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Concurrency control of the multiferroic transition in tetragonal-like $BiFeO_3$ BYUNG-KWEON JANG, KAIST, Daejeon, Republic of Korea, JUN-SIK LEE, SSRL, SLAC National Accelerator Laboratory, CA, JIN HONG LEE, KWANG-EUN KIM, KAIST, Daejeon, Republic of Korea, MIN HWA JUNG, POSTECH, Pohang, Republic of Korea, TAE YEONG KOO, PAL, POSTECH, Pohang, Republic of Korea, YOON-HEE JEONG, POSTECH, Pohang, Republic of Korea, HENDRIK OHLDAG, SSRL, SLAC National Accelerator Laboratory, CA, CHAN-HO YANG, KAIST, Daejeon, Republic of Korea — The highly-elongated tetragonal-like $BiFeO_3$ (BFO) shows the concurrent transition of antiferromagnetic and ferroelectric order close to room temperature [1]. Despite the *concurrency* indicating strong spin-lattice coupling effect, electric switching of the magnetic state has not been demonstrated so far. In this talk, we will introduce our efforts controlling the multiferroic transition temperature by means of A-site chemical substitution. Structural, ferroelectric, and magnetic states with varying chemical substitution ratio and temperature were systematically investigated through x-ray reciprocal space maps, capacitance measurement, and soft x-ray absorption spectroscopy. Landau phenomenological theory was employed to understand the behavior of multiple order parameters in a proposed phase diagram. Finally, we will discuss a new pathway to the electric switching of the magnetic state.

[1] K.-T. Ko *et al.*, Concurrent transition of ferroelectric and magnetic ordering near room temperature. *Nature Communications* **2**, 567 (2011).

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