Simultaneously Enhanced Magnetic and Ferroelectric Properties of Bi$_{0.9}$Dy$_{0.1}$Fe$_{0.97}$Co$_{0.03}$O$_3$ compound

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Multiferroic material BiFeO$_3$ (BFO) is a typical multiferroic material with a room-temperature magnetoelectric coupling in view of high magnetic- and ferroelectric-ordering temperatures (Neel temperature $T_N \sim 647$ K and Curie temperature $T_C \sim 1,103$ K). Rare-earth ion substitution at the Bi sites is very interesting, which induces suppressed volatility of the Bi ion and improved ferroelectric properties. At the same time, the Fe-site substitution with magnetic ions is also attracting, since the enhanced ferromagnetism was reported. In this study, BFO, Bi$_{0.9}$Dy$_{0.1}$FeO$_3$ (BDFO), BiFe$_{0.97}$Co$_{0.03}$O$_3$ (BFCO) and Bi$_{0.9}$Dy$_{0.1}$Fe$_{0.97}$Co$_{0.03}$O$_3$ (BDFCO) compounds were prepared by conventional solid-state reaction and wet-mixing method. High-purity Bi$_2$O$_3$, Dy$_2$O$_3$, Fe$_2$O$_3$ and Co$_3$O$_4$ powders with the stoichiometric proportions were mixed, and calcined at 500°C for 24 h. The samples were immediately put into an oven, which was heated up to 800°C and sintered in air for 1 h. 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). Dy and Co co-doping at the Bi and the Fe sites induce the enhancement of both magnetic and ferroelectric properties of BiFeO$_3$.

Keywords: Multiferroic, BiFeO$_3$, Magnetic properties, Ferroelectric properties

![Fig. 1: $M$-$H$ hysteresis loops of BFO, BDFO, BFCO and BDFCO samples.](image1.png)

![Fig. 2: $P$-$E$ hysteresis loops of (a) BFO, (b) BDFO, (c) BFCO and (d) BDFCO samples.](image2.png)