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Mon-Mo-Po1.06-11 [73]: A Study on the Design of IPMSM for Reliability of Demagnetization Characteristics-based Rotor

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The recent next-generation railway vehicles are aiming at energy saving and weight lightening and IPMSM(Interior Permanent Magnet Synchronous Motor) with a more improved efficiency and weight to output ratio than induction motor when rare-earth permanent magnet with high energy density is applied to synchronous motor have been developed a lot. Interior permanent magnet synchronous motor, used in this study is a high-capacity traction motor for railway vehicles and has a totally-enclosed structure to prevent dust, foreign materials, etc during operation as it is placed at the bottom of railway vehicles. This totally-enclosed structure is vulnerable to temperature because the cycle of heat is not good. The high-capacity traction motor for railway vehicles requires a high weight to output ratio and to increase the weight to output ratio, rare-earth neodymium permanent magnet with high energy density should be used, but are characterized by high-temperature demagnetization. Also, high current may flow due to failure in power converter and it may produce a big reverse magnetic field and be demagnetized by the reverse magnetic field. Demagnetization characteristics caused by such high- temperature demagnetization and reverse magnetization are characterized by permanent demagnetization as a new demagnetization curve called as recoil line is generated. This study proposes how to interpret demagnetization characteristics and carries out demagnetization analysis to obtain the reliability of rotor. It sets up an analysis scenario to drive electric motor based on demagnetization characteristics by considering recoil line and predicts the demagnetization of permanent magnet. And it examines the effects of output based on predicted demagnetization characteristics. It manufactures a model verified through analysis as test product and designs interior permanent magnet synchronous motor to obtain the reliability of rotor based on demagnetization characteristics proposed in this study through performance test and saturation temperature teste.

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