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External voltage control of $LaAlO_3/SrTiO_3$ interface structure HIROMASA FUJII, Osaka Univ., MAKOTO MINOHARA, KEK, CHRISTOPHER BELL, YASUYUKI HIKITA, HAROLD Y. HWANG, Stanford Univ., TSUYOSHI KIMURA, YUSUKE WAKABAYASHI, Osaka Univ. — Physical properties of the $LaAlO_3$ (LAO)/ $SrTiO_3$ (STO) interface are controlled by external voltage such as voltage-induced metal-insulator transition [1] and superconductivity-insulator transition [2]. The modulated parameters by external voltage are not only the carrier density but also the Hall mobility [3]. In order to clarify local electric field and polarization around the interface, we have investigated the effect of external voltage on the interface structure at room temperature by means of a surface x-ray diffraction technique, crystal truncation rod (CTR) scattering. Our measurements were performed at BL-4C of the Photon Factory, KEK, Japan. A 5-unit-cell thick sample was prepared using the pulsed laser deposition technique. The scattered x-ray intensity profile shows slight external voltage dependence, which means that the interface structure is changed by the external voltage. We also found that the voltage dependence of the scattering intensity exhibits hysteresis. Least squares refinement revealed that main atomic displacement induced by the eternal voltage occur in the LAO. The displacements in STO at the interface are of the order of sub-pm, which is much larger than expected for bulk STO ($\sim$ 0.01pm).

[1] S. Thiel *et al.* Science **313,** 1942 (2006).
[2] A. D. Caviglia *et al.* Nature **456,** 624 (2008).
[3] C. Bell *et al.* Phys. Rev. Lett. **103,** 226802 (2009).

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