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External and internal magnetic-field effects on ferroelectricity in orthorhombic rare-earth manganites H. KUWAHARA, K. NODA, M. AKAKI, Dept. of Phys., Sophia Univ. — We report the dielectric and magnetic properties of the perovskite (Eu,Y)MnO_3 crystal *without* the presence of the $4f$ magnetic moments of the rare earth ions. The subject compound, (Eu,Y)MnO_3, was controlled the average ionic radius of the A site so that it was the same as that of $TbMnO_3$ in which the intriguing magnetoelectric effect has been recently discovered. The (Eu,Y)MnO_3 crystal was found to have two distinct ferroelectric phases with polarization along the a (P_a, $T \leq 23$K) and c (P_c, $23\text{K} \leq T \leq 25\text{K}$) axes in the orthorhombic $Pbnm$ setting in a zero magnetic field. In addition, we have demonstrated a magnetic-field-induced switching between these ferroelectric phases: P_a changed to P_c by the application of magnetic fields parallel to the a axis (H_a). In analogy to the case of P_c in $TbMnO_3$, this result is possibly interpreted as follows. In the case of (Eu,Y)MnO_3, Mn $3d$ spins rotate in the ab plane and P_a would emerge in a zero field. In the H_a, the field will force the spins to rotate in the bc plane, in which P_c would be stabilized. Magnetization measurements supported this interpretation: We confirmed the change of the spin rotation axis of the helix from the c axis to the a axis induced by application of the H_a because there is no $4f$ moments acting as an internal magnetic field and interacting with the $3d$ spins. Results obtained with other rare-earth manganites such as (Gd,Tb)MnO_3 and (Eu,Ho)MnO_3 will be presented.

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