DU02

Polarization Enhancement and Depolarization by Induced Electric Field in Mn-Zn Ferrimagnetic Sample and its Influence on its Permittivity Measurement

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Mn-Zn ferrites have high permeability as well as high permittivity simultaneously [1-4]. This unique property makes its magnetization and polarization different from those in its low-frequency counterpart, silicon-iron material. In silicon-iron material, the induced magnetic field is demagnetizing field, induced electric field depolarizing one. But in Mn-Zn ferrite sample, the induced electric field could be either polarization enhancement or depolarization, when it is inserted between two electrodes to construct a capacitor for measuring its complex permittivity[1-4]. This paper investigates depolarization and polarization enhancement in Mn-Zn ferrites, by using a capacitor constructed from two electrodes with a solid rectangular Mn-Zn ferrite sample inserted between them. It is found that in low-loss frequency region, high permeability of Mn-Zn ferrites produces an induced electric field that strengthens the incident electric field and makes the resultant field higher than it. This phenomenon makes the measured permittivity pronouncedly larger than its intrinsic value in the low-loss frequency region. It is also found that the larger the sample is, the bigger the difference. When the frequency is high and consequently the ferrite sample becomes more dissipative, the induced electric field weakens the incident electric field, and results in the measured permittivity smaller than its intrinsic value. The larger the sample, the more pronounced the effect is. Figure 1 shows the polarization enhancement in a rectangular ferrite sample, from which one can see the resultant field is higher than the incident electric field. The depolarization phenomenon will be shown in the detailed paper.

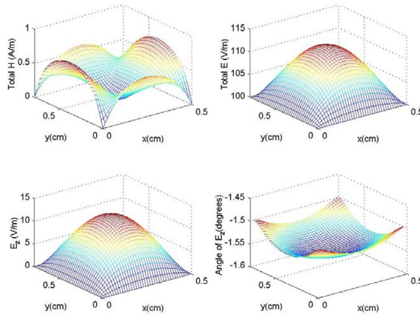

Fig. 1. Polarization enhancement.

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DU03

Magenetic Properties and Workability of Fe-Si Alloy Powder Cores

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Fe-6.5% Si alloys have a good magnetic property for electronic device application due to their high electrical resistivity, very low magnetostriction, and low crystalline anisotropy. Despite of their high potential these alloys have been seldom used in magnetic applications because of very poor ductility of Si-steel above 3% Si[1-6]. It is not easy to have compressed Fe-6.5% Si powder cores with an excellent property because of low density due to poor ductility. In compressed powder cores, high density is essential to get high magnetization and permeability. Therefore, intrinsic magnetic properties and mechanical properties should be compromised in order to get reasonable magnetic properties for the engineering applications. In this study Fe-3%Si powder cores were attempted because the Fe-3%Si alloys have relatively good magnetic properties and room temperature ductility. Gas atomized Fe-3% Si powder smaller than 150 μm were compressed to toroid shape cores with inner and outer diameter of 27 and 14 mm, respectively. The compressed cores were annealed at 880°C for 1 hr in nitrogen atmosphere. By reducing Si content to 3 wt.% hysteresis loss could be greatly reduced and thus total core loss could be optimized. The optimized total core loss is 600 mW/cm^3 at 0.1 T and 50 kHz. The properties better than those of Fe-6.5%Si cores were attributed to better dc magnetic properties which were due to higher compaction ratio[Fig.1].

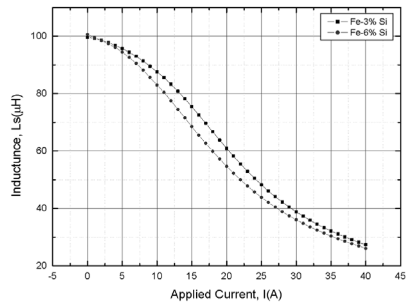

Fig. 1. DC magnetic property of Fe-Si alloy powder core as a function of Si content.

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