Effects of Sintering Conditions on Magnetic Properties of Nanocrystalline $BaTiO_3$ Powders

R. Rajagukguk*, Hadiyawarman, K. J. Parwanta, B. W. Lee and C. Liu
Department of Physics, Hankuk University of Foreign Studies

$BaTiO_3$ is known to be a classical ferroelectric material with Curie temperature around 120℃. Due to its wide range applications, nanocrystalline $BaTiO_3$ (n-BTO) has been getting more research attention over the last decade. Recently, n-BTO is reported to have a magnetic ordering at room temperature which has never been observed in bulk BTO[1,2]. It was suggested that the existence of magnetic ordering on n-BTO is due to oxygen vacancy on the surface of the crystal[1,3]. It is expected that the amount of vacancy can be controlled through sintering conditions. As the heat treatment will yield different phase of n-BTO, we believe that different heat treatment will induce changes in the magnetic properties of n-BTO.

The n-BTO powder was synthesized by using a polymer precursor method. The precursor was produced using $BaCO_3$, $Ti(O\text{-}iPr)_4$, citric acid, and Ethylene glycol. The obtained precursor was heated at 600~900℃ for 2-8 h in air ambient. X-ray diffraction was carried out using Rigaku diffractometer Miniflex with Cu-K_α radiation. The magnetization (M) was measured using a vibration sample magnetometer at room temperature.

XRD data shows that the samples which are heated at 900℃ have tetragonal phase while those that heated below 900℃ have cubic phase. The effects of heating treatment on the crystal structure and the magnetic properties of n-BTO will be discussed.

References

[1] R.V.K. Mangalam, Nirat Ray, Umesh V. Waghmare, A. Sundaresan, and C.N.R. Rao, Solid State Commun. **149**, 1 (2009).

[2] S. Qin, D. Liu, Z. Zuo, Y. Sang, X. Zhang, F. Zheng, H. Liu, and X. Xu, J. Phys. Chem. Lett. **2**, 238 (2010).

[3] A. Sundaresan, R. Bhargavi, N. Rangarajan, U. Siddesh, and C. N. R. Rao, Phys. Rev. B **74**, 161306 (2006).