

Investigation of the multiferroics properties of the substitution of Sr in the BiFeO₃ matrix

K. Belakroum¹, M. Batouche¹, V. Tsurkan², A. Loidl²

¹ Université Kasdi Merbah-Ouargla, Département de physique, laboratoire de développement des énergies nouvelles et renouvelables dans les zones arides et sahariennes

² Experimental Physics V, Centre for Electronic Correlations and Magnetism, Institute of Physics, University of Augsburg, 86135 Augsburg, Germany
mouna.batouche@gmail.com

Abstract

Multiferroic materials have renewed interest in recent years, in which both ferromagnetic and ferroelectric properties exist in the same phase [1]. As a result they have spontaneous magnetization which can be switched by an applied field, spontaneous polarization which can be reoriented by an electric field, and often some coupling between the two. Special device application which has been suggested for such materials include multiple state memory elements, electric field controlled ferromagnetic resonance devices, and transducers with magnetically modulated piezoelectricity [2]-[3]. Many efforts have been devoted to find new materials with and to find multiferroic properties in known compounds. However, almost all those gigantic magnetoelectric effects occur essentially below liquid-nitrogen temperature. BiFeO₃ is an interesting candidate as magnetoelectric materials because the ferroelectricity and antiferromagnetic order present simultaneously at room temperature. G-type antiferromagnetic ordering takes place at 640 K, while ferroelectric order appears at a higher temperature of 1100 K [4]. One problem for BFO as a room-

temperature multiferroic is its intrinsic antiferromagnetic ordering. In order to improve the properties of BFO ceramics, some attempts have been made including doping rare earth (RE) or Mn, respectively, on the Bi sites or Fe sites, and fabricating strained films [5]. However, little improvement in the magnetic properties of BFO has been achieved by element substitution, and the role of strain in magnetization also requires further investigation. The crystal and magnetic structure of polycrystalline Bi_{1-x}Sr_xFeO_{3-δ} for x = 0.1 prepared by a solid-state reaction method. The sample is characterized by using various techniques: X-ray diffraction (XRD) study is carried out for phase determination and lattice parameter calculations (a = b = 31.00000 Å° et c = 41.00000 Å°). The magnetization measurement

performed at room temperature showed a perfect hysteresis loop with large remnant magnetization.

References

1. Schmid, H., *Ferroelectrics*, 162, 317 (1994).
2. Dho, J. H., X. D. Qi, H. Kim, J. L. MacManus-Driscoll, and M. G. Blamire, *Adv. Mater.*, Weinheim, Ger., 18, 1445 (2006).
3. Lorenz, B., A. P. Litvinchuk, M. M. Gospodinov, and C. W. Chu, *Phys. Rev. Lett.*, 92, 087204 (2004).
4. Lampis, N., C. Franchini, G. Satta, A. Geddo-Lehmann, and S. Massidda, *Phys. Rev. B*, 69, 064412 (2004)
5. Hai-Xia Lu, Xiang-Yu Mao, Wei Wang, and Xiao-Bing Chen *Progress In Electromagnetics Research Symposium*, Hangzhou, China, March 24-28 (2008)