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Ferroelectric and Magnetic Properties of Dy and Co Co-Doped $BiFeO_3$ Ceramics

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Multiferroic materials have attracted much attention due to their fascinating fundamental physical properties and technological applications in magnetic/ferroelectric data-storage systems, quantum electromagnets, spintronics, and sensor devices. Among single-phase multiferroic materials, $BiFeO_3$is a typical multiferroic material with a room temperature magnetoelectric coupling in view of high magnetic-and ferroelectric-ordering temperatures (Neel temperature T_N～647 K and Curie temperature T_C～1,103 K). Rare-earth ion substitution at the Bi sties is very interesting, which induces suppressed volatility of Bi ion and improved ferroelectric properties. At the same time, Fe-site substitution with magnetic ions is also attracting, and the enhanced ferromagnetism was reported. In this study, $Bi_{1-x}Dy_xFe_{0.95}Co_{0.05}O_3$ (x=0, 0.05 and 0.1) bulk ceramic compounds were prepared by solid-state reaction and rapid sintering. High-purity Bi_2O_3, Dy_2O_3, $Fe_2O_3$and Co_3O_4 powders with the stoichiometric proportions were mixed, and calcined at 500°C or 24 h to produce $Bi_{1-x}Dy_xFe_{0.95}Co_{0.05}O_3$. The samples were immediately put into an oven, which was heated up to 800°C nd sintered in air for 30 min. The crystalline structure of samples was investigated at room temperature by using a Rigaku Miniflex powder diffractometer. The field-dependent magnetization measurements were performed with a vibrating-sample magnetometer. The electric polarization was measured at room temperature by using a standard ferroelectric tester (RT66B, Radiant Technologies).

Keywords: Multiferroic, BiFeO3, Magnetic properties, Ferroelectric properties