Mechanical and Magnetic Properties of Multilayer Ferrite

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Introduction

Ferrite chip inductors can be classified into winding types and multilayer types. The multilayer coil parts, which use Ag for the internal conductor must be sintered at low temperature in the vicinity of 900℃. There have been many studies into how to obtain low temperature sintered ferrite, which has a high density and highly magnetic properties. The authors have also been engaged in the development of a high performance NiCuZn ferrite(1).

The multilayer chip inductor, due to its shape, is very strong and resistant to thermal shock. In this study, we made ferrite multilayer bodies using the Doctor Blade method, and proved the superiority of multilayer ferrite to conventional ferrite in terms of mechanical and magnetic properties, irrespective of the shape.

Experimental Procedure

The composition of the ferrite is $[NiO_{0.30}CuO_{0.12}ZnO_{0.58}]Fe_2O_4$. The raw materials were commercial grade NiO, CuO, ZnO, and Fe_2O_3 powders. The above raw materials were weighed and then mixed by a wet ball mill for 15 hours. Then, the mixed powders were dried and calcined at 700℃ for 2 hours. The calcined powders were milled by a wet ball mill for 30 hours. Afterward, the mixed powders were thoroughly mixed with PVB solution, and flat ferrite sheets of about 50μm in thickness were fabricated by the Doctor Blade method. The sheets were laminated under pressure of 20MPa at 80℃. The green compacts prepared by cutting were sintered at between 920～960℃.

For comparison, we made some specimens by conventional dry pressing.

Results and Discussion

Figure 1 shows the bending strength and the electromagnetic properties. It is clear that multilayer ferrite(M) is superior in strength compared with the other specimens by conventional dry pressing(B and C). The fractured surfaces of specimens are shown in Figure 2. Although intragranular fracture and

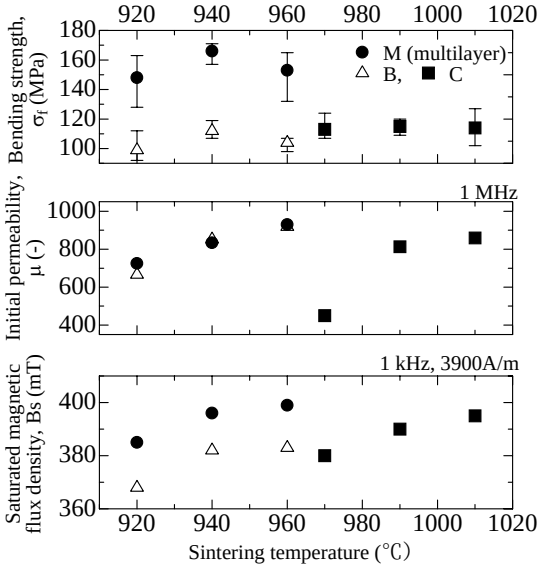
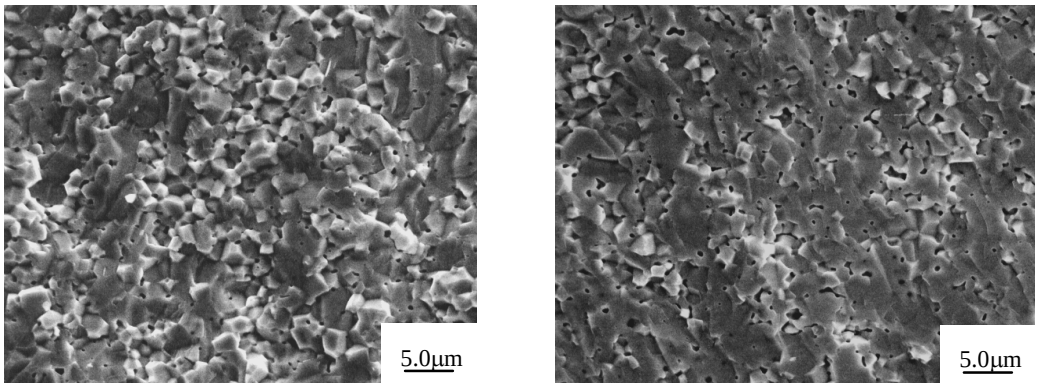


Fig. 1 Effects of preparing condition on bending strength and magnetic property.

intergranular fracture coexist in both, in the case of the multilayer ferrite, there is clearly a greater ratio of intergranular fracture. Similar results were obtained with other multilayer specimens.
The saturated magnetic flux density Bs of the multilayer ferrites were improved, as is shown in Figure 1.



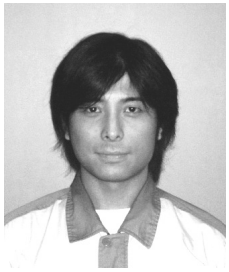
(a) (b)

Fig. 2 SEM images of fracture surface of M-920(a) and B-920(b).

Reference

[1] Y. Matsuo, M. Inagaki, T. Tomozawa and F. Nakao, *IEEE Trans. Mag.*, 37, 2359 (2001)

Biographical Sketch



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