Effects of Fe Ions Substitution on the Structure and Magnetic Properties of $Ba_{0.95}Bi_{0.05}TiO_3$

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1. Introduction

$BaTiO_3$(BTO)is known as a classical ferroelectric material with Curie temperature(T_C) at 120℃. It belongs to tetragonal perovskite structure at room temperature and has a wide range of application such as capacitor, positive temperature coefficient of resistance thermostat, and piezo electricsensors[1]. It has been reported that the substitution of Bi^{3+}ion on Ba^{2+}site resulted an increase in dielectric constant and the T_C[1,2]. On comparison the other hand, transition metal ions doped BTO are reported to have a magnetic ordering[3]. However, the ferroelectricity of those materials is suppressed[4]. Based on those reports, we synthesized $Ba_{0.95}Bi_{0.05}Ti_{1-x}Fe_xO_3$($0 \leq x \leq 0.1$) in order to study the effects of Fe ions on the structure and magnetic properties of Bi doped BTO.

2. Experimental

Polycrystalline samples of $Ba_{0.95}Bi_{0.05}Ti_{1-x}Fe_xO_3$($0 \leq x \leq 0.1$) were prepared via solid-state reaction. The structure of samples was confirmed by powder x-ray diffraction(XRD) measurements using CuKα radiation. Isothermal magnetization measurements at room temperature were measured using VSM (Lakeshore 7300).

3. Results and Discussion

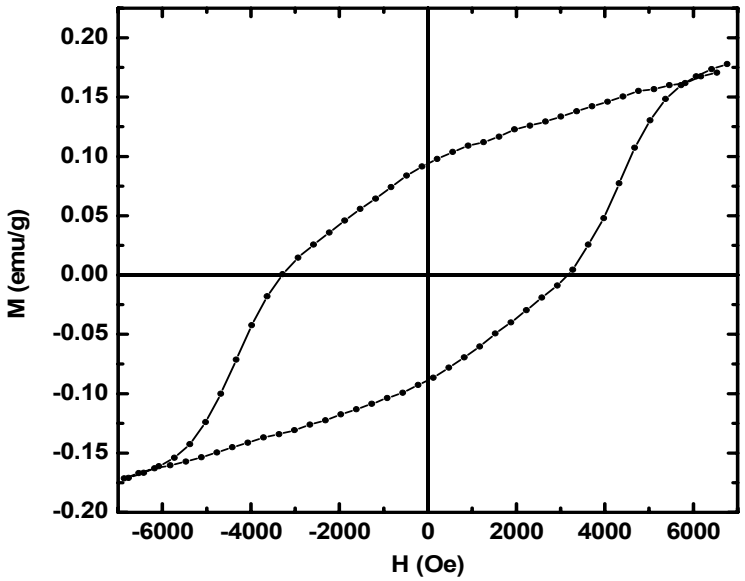

Fig. 1. The M(H) hysteresis loops of $Ba_{0.95}Bi_{0.05}Ti_{0.9}Fe_{0.1}O_3$ at room temperature.

XRD data indicate that $Ba_{0.95}Bi_{0.05}TiO_3$ has a tetragonal structure, but for x≥5% of Fe ions substitution, the tetragonal structure is gradually merged in hexagonal structure. The large hysteresis of MH curve at room temperature for $Ba_{0.95}Bi_{0.05}Ti_{0.9}Fe_{0.1}O_3$ is shown in Fig. 1. The magnetic moments increase when the doping amount increases. It is believed that the magnetic properties come from the superexchange between pentahedral Fe^{3+} ions and also between pentahedral and octahedral Fe^{3+} ions[5].

4. References

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