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PREPARATION OF HIGH-ORIENTED FERROXPLANA $Ba_2Co_2Fe_{12}O_{22}$ CONSISTING OF FINE SINGLE CRYSTALS

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1. INTRODUCTION

$Ba_2Co_2Fe_{12}O_{22}$ (Co_2Y) one of hexagonal ferrites has magnetic anisotropy of plana type[1], that is, easy magnetization plane (0001).

Because of Sneok's effect [2] by magneto-crystalline anisotropy , spinel ferrites are not adapt to high frequency, but Co_2Y is favorable magnetic core for very high frequency. Especially, with the progress of high frequency application to recent electronic engineering and telecommunication, the needs of developement of Co_2Y magnetic core for high frequency are increased.

The various methods of preparation of Co_2Y have been reported, but restricted to single crystal growing for basic research of electromagnetic characteristics. Although the process using the wet chemical preparation was reported recently, to obtain Co_2Y of the single-phase crystals dipersed perfectly it is very difficult.

This study is a basic research for manufacture of the high-oriented polycrystals, the magnetic properties of which can be compare with that of single crystal, using the powder by glass crystallization and pressing in magnetic field.

2. EXPERIMENTAL PROCEDURE

Particles of Co_2Y single crystal are manufactured by crystallization of glass. The stable slurry obtained by mixing powder, distilled water (PVA 10 wt% an aqueous solution) and ammonium citrate, divasic 1 wt% as dispersant, was injected into plaster mold in magnetic field and dried for 24 hours at room temperature.

The casting specimens was sintered from 1000 ℃ to 1300 ℃. At 1200 ℃, sintering carried out at Po_2 = 0.1 , 0.21 , and 1 atm. The heating / cooling rate and the final hoding time are fixed to 200 ℃/hr and 1.5 hours respectively.

The charateristic of powder and sintered samples were studied by use of XRD, SEM, TGA, dilatometer, and VSM.

3. RESULTS

In the powder manufactured by crystallization of glass, $CoFe_2O_4$ phase is existed little besides Co_2Y phase. The magnetization and Curie temperature Tc are consistent with the other reported papers(σ_s = 35 emu/g, Tc = 670 °K).

Since σ_s converges approximately to 1 emu/g at 690 ℃, the $CoFe_2O_4$ phase with Tc = 780 °K was identified.

During sintering the disoriented pressed sample, the abrupt shrinkage is occured at 1050 ℃. By result of TGA, it is confirmed that the reduction reaction(Fe^{3+} --> Fe^{2+}) takes place at 1050 ℃.

The results of observation of cutting section of oriented sample show that average particle size is 3~5 μm, and paticles are distributed very homogeneously.

The easy magnetization direction has the highest σ_s, σ_r value and the difficult direction the lowest σ_s, σ_r value and disoriented sample has intermediate value, but $_{iH}c$ has the same value in all cases.

4. REFERENCE

1) J.Smit and H.P.H.Wijn , "Ferrites" , Philips Tech. Library , Eindhoven , the Netherlands , 202-210 (1965)

2) J.L.Sneok , "Dispersion and absorption in magnetic ferrites at frequencies above one megacycle", Physica , 14 , 207-217 (1948)