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Electrical and Magnetic Properties of (1-x)CoFe$_2$O$_4$-(x)BaTiO$_3$ Composites

Achana Khamkongklaeo$^1$, Teerapon Yumwong$^1$, and Santi Maesini$^{1,2,*}$

$^1$Department of Physics, Faculty of Science, Khon Kaen University, Khon Kaen, 40002, Thailand.
$^2$National Metals and Materials Technology Center (MTEC), Thailand Science Park, Pathumthani, 12120, Thailand.

*Corresponding author: Achana Khamkongklaeo, e-mail: achana_k@kku.ac.th

The magnetoelectric composites, namely (1-x)CoFe$_2$O$_4$-(x)BaTiO$_3$ (CF-BT) in which x varies as 0.3, 0.4, 0.5, 0.6, 0.7, 0.8 and 1.0 have been prepared by wet ball milling method using nanopowders of CoFe$_2$O$_4$ (35-55 nm) and BaTiO$_3$ (85-128 nm) as starting materials. The compacted CF-BT samples were sintered at 1200°C for 18 hours in air to obtain CF-BT composites. The structure of the sintered CF-BT composites was studied by XRD technique. Morphology of the CF-BT composites was revealed by SEM. The magnetic properties of composite samples were measured using vibrating sample magnetometry (VSM). Room temperature magnetization results showed a ferromagnetic behavior for all the CF-BT composite, having the values of specific magnetic moment (M_s) in the range of 15-46.5 emu/g at 10 kOe. M_s decreased with increasing the BaTiO$_3$ concentration. The dielectric properties were determined as a function of the temperature ranging from -50 to 200°C at 1 kHz. The dielectric constant did not depend on the parameter x. The effects of parameter x on the electrical and magnetic properties of the materials were discussed.

Characterization of CoCr$_2$O$_4$ on Pt(111) Grown by Using Pulse Laser Deposition

Kang Ryong Choi, Seung Je Moon, Taejoon Koh, In Bo Shim, Sam Jin Kim, and Chul Sung Kim$^*$

$^*$Department of Physics, Kookmin University, Seoul 136-702, Korea

*Corresponding author: Chul Sung Kim, e-mail: ckim@kookmin.ac.kr

CoCr$_2$O$_4$(CCO) materials show multiferroic effect that ferroelectricity and ferromagnetism co-exist[1,2]. CCO film was deposited on Pt/Ti/SiO$_2$ substrates by Pulse Laser Deposition (PLD). The CCO film were prepared using KrF(248 nm) excimer lasers and with a pressure of 100 mTorr, substrate temperatures of 70°C. The crystal structure was found to be oriented (111) planes by means of X-ray diffraction (XRD) with Cu radiation. The thickness and morphology of film were measured by scanning electron microscopy (SEM) and atomic force microscopy (AFM). The magnetic properties were measured using a Superconducting Quantum Interference Device(SQIUD). The ferrimagnetic transition was observed at around 95 K, which was determined as Néel temperature and spin magnetic transition temperature($T_S$) was 21.5 K, while the $T_C$ of bulk CCO was 28.0 K. We note that lowering of CCO film in $T_C$ is closely related to the preferred orientation of (111) direction.

REFERENCES