学 位 論 文 内 容 の 要 旨

博士の専攻分野の名称　博士（工学）　氏名　朴 志成

学 位 論 文 題 名

Study on Hybrid-Type PM Motor for BEV/HEV Traction to Reduce PM Cost
（PM コスト低減のための BEV/HEV 牽引用ハイブリッドタイプ PM モーターに関する研究）

According to international carbon dioxide emission regulations, the demand for eco-friendly vehicles is rapidly increasing. The core technology of eco-friendly cars is electrification. A traction motor is a key component for the implementation of electrification. Traction motors require high power density and wide variable speed operation. Therefore, the inner permanent magnet synchronous motor (IPMSM) is mainly adopted. High energy density NdFeB sintered magnet (Nd-PM) is applied to IPMSM for traction motor. The core materials of Nd-PM are neodymium (Nd), a light rare earth, and dysprosium (Dy), a heavy rare earth. Due to the problem that these raw materials are exclusively mined in a specific country, the price skyrocketed in 2011, which became a big problem in the industrial aspect. Therefore, there is a strong demand in the industry for technologies that do not use or reduce these raw materials.

As an existing research case that can reduce the use of rare earth, there is a hybrid type permanent magnet motor (HPMM). HPMM is a motor that uses low-cost ferrite magnets (Fe-PM) to partially replace Nd-PM. However, most of the existing research cases are within 5kW and do not sufficiently reflect the characteristics required for traction motors for automobiles.

Therefore, in this study, compared to traction motors for automobiles that are actually mass-produced, we propose a novel HPMM that can reduce PM price and minimize the use of rare earth under the same torque and power density.

In this study, two types of target motors are presented. The first is a traction motor for the NISSAN LEAF electric vehicle, and the second is a traction motor for the TOYOTA PRIUS 4th generation hybrid vehicle. Benchmarking is performed for each target motor, and a new HPMM topology is proposed under the same stator structure as the target motor. The proposed HPMM meets the durability and efficiency characteristics required in automobiles and achieves the same power density as the target motor.