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Optically-probed polarization in ultrathin epitaxial $YMnO_3$ films[1] ZHIGAO SHENG, RCAST, Univ. of Tokyo, NAOKI OGAWA, YASUSHI OGIMOTO, KENJIRO MIYANO, RCAST, Univ. of Tokyo, CREST-JST — The critical thickness has been a fundamental issue in thin films of ferroelectric materials– the absence of which was recently predicted theoretically for improper ferroelectric materials of hexagonal $YMnO_3$ (YMO). [1] Here we report second harmonic generation (SHG) studies on YMO ultrathin films, revealing experimentally this prediction. The YMO ultrathin films were deposited on YSZ (111) substrates by pulsed laser ablation. The samples were single crystalline having atomically flat surfaces and epitaxial relation ($[10\text{-}10]_{YMO}//[\text{-}110]_{YSZ}$), as characterized by *in-situ* RHEED, AFM, XRD, and HR-TEM. It is found that even a film with 1.5-unit-cell thickness shows substantial SHG intensity, indicating the existence of spontaneous polarization. In addition to the polarization along the *c*-axis, we found in-plane components which are not observed in single crystals. The details of the crystallographic symmetry and possible origins of the in-plane components will be discussed.

[1] N. Sai, *et al.*, Phys. Rev. Lett. **102**, 107601 (2009).

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