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Room-Temperature Ferroelectricity in Hexagonal $TbMnO_3$ Thin Films TULA R. PAUDEL, DONG JIK KIM, HAIDONG LU, J.D. BURTON, University of Nebraska, Lincoln, NE, JOHN G. CONNELL, University of Kentucky, KY 40506, EVGENY Y. TSYMBAL, University of Nebraska, Lincoln, NE, S.S. AMBROSE SEO, University of Kentucky, KY 40506, ALEXEI GRUVERMAN, University of Nebraska, Lincoln, NE — Magnetoelectric multiferroics exhibit coupling between the ferroelectric and magnetic order parameters, allowing control of electric polarization by a magnetic field or magnetization by an electric field. This property is appealing for novel device applications but they require room-temperature functionality. Among a limited group of single-phase multiferroic materials, rare-earth manganites, such as $TbMnO_3$, are promising due to their strong magnetoelectric coupling. However, the ferroelectric transition temperature of $TbMnO_3$ in the bulk orthorhombic phase is very low. Here, we report room-temperature ferroelectricity of epitaxially-stabilized hexagonal $TbMnO_3$ thin films which is accompanied by significant polarization-dependent resistive switching. The first principle calculation and group theoretical analysis reveals that the ferroelectric polarization of hexagonal $TbMnO_3$ is associated with the lattice instability of prototypical paraelectric phase at the zone boundary and is also an improper ferroelectric similar to other manganites such as $YMnO_3$. Our results demonstrate a possibility to engineer new single-phase multiferroics by epitaxial growth, which broadens the range of functional materials desirable for novel electronic devices.

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