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Coexistence of Ferromagnetism and Ferroelectric Polarization in Epitaxial $NiTiO_3$ thin films with the $LiNbO_3$-Type Structure TAMAS VARGA, EMSL, TIMOTHY DROUBAY, PNNL, MARK BOWDEN, EMSL, SCOTT CHAMBERS, PNNL, ROBERT COLBY, BERND KABIUS, EDOARDO APRA, WILLIAM SHELTON, VAITHIYALINGAM SHUTTHANANDAN, EMSL — In a search for new multiferroic materials where the direction of magnetization can be switched by an applied electric field, we have looked for materials in which polarization and magnetization are strongly coupled. Recent theory calculations predicted that the family of compounds $MTiO_3$ (M = Mn, Fe, Ni), in a certain polymorphic structure (acentric *R3c*), are promising candidates where a polar lattice distortion can induce weak ferromagnetism (WFM). Guided by these insights, the *R3c* phase of $NiTiO_3$ has been prepared in epitaxial thin film form. The synthesis of these $NiTiO_3$ films, their full structural characterization, physical property measurements along with first-principles DFT calculations to predict the desired $NiTiO_3$ structure, its stability, and the effect electronic structure on the ferroic properties are presented. Optical SHG imaging of the $NiTiO_3$ films indicates a polar lattice. Temperature-dependent magnetization measurements suggest a Neel transition consistent with the *R3c* structure. Our field-dependent magnetization results show a residual magnetism below the Neel temperature suggesting the presence of a ferromagnetic moment induced by the polar lattice distortion. These results validate theory predictions about the coexistence of WFM and ferroelectric polarization in $MTiO_3$ compounds with the *R3c* structure.

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