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THE RELATION BETWEEN THE MICROSTRUCTURE AND MAGNETIC PROPERTIES OF YIG CERAMICS

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1. INTRODUCTION

After C.L.Hogan reported gyromagnetic resonance for 10 GHz in 1952, the application has been actively developed. Recently these have been made useful for communication and radar in the frequency band from 30 MHz to 100 GHz.

Ferrites for microwave are hexagonal ferrites , garnets and spinel ferrites. Especilly, garnets have particular property that is apt for computer storage, acoustics and integrated optics [1].

Because the accumulated energy by precession of the garnets are larger than dissipated energy, resonator can be fabricated using magnetic resonance. Therefore yttrium iron garnet is expected for filter, oscillator, laser and ultrasonic generator, and magnetic core for mm wave telecommunication.

The purpose of this paper is about the relation between microstructure , and magnetic properties of stoichiomatric YIG ceramics.

2. EXPERIMENTAL PRECEDURE

The sintered YIG of stoichiometric composition (Y_2O_3 : Fe_2O_3 = 3:7) was prepared by use of conventional ceramic method. Wet milling is carried out by stainless steel ball mill with ethanol for 24 hours. The mixed powder was calcined from 900 ℃ to 1400 ℃ for 6 hours. This calcined sample was ground in stainless steel ball mill and pressed at pressure of 2×10^4 MPa.

The toroidal sample was sintered at most suitable temperature. The crystal structure, microstructure and magnetic properties of the sintered YIG ceramics were observed by XRD, optical microscope, VSM and BH tracer.

3. RESULTS

In YIG powder calcined at 1000℃, intermediate perovskite phase ($YFeO_3$) exists. At 1100 ℃, the formation of garnet phase begins, and YIG phase is mostly identified above 1200 ℃.

At 1400 ℃, the density of YIG toroidal sample is about 95 % of theoretical density. Hc and Br value decrease with the increase of sintering temperature.

4. REFERENCE

1) H.Stumpf and K.Wildermuth , "Magnetic Garnets", Vieweg Tracts in Pure and Applied Physics , 5 , (1981)