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# DESIGN CRITERIA FOR HIGH-SPEED PERMANENT MAGNET SYNCHRONOUS MOTORS CONSIDERING ROTOR MAGNET AND SLEEVE MATERIAL

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Recently, high-speed electrical machines are being used at an increasing rate owing to the numerous advantages of high-speed compressors such as high efficiency, simple structure, high power density, and small size. Researchers have proposed various electromagnetic designs for high-speed permanent magnet (PM) machines. However, for high-speed PM machines, mechanical stresses are generated in the rotor when it rotates at high speed. A retaining sleeve is typically installed around PM rotors for protection, and several sleeve materials have been used. The mechanical stresses generated on the surface of the PM when the rotor rotates at a high speed can damage both the PM and the sleeve. Moreover, sleeve thickness, radial interference fit, the material of the PM and the sleeve, all have an influence on the mechanical stress, and ultimately, on the target rotation speed. Therefore, sleeve thickness and radial interference fit, followed by the material of the sleeve and the PM, should be considered in the design stage. In this paper, the influence of four different sleeve materials with two different PM materials on the mechanical stress of a high-speed PM rotor is presented, and the relationship between the sleeve thickness and sleeve material is examined. The proposed method was validated by an actual driving test at 400,000 rpm, and this would be useful for the design of high-speed PM rotors for fast mechanical structures. In addition, the design and manufacturing procedures for high-speed PM rotors could then be greatly simplified since accurate prediction is possible, and it would be possible to develop lightweight motors and generators with smaller volumes. More specific comparison with an accurate initial design method that considers the mechanical structure will be present in the final paper.

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