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Electrically controlled magnetization in tricolor superlattices[1]
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— With recent breakthroughs in fabricating high-quality oxide films, ultra thin ferroelectric (FE) films have attracted significant attention. Many FE-based electronic devices proposed to date have a capacitor configuration, where a FE layer is inserted between two identical metal electrodes. We consider theoretically so-called tricolor structures or asymmetric capacitors with one electrode being ferromagnetic and other normal metal. An interesting aspect of a tricolor structure is breaking of the inversion symmetry which is expected to generate new properties. Of particular interest is the control of the magnetization in a ferromagnetic layer without using an external magnetic field. The effect may find applications in low-power and high-density integration in future spintronics devices. To investigate the polarization-dependent magnetization change in the iron layer we construct the tricolor superlattices comprised of Fe/$BaTiO_3$/Pt, Fe/$PbTiO_3$/Pt and perform first principles calculations at the LSDA+U level. We find the electrode magnetization sensitive to the polarization direction in the FE layer, which suggests a multiferroic character of the structure. The effect is much stronger than in the analogous symmetric structures.

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