Epitaxially stabilized hexagonal TbMnO$_3$ thin films DAESU LEE, JUNG-HYUK LEE, PATTUKKANNU MURUGAVEL, HYEJIN RYU, TAE WON NOH, ReCOE & FPRD, Department of Physics and Astronomy, Seoul National University, JAE WOOK KIM, HYUNG JIN KIM, KEE HOON KIM, CSCMR, Department of Physics and Astronomy, Seoul National University, YOUNGHUN JO, MYUNG-HWA JUNG, Quantum Material Research Team, Korea Basic Science Institute, JONG-GUL YOON, Department of Physics, University of Suwon, JIN-SEOK CHUNG, Department of Physics and CAMDRC, Soongsil University
— We observed that hexagonal TbMnO$_3$ thin films showed multiferroic properties with enhanced ferroelectricity. The hexagonal TbMnO$_3$ thin film shows 1.6 $\mu$C/cm$^2$ as the remnant polarization value, which is 20 times larger than that of its orthorhombic bulk phase. In addition, the ferroelectric Curie temperature is shifted to 60 K compared to the low temperature value (27 K) of its bulk orthorhombic phase. Interestingly, the hexagonal TbMnO$_3$ film displayed the emergence of a new antiferroelectric-like phase just above 65 K, which is the first of its kind in the family of multiferroic hexagonal manganites. A clear anomaly in dielectric constant near the antiferromagnetic Neel temperature ($T_N \sim 70$ K) shows the possible coupling between the spin and charge degrees of freedom. This is indeed confirmed by the observed second-order magnetoelectric effect below $T_N$.

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