

Measurement technology of new permanent magnets and motors for development of high efficiency motors.

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Recently, the demand for high-efficiency motors has been increased for saving the energy. However, the high energy product magnets without heavy rare-earth elements, of which ores are eccentrically located in some areas, are necessary to apply for high-efficiency motors of Hybrid Electric Vehicles (HEVs). Therefore, Technology Research Association of Magnetic Materials for High-Efficiency Motors (MagHEM) was founded in 2012 and consists of nine companies, an incorporated administrative agency, and an organization¹⁾. The objective of MagHEM is the development of innovative magnetic materials by 2017 and 2022 and high-efficiency motors of HEV using these materials. In this paper, we introduce the activities for developing high-efficiency motors in MagHEM.

First, we show the development of motor material evaluation techniques for the development of high-efficiency motors using new magnetic materials developed by MagHEM. It is necessary to evaluate the demagnetization characteristics of magnets in a high-temperature environment because HEV/EV motors are used in this environment. However, the demagnetization state is not uniform in the magnet owing to the nonuniformity of the magnetic properties and the strength of the magnetic field applied by the armature coils. Furthermore, the flux density is only measured on the surface of the magnet to evaluate the demagnetization state, and the state inside the magnet is estimated by using FEA. Therefore, we develop a method to evaluate the three-dimensional demagnetization state including the inside the magnet by cutting the magnet into the cubes, as shown in Fig.1, and measuring the B-H characteristics of each magnet cube.

Further, it is important to establish a high-precision motor-loss measurement technology, especially the iron loss, for accurate evaluation of the motor efficiency. The mechanical loss generated in the bearings makes it difficult to precisely evaluate the iron loss in a conventional measurement system. Therefore, we are developing a high-precision motor-loss measurement system that dramatically reduces the mechanical loss in the system, as shown in Fig.2.

Reference

- 1) Technology Research Association of Magnetic Materials for High-Efficiency Motors,
<http://www.maghem.jp/english/about.html>

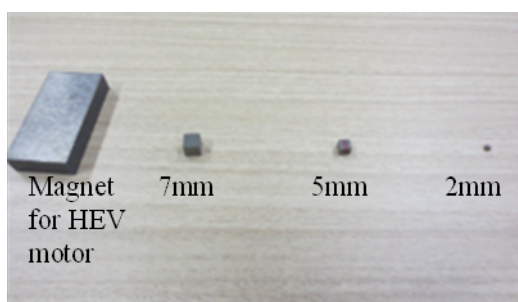


Fig. 1 Magnet cut into cubes.



Fig. 2 High-precision motor-loss evaluation system.