

MAR11-2010-001921

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Multiferroic Perovskite Manganites with Symmetric Exchange Striction

SHINTARO ISHIWATA, Dept. of Appl. Phys. and Quantum-Phase Electronics Center (QPEC), University of Tokyo

Orthorhombic perovskite manganites have been extensively studied as a representative system hosting versatile multiferroic phases such as the cycloidal spin phase and the E -type antiferromagnetic phase with an exchange striction mechanism. Recently, the latter phase has been the subject of growing interest for a potentially giant polarization as large as $60000 \mu\text{C}/\text{m}^2$, which might involve a significant contribution from the orbital polarization.¹ However, while several groups have reported ferroelectricity in this phase, further experimental progress on the clarification of the multiferroic properties and the microscopic mechanism has been hampered by the difficulty in sample preparation. In this talk, we report a series of multiferroic perovskite $RMnO_3$ with $R = \text{Dy-Yb}$, $\text{Eu}_{1-x}\text{Y}_x$ and $\text{Y}_{1-y}\text{Lu}_y$, synthesized under high pressure and show the complete phase diagram.^{2,3} The magnitude of the polarization in the E -type phase was estimated to be about $5000 \mu\text{C}/\text{m}^2$ (10 times larger than that of the bc -cycloidal phase) and an enhanced magnetoelectric response was discovered near the first-order phase boundary. Furthermore, we have succeeded in synthesizing single crystals of perovskite YMnO_3 under a high pressure and succeeded in structure refinements for the E -type phase with a polar space group of $P2_1nm$.⁴ This work demonstrates for the first time the quantitative estimation of ferroelectric lattice displacements induced by a magnetic order. This work was done in collaboration with D. Okuyama, Y. Kaneko, Y. Takahashi, H. Sakai, K. Sugimoto, K. Yamauchi, S. Picozzi, Y. Tokunaga, R. Shimano, Y. Taguchi, T. Arima and Y. Tokura, and in part supported by JSPS FIRST program.

¹S. Picozzi *et al.*, Phys. Rev. Lett. **99**, 227201 (2007).

²S. Ishiwata *et al.*, Phys. Rev. B **81**, 100411(R) (2010).

³Y. Takahashi *et al.*, Phys. Rev. B **81**, 100413(R) (2010).

⁴D. Okuyama *et al.*, manuscript in preparation.