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ROOM TEMPERATURE SINGLE PHASE MULTIFERROIC AURIVILLIUS COMPOUND

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Multiferroics (MFs) have attracted great research interest due to the coexistence of ferroelectric and magnetic ordering, as well as magnetoelectric (ME) coupling. At present, there is a very limited number of single-phase MFs known and these are still far from practical applications. In single-phase MFs, the simultaneous presence of electric and magnetic dipoles does not guarantee strong (ME) coupling, as the microscopic mechanisms of ferroelectricity and magnetism are quite different and do not intrinsically interact with each other. Here we show that in the Aurivillius system Bi3.25La0.75Ti3-2xNbxFex/2Cox/2O12, the x=0.25 composition is ferroelectrically and ferromagnetically active at room temperature. A single-phase structure was supported by XRD, SEM/EDX and neutron diffraction data. Clear ME couplings were observed in this single-phase material at room temperature, where the magnetic iron and cobalt ions contribute to ferroelectric polarization and magnetic moment simultaneously. The results of structural, electrical and magnetic measurements are supported by first principle calculations. This discovery of room temperature multiferroic activity in this system will help to guide the design of room temperature single-phase MFs with strong ME coupling for sensors and solid-state memory applications.

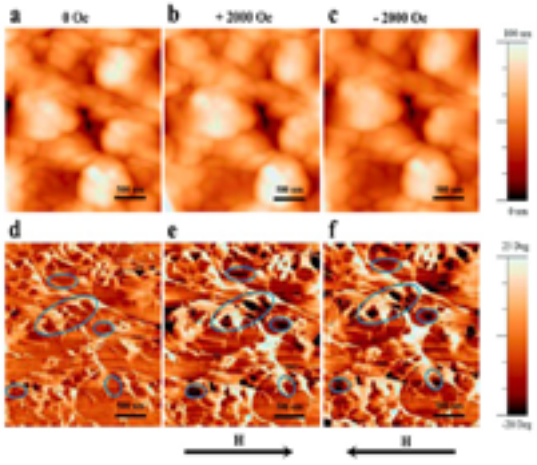

Figure.1: Ferroelectric domain switching under magnetic field in BFCT25. (a) topography and (d) vertical PFM phase at zero magnetic field; (b) topography and (e) vertical PFM phase at +2000 Oe; (c) topography and (f) vertical PFM phase at -2000 Oe via FMR.

Recent Publications

1. Li Zheng et al., (2016). Room temperature magnetoelectric coupling in intrinsic multiferoic Aurivillius phase textured ceramics. In Dalton Trans. 45: 14049.
2. Jia C L et al., (2014). Mechanism of interfacial magnetoelectric coupling in composite multiferroics. Phys. Rev. B 90: 054423.
3. Jia C L et al., (2007). Microscopic theory of spin-polarization coupling in multiferroic transition-metal oxides. Phys. Rev. B 76: 144424.
4. Jia C L et al., (2006). Bond electronic polarization induced by spin. Phys. Rev. B 74: 224444.

BIOGRAPHY

Chenglong Jia is currently working as a Professor at Lanzhou University, China. He was the distinguished visiting fellow of the Royal Academy of Engineering, UK (2015). He is the Deputy-Director of Key Laboratory for Magnetism and Magnetic Materials of the Ministry of Education, Lanzhou University, China. He has published more than 50 papers in reputed journals and has been serving as an Editorial Board Member of repute.

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