Development of fundamental technologies for motors in Technology Research Association of Magnetic Materials for High-Efficiency Motors (MagHEM).

Yoshinari Asano, Yoshihito Sanga, Shintarou Araki, Michihiro Nakagawa, Akio Yamagiwa
(Daikin Industries, Ltd.)
Shigeo Morimoto, Masayuki Sanada, Yukinori Inoue
(Osaka Prefecture University)

The Technology Research Association of Magnetic Materials for High-Efficiency Motors (MagHEM) was founded in 2012 to develop the innovative high-performance magnets without/less rare-earth materials which exceed current magnets with rare-earth materials in performance, the high-efficiency soft magnetic materials (Iron core) for internal loss reduction, and compact high-efficiency motors.

Targets of R&D are new magnets exceeding Neodymium magnets with 2 times in (BH)max (180℃), and high efficiency motors with 40% reduction in loss, 40% improvement in power density using new magnets.

This paper investigates the performance of three modified versions of IPMSMs typically used in automotive applications and compares them with a reference model. The modified IPMSMs use a strong magnet model designed to have the properties of NdFe12Nx, which is a novel hard-magnetic compound developed by Hirayama et al. (1). Table I shows the motor specifications, and Fig. 1 shows the cross-sectional analysis model with three types of rotor structures(2)(3). Model B and model C achieved the target of motor in FEA, and model C could meet the strength to centrifugal force.

Acknowledgments
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Reference

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3) R. Imoto, M. Sanada, S. Morimoto, Y. Inoue: "Study on Mechanical Strength Improvement of Rotor in Compact and High Speed 2-layer IPMSM for HEV Applications", 2018 Kansai Joint Convention of Institutes of Electrical Engineering, G4-17 (2018)

TABLE I MOTOR SPECIFICATIONS

		Reference model	Model A	Model B	Model C
Number of pole/slot		8/48			
Stator diameter (mm)		264		210	
Stack lengsh (mm)		50		54	
Maximus speed (p.u.)		1		1.8	
Rotor Structure		1V	2D		
Iron core	B_{50}(p.u.)	1	0.888		
	$W_{10/50}$(p.u.)	1	0.556		
	Yield stress(p.u.)	1	1.5		
PM material	Remanence (140℃) (T)	1.04	1.39		
	Coercivity (kA/m)	784	1052		
	Wolume (cm^3)	100		69	

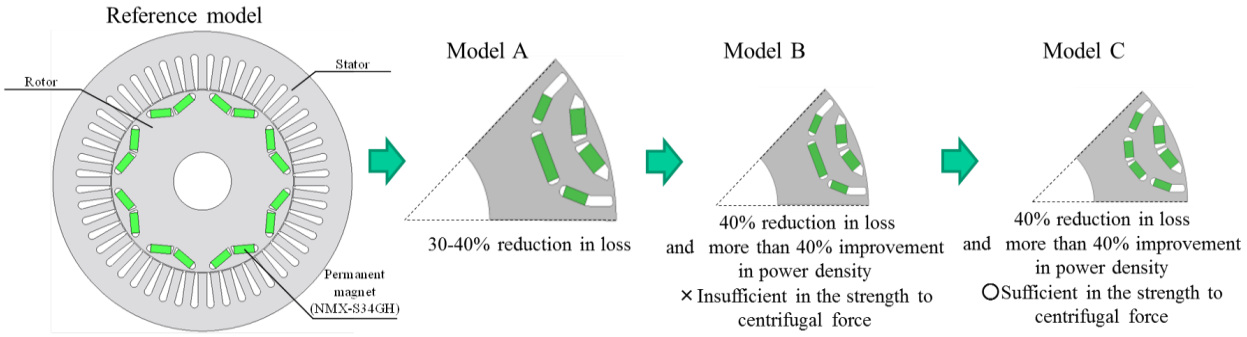

Fig.1. Rotor structure and result of analysis