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Effects of Ferroelectric Polarization and Strain on Magneto-Crystalline Anisotropy of $SrRuO_3$ JEEVAKA WEERASINGHE, TULA R. PAUDEL, EVGENY Y. TSYMBAL, Department of Physics and Astronomy and Nebraska Center for Materials and Nanoscience, University of Nebraska, Lincoln, Nebraska 68588, USA — Magnetoelectric properties of materials have recently been extensively investigated due to their potential application in magnetic data storage, spintronics and high-frequency magnetic devices. Among those properties is the electric field effect on magneto-crystalline anisotropy (MCA) which allows the control of magnetization orientation and thus has a direct relevance to magnetic memory applications. In this work, we explore the magneto-crystalline anisotropy of ferromagnetic metal oxide $SrRuO_3$ using first-principles density functional calculations. Due to the presence of Ru atoms this material has a relatively strong spin-orbit coupling resulting in high MCA. We investigate how epitaxial compressive and tensile strains affect the bulk anisotropy of this material. We also explore epitaxial $SrRuO_3/BaTiO_3$ heterostructures where ferroelectric polarization of $BaTiO_3$ affects the interface MCA energy and thus may be used as a control parameter to switch the magnetization orientation. We discuss the physical origins of the effects predicted in terms of the modulation of the electronic structure of SrRuO3 by polarization charge screening and strain.

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