Contribution ID: **745** Contribution code: **THU-PO3-508-08** Type: **Poster**

Investigation on Time-Varying Behavior of No-Insulation HTS Field Coil for Synchronous Motors Considering Armature Reaction and Slotting Effect

Thursday 18 November 2021 10:00 (20 minutes)

This paper presents calculation results of time-varying behavior of no-insulation (NI) high temperature superconductor (HTS) field coil for synchronous motor considering armature reaction and slotting effect. Despite the direct current (DC) operation in synchronous motor with HTS field winding, NI field coils are under time-varying conditions caused by rotor field harmonics depending on armature winding configuration and structural features of stator. Under the time-varying condition, current flows not only in the azimuthal path but also in the radial path of the field coil due to the so-called "NI characteristics", and such behaviors change the magnetic field generated by the field coil and have a significant influence on the performance of the motor. To investigate field harmonics effects on NI coil characteristics during steady state operation of synchronous motor, the circuit parameters varying with position of rotor are stored as look-up tables and the dq equivalent circuit simulations are implemented. For case studies, we select four NI HTS motor models having different stator topologies divided into air-cored and iron-cored teeth, and armature winding layouts classified with concentrated winding and distributed winding. Then, the following key characteristics are calculated: (1) turn-to-turn radial leakage current; (2) flux linkage; and (3) Joule heating loss due to contact resistance. Considering these characteristics, we found the most advantageous stator topology and armature winding layout in terms of performance parameters such as torque and efficiency of NI HTS motors.

Acknowledgement
This work was supported by the R&D Collaboration Programs of Hyundai Motor Company. This work was also partly supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2018R1A2B3009249)

Primary author: YOON, Jonghoon (Seoul National University)

Co-authors: BONG, Uijong (Seoul National University); AN, Soobin (Seoul National University); LEE, Jung Tae (Seoul National University); Dr JUNG, Seok-Won (Seoul National University); HAHN, Seungyong (Seoul National University)

Presenter: YOON, Jonghoon (Seoul National University)

Session Classification: THU-PO3-508 Superconducting Rotating Machines, Linear Machines, and Related Subjects III