Electronic and magnetic structure in artificial superlattice

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Recently, pulsed later deposition technique to fabricate artificial lattice has rapidly developed. It came to be able to atomically control the artificial lattice of perovskite system. In the perovskite structure family, wide variety of physical properties was reported. Hence many groups tried to fabricate superlattices combining different physical properties to create new physical property and new function. There, especially, the interface state is an important issue.

The perovskite manganites show various interesting phenomena including colossal magnetoresistance (CMR) due to a close interplay among charge, orbital, spin, and lattice degrees of freedom. The superlattice $[(LaMnO_3)_m(SrMnO_3)_m]_n$ was fabricated as a stage to control the Mn valence artificially. The films are composed of same number of $LaMnO_3$ and $SrMnO_3$ layers, and the average Mn valence is kept to be 3.5+. The Mn valence is commonly 3+ (4+) in the $LaMnO_3$ ($SrMnO_3$) layer, and the valence distribution is expected to be controlled by the stacking sequence of $LaMnO_3/SrMnO_3$ layer. Recently, new CMR effect was discovered in this superlattice system, that can never been realized in alloy (La,Sr)MnO_3. [1] To understand the physical property in $[(LaMnO_3)_m(SrMnO_3)_m]_n$ microscopically, we have performed resonant x-ray scattering experiment, which can detect Mn valence state sensitively. Neutron scattering experiment was also performed to elucidate the magnetic structure in the superlattice. On the basis of the obtained electric and magnetic structure, the origin of the physical property will be discussed.

[1] H. Yamada et al., Phys. Rev. B **81** (2010) 014410.