ST-P003

Enhanced Magnetic Properties of $BiFe1-_xNi_xO_3$

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Multiferroic materials have been widely studied in recent years, because of their abundant physics and potential applications in the sensors, data storage, and spintronics. $BiFeO_3$ is one of the well-known single-phase multiferroic materials with ABO_3 structure and G-type antiferromagnetic behavior below the Neel temperature T_N ~ 643 K, but the ferroelectric behavior below the Curie temperature T_c~1,103 K. In this study, the $BiFe_{1-x}Ni_xO_3$ (x=0 and 0.05) bulk ceramics were prepared by solid-state reaction and rapid sintering with high-purity Bi_2O_3, Fe_3O_4 and NiO powders. The powders of stoichiometric proportions were mixed, as in the previous investigations, and calcined at 450°C for $BiFe_{1-x}Ni_xO_3$ for 24 h. The obtained powders were grinded, and pressed into 5-mm-thick disks of 1/2-inch diameter. The disks were directly put into the oven, which has been heated up to 800°C and sintered in air for 20 min. The sintered disks were taken out from the oven and cooled to room temperature within several min. The phase of samples was checked at room temperature by powder x-ray diffraction using a Rigaku Miniflex diffractometer with Cu Kα radiation. The Raman measurements were carried out by employing a hand-made Raman spectrometer with 514.5-nm-excitation Ar+ laser source under air ambient condition on a focused area of 1-μm diameter. The field-dependent magnetization measurements were performed with a superconducting quantum-interference-device magnetometer.

Keywords: Multiferroic, BiFeO3, Magnetic properties, Ferroelectric properties