M ą f AC-Ma i L i P a
Ma a H i T a

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Abstract:

Most EV/HEV have adopted Nd-Fe-B sintered magnet having high coercive field strength and remanent flux density. AC-magnetic loss in Nd-Fe-B sintered magnets is relatively large compared to ferrite magnets and other permanent magnets due to low electrical resistivity of Nd-Fe-B sintered magnets and there is a concern that the magnet is demagnetized by heat generated from AC-magnetic loss. The evaluation of the AC-magnetic loss especially at high temperature corresponding to internal environment in the motor during driving is important and the measurement-system for evaluation of the AC-magnetic loss was developed. In this paper, the behavior change of the AC-magnetic loss at high temperature (–200˚C) in Nd-Fe-B sintered magnets having various H_{cj} *and* B_r *was presented. They indicated that the behavior is different between each Nd-Fe-B sintered magnet, and that it is difficult to consider the behavior associating the loss with basic magnetic properties in the magnets such as* H_{cj} *and* B_r*. Furthermore, it was clarified that it is unable to understand the loss-behavior from the change of classical eddy current loss.*

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With increasing importance attached to protection

high power and high efficiency in the traction motors of EV/HEV, Nd-Fe-B sintered magnets have been ties of Nd-Fe-B sintered magnets change remarkably depending on temperature, how AC-magnetic loss changes with temperature is not known. In conventional method, Since the AC-magnetic loss ΔW_t of a magnet under a high frequency AC magnetic field con-

3. E

3.1

Chapter 2 showed that the AC-magnetic loss of a magnet can be calculated by measuring the H of the applied AC magnetizing fore and measuring and calculating the flux density B of the magnet at that time. This section introduces a method for actually measuring H and B. Figures 2 and 3 show schematic diagrams of the measurement systems in the AC magnetizing device used on those measurements. In this measurement system, the sample magnet is placed in the excitation coil, and an AC magnetizing fore is applied to the magnet by the AC magnetizing fore generated by electrification of the coil. The flux density B of the

Retentivity B_r, or other basic property values.

4.2 DC E

F **5** shows the temperature dependence of the DC electrical resistivity of the sample magnets. The vertical axis shows the rate of change of electrical resis

5. D ,

AC-magnetic loss W_t comprises eddy current loss W_e and hysteresis loss W_h. Their relationship is as shown in the following Eq. (5)[5].

$$W_t[\mathrm{W/kg}] = W_h[\mathrm{W/kg}] + W_e[\mathrm{W/kg}] = k_h f B^2 + k_e f^2 B^2 \quad \cdots\cdots\cdots (5)$$

f : frequency, B: flux density of magnet

k

shows an enlargement of Fig. 8 (only for 110˚C and 150˚C). As the temperature increased, J_m showed an increasing tendency, and in particular, J_m increased dramatically at 150˚C (Fig. 8). However, the loop width became narrower at 150˚C (Fig. 9). From this loop behavior, it can be inferre.T itper26.6 (b)0.m0.00(.T6 (ic)90.7 (incr)92.8 (eer)7 b)0.s[b)0.5