BR13

Enhancement of Ferromagnetic Properties in Epitaxial (001) $BiFeO_3$ Films by Co Doping

Sang-Hyun Kim[1]*, Ki-Yeon Kim[2], and Sung-Chul Shin[1]

[1]Department of Physics and Center for Nanospinics of Spintronic Materials, Korea Advanced Institute of Science and Technology, Daejeon 305-701, Korea

[2]Neutron Science Division, Korea Atomic Energy Research Institute, Daejeon 305-353, Korea

*Corresponding author: Author1 Kim, e-mail: acejoey@kaist.ac.kr

The magnetoelectric (ME) effect, which is the induction of magnetization by an electric field or polarization by a magnetic field has enabled multiferroics to become materials with exciting possibilities. Among them, $BiFeO_3$ (BFO) has been intensively studied, because of having a large polarization at room temperature. In spite of its superiority in electrical properties, the presence of antiferromagnetism(or weak ferromagnetism) has inhibited the observation of ME effect in BFO films. In this paper, we report the enhancement of ferromagnetic properties in epitaxial (001) BFO films achieved by Co doping. Epitaxial (001) BFO films with 800-nm thickness have been successfully grown on (001) $SrTiO_3$ (STO) substrate by on-axis sputtering technique. The Co doping ratio is controlled by adjusting Co chips on the BFO target during deposition. At room temperature, the pure BFO film shows antiferromagnetic behavior, as shown in Fig. 1(a). As the Co-doping ratio increases, both the saturation magnetization and the coercivity dramatically increase up to 69 emu/cc and 680 Oe, respectively, as shown in Fig. 1(b). We believe that the Co plays a role of ferromagnetic particles in antiferromagnetic BFO film. Such ferromagnetic particles can easily increase the saturation magnetization and ferromagnetic particles in antiferromagnetic BFO film can induce the exchange bias, which is considered to be the reason of the increase in the coercivity.

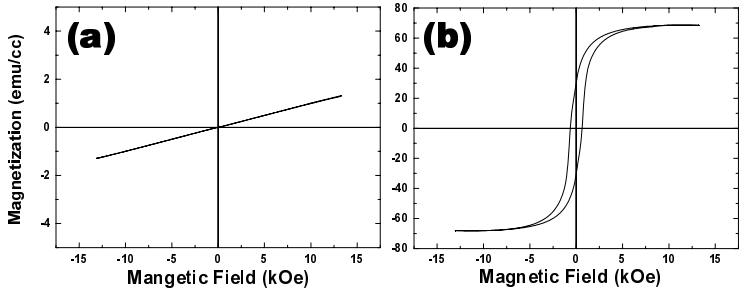

Fig. 1. M-H hysteresis loops of the pure BFO film (a) and the Co-doped BFO film (b).

This research work was supported by the National Research Laboratory Project, the Global Partnership Program, and the Basic Research Program.

BR14

Synthesis, Structural Details and Induction of Superconductivity in $Ga_{1-x}Pb_xSr_2Y_{1-y}Ca_yCu_2O_7$ (x=0.0 to 0.6 & y=0.0 to 0.5)

Shiva Kumar, Anuj Kumar, V.P.S. Awana*, and H. Kishan

National Physical Laboratory, New Delhi-110012, India.

*Corresponding author: V. P. S. Awana, e-mail: awana@mail.nplindia.ernet.in

We have synthesized $Ga_{1-x}Pb_xSr_2Y_{1-y}Ca_yCu_2O_7$ (x = 0.0 & y = 0.0 to 0.5; y = 0.0 & x = 0.0 to 0.6; x = 0.30 & y = 0.2 ,0.3 & 0.35) 1212 type compound. The samples are synthesized by solid state reaction route in air with calcinatning at 980C, and 1000C &sintering at 1020C with intermediate grindings. All the compounds have single phase orthorhombic structure with space group Ima2, Fig.1. shows the Reitveld refinement for all the compositions. For $GaSr_2Y_{1-y}Ca_yCu_2O_7$ composition it shows that there is decrease in lattice parameter a, b and c with increasing Caand it is soluble up to y<0.50, Table 1. The room temperature conductivity also improves with increasing Ca content. For $Ga_{1-x}Pb_xSr_2YCu_2O_7$ composition there is increase in a, b and c with increasing Pb content and it is soluble up to x<0.70.The R-T measurement shows as $GaSr_2Y_{1-y}Ca_yCu_2O_z$ and $Ga_{1-x}Pb_xSr_2YCu_2O_7$ compositions are highly semiconductig though compositions $(Ga_{0.7}Pb_{0.3})Sr_2Y_{1-y}Ca_yCu_2O_7$ (y= 0.2, 0.30 & 0.35) have less semi conductivity.

Sample	a(Å)	b(Å)	c(Å)
$GaSr_2YCu_2O_7$	22.7953 (12)	5.4807 (2)	5.3929 (2)
$GaSr_2Y_{0.7}Ca_{0.3}Cu_2O_7$	22.7831 (14)	5.4741 (2)	5.3870 (3)
$Ga_{0.5}Pb_{0.5}Sr_2YCu_2O_7$	23.1970 (15)	5.3992 (2)	5.4360 (3)
$Ga_{0.4}Pb_{0.6}Sr_2YCu_2O_7$	23.3103 (19)	5.4087 (4)	5.4260 (4)
$Ga_{0.7}Pb_{0.3}Sr_2Y_{0.65}Ca_{0.35}Cu_2O_7$	22.8624 (33)	5.4531 (7)	5.3830(7)

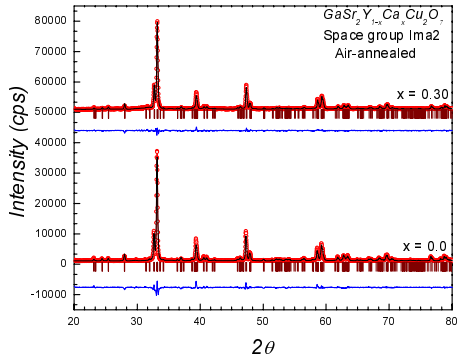

Fig. 1. Fitted and observed X-ray diffractions for $GaSr_2Y_{1-y}Ca_yCu_2O_7$ with y = 0.0 and 0.30 samples.