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Strain control of cationic distribution and magnetism in $Bi_4Ti_3O_{12}$-$BiFeO_3$ composite thin films[1] CHANG HEE SOHN, DONGKYU LEE, XIANG GAO, HO NYUNG LEE, Oak Ridge National Lab — Advancing synthesis science, i.e., knowing not only what kinds of materials are needed, but also how to realize them, is highly desirable to effectively develop materials with novel functionalities and/or desired physical properties. Here, by using pulsed laser epitaxy, we experimentally examine a recent theoretical prediction [A. Y. Birenbaum and C. Ederer, Appl. Phys. Lett. **108**, 082903 (2016)] on controlling the cationic distribution of magnetic Fe and relevant magnetism in Bi4Ti3O12-BiFeO3 (BTFO) by strain engineering. Bulk Bi4Ti3O12-BiFeO3 (BTFO) is known as a ferroelectric and canted antiferromagnetic material with the layered Aurivillius structure, where Ti and Fe ions are rather randomly distributed. Recently, the above-mentioned density functional theory calculations showed a possibility of site-specific substitution of Fe for Ti by epitaxial strain. This site preference of magnetic Fe ions is expected to control the magnetism. We have epitaxially designed BTFO films on various perovskite substrates in order to control the sign and degree of strain. Detailed studies on identifying strain control of the cationic distribution and magnetism were performed and will be presented based on results from x-ray diffraction, atomic-resolution scanning transmission electron microscopy/electron energy loss spectroscopy, and various magnetic measurements.

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