Effects of La and Ti Substituting Elements on Magnetic Properties of Barium Hexaferrite Powders

Emre Burak Ertuş[a,c], Serdar Yildirim[b] and Erdal Çelik[b]

[a)] KTO Karatay University, Materials Science and Nanotechnology Engineering, Karatay, Konya, Turkey
[b)] Dokuz Eylul University, EMUM Electronic Materials Production and Application Centre, Buca, Izmir, Turkey
[c)] Middle East Technical University, Metallurgy and Material Engineering, Çankaya, Ankara, Turkey

ABSTRACT

One of the most important hexagonal ferrite is barium ferrite, $BaO.6Fe_2O_3$. Barium ferrite crystallizes in the hexagonal magnetoplumbite structure. Barium hexaferrite have been widely using as a material for permanent magnets, microwave absorber devices, recording media due to its high stability, excellent high frequency response, narrow switching field distribution and the temperature coefficient of the coercivity in various applications [1-4].

In this study pure and doped barium hexaferrite powders were produce by the sol-gel method. Titanium and Lanthanum elements were substituted to the raw materials with appropriate stoichiometric ratios ($BaFe_{12}O_{19}$, $Ba_{0.7}Ti_{0.3}Fe_{12}O_{19}$ and $Ba_{0.7}La_{0.3}Fe_{12}O_{19}$) to obtain doped barium hexaferrite powders. Barium nitrate, iron (III) nitrate, lanthanum (III) nitrate and titanium (IV) isopropoxide was used as precursor materials. After pre-heat treatment process, the produced xerogels were characterized with FTIR in order to investigate the nature of the chemical bonds formed and DTA-TG analysis for define thermal behavior of dry gels. After final sintering process, X-ray Diffractometry (XRD) and X-ray Photoelectron Spectroscopy (XPS) were used for phase identification and elemental analysis of produced powders respectively. In order to examine the particle morphology of powders, scanning electron microscopy (SEM) was used. Finally Vibrating Sample Magnetometer (VSM) was utilized to investigate the magnetic properties of barium hexaferrite powders. The effects of substituting elements were studied in terms of magnetic properties and microstructure of barium hexaferrite powders. Magnetic properties remarkably changed by substitution of La^{3+} and Ti^{4+} ions for Ba^{2+} in the $BaFe_{12}O_{19}$. Coercivities from 4200 to 5100 Oe, remanences from 22 to 49 emu/g and saturation magnetizations from 41 to 73 emu/g were obtained for different samples. The obtained results were discussed in detail.

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