

Behavior of a permanent magnet used for a high efficiency motor under a high frequency magnetic field

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The development of high efficiency motors is accelerating as energy problems become more serious. Many magnetic materials are used in high efficiency motors, and the demands on the properties of the magnetic materials are changing greatly by the use of power electronics¹⁾.

For example, in soft magnetic materials such as electrical steel, increases in iron losses of 20% to 60% caused by the inverter excitation have been reported¹⁾.

On the other hand, hard magnet such as permanent magnets, as the electric resistivity of rare earth sintered magnets is very low in comparison with ferrite sintered magnets, the eddy current loss on the surface of the magnet can not neglect. As a result, the measurement and numerical analysis of losses under AC magnetic fields based on NdFeB sintered magnets has been studied^{2), 3)}.

With recent high speed motors, larger magnetic fields are applied to the magnet and the frequencies of those fields are higher, and as a result the problem of magnet losses will become more important.

However, up to now the studies of these problems were restricted to estimates of magnet losses, while studies of their magnetic phenomena or the behavior of the magnets have not been carried out. In order to study the magnetic behavior of magnets under high frequency fields, we have started up the Energy Magnetics Special Meeting, and intend to study the issues in depth.

Among these issues, a method for magnetic measurement under the high frequency magnetic field will be a problem.

For understanding the magnetic behavior of magnets, the DC BH tracer has been the main tool to date. Therefore, we plan to develop an experimental device and to measure magnetic behavior using this device under a high frequency magnetic field. Fig.1 is a conception of the device being planned now. It is planned to produce a frequency of 10kHz and magnetic field of 330Oe by using a pulse electric current in a multilayered winding solenoid coil. In this presentation, we report the outline, performance, and problems of the high frequency magnetic field emitting device, and actual measurement results to clarify the types of issues facing this development.

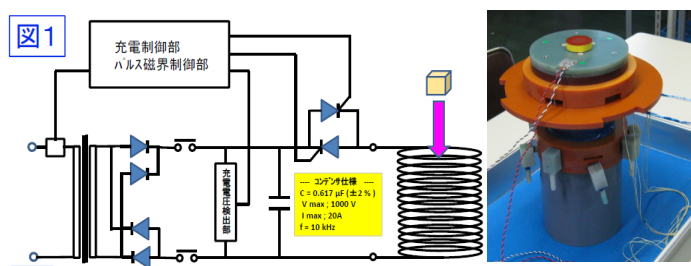


Fig.1 The concept of high frequency magnetic field device.

Reference

- 1) K.Fujisaki : IEE Japan, MAG-13-149
- 2) K.Itoh, Y.Hashiba, K.Sakai, T.Yagisawa : T.IEE Japan, Vol.118-A (1998) p.182
- 3) K.Yamazaki, A.Abe: T.IEE Japan, Vo.127-D (2007) p.87