double pancake coil wound by the parallel conductor with three REBCO tapes. The iron core of the armature was split into 24 parts made of laminated silicon steel sheets. Each REBCO coil was combined with the split iron core and these were assembled in the toroidal structure. The AC losses in the developed armature REBCO winding in 3-phase AC condition were investigated. In the presentation, the electric design and the detailed specification of the stator winding using REBCO coils is summarized and its AC loss characteristics in the 3-phase AC condition are reported.

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