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AC loss measurement of MgB2 superconducting coils under rotating magnetic field

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Electric machines have been applied to every industrial and transport applications today and are required to realize high-output density.
Superconducting technology is one of the most effective methods for realizing the high-output density motors. The superconducting coils at ultra-low temperature can energize several hundred times higher current density in comparison with copper wires; it directly leads to the realization of high current density coil, while reducing the weight of field coils and armature windings at rotor and stator.
AC losses occur, however, by applying alternating magnetic field or current to superconductors; the losses mainly consist of hysteresis and coupling losses and are often technical problems for the superconducting applications. One of the effective methods to reduce the AC losses is the employment of the multi filament wire structures. MgB2 wire, which has multi filament structure and can be used at liquid hydrogen temperature (20 K), is one of optional materials for superconducting motor coils.
We have been designing and constructing an AC loss measurement device using PM rotor; in this device, rotating magnetic field is applied to the MgB2 superconducting coil. The PM rotor employs Halbach structure to apply rotating magnetic field of over 0.1 T to the MgB2 superconducting coil. The MgB2 superconducting coil stored within the cryostat is to be cooled at 20 K with refrigerator. By using this AC loss measurement device, the AC loss of MgB2 superconducting coil in rotating field is measured from the torque change. This change can be considered as the loss of the whole rotation system. In this presentation, we will report the AC loss measurement results of the MgB2 superconducting coils, by using the constructed device.

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