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Wed-Mo-Po3.12-02 [97]: Measurement of eddy current loss of permanent magnet with higher frequency and temperature effects

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The use of a permanent magnet (PM) to achieve high performance and high efficiency in the modern motor and generator industry technology has increased rapidly. In the design process, one needs to consider the magnetic properties and the eddy current loss due to high conductivity in long term operating condition. Due to high eddy current loss the temperature of the permanent magnet increases which increases the chance of thermal demagnetization and completely irreversible loss of magnetic properties. For measurement of AC loss of PM under the presence of an external magnetic field as synonymous to operating permanent magnet synchronous machine (PMSM), closed loop magnetic measurement system is designed, developed and manufactured. With this symmetrical closed magnetic measurement system, the loss of the PM is measured with varying frequency and for varying temperature. Two different shaped of PMs which are used in PMSM is evaluated from this measurement setup. Most promising improvements in magnetic measurement and loss calculation can be analyzed and investigated.
Initially, the AC loss in PM is measured under sinusoidal conditions to verify the FEM PM loss model. The AC loss measurement is further validated using the thermal measurement for AC loss calculation. The accuracy of the AC loss measurement method is improved by modifying the measurement coils using the printed circuit board (PCB) to measure the induced voltage due to eddy current in the PM. Then it is used for measurement of AC loss under non-sinusoidal excitation. The non-sinusoidal excitation signal is generated either using a function generator or pulse with modulated (PWM) inverter. In this paper, the calculated and the measured AC loss in PM under sinusoidal and non-sinusoidal excitations with different harmonic contents are compared with higher frequency and temperature effects.

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