Poster Presentation

MS90.P09

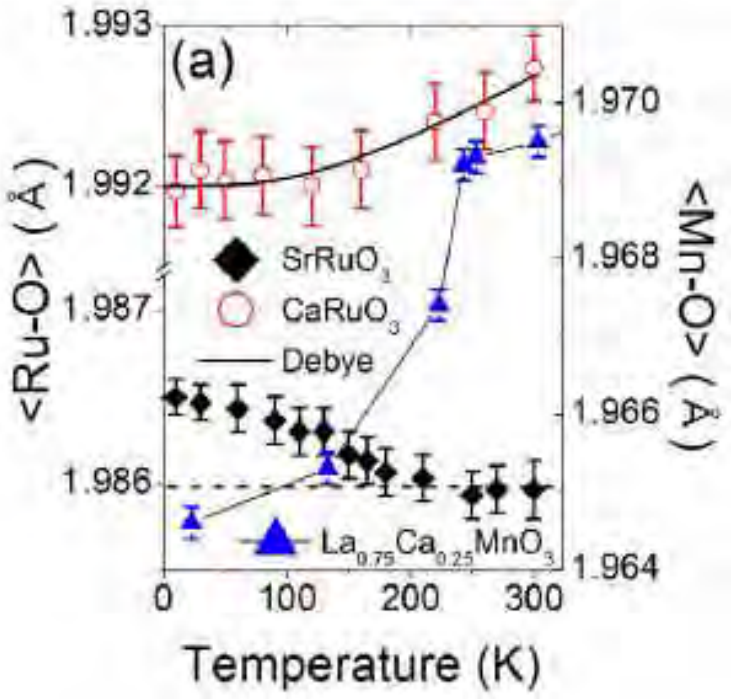
Large in-plane deformation of RuO6 octahedron and ferromagnetism of bulk SrRuO3

S. Lee[4], Z. J.R.[4], T. S.[4], S. Choi[1,2,3], D. Cho[1], K. T.[4], J. Yu[2,5], M. K. A.[6], J. Park[1,2,5,7]

[1]Center for Correlated Electron Systems, Institute for Basic Science, Seoul National University, Seoul, Korea, [2]Center for Strongly Correlated Materials Research, Seoul National University, Seoul, Korea, [3]Department of Physics, SungKyunKwan University, Suwon, Korea, [4]Institute of Materials Structure Science and J-PARC Center, KEK, Tsukuba, Japan, [5]FPRD, Department of Physics and Astronomy, Seoul National University, Seoul, Korea, [6]University College London, London Centre for Nanotechnology and Department of Physics and Astronomy, London, UK, [7]Seoul National University, Center for Korean J-PARC Users, Seoul, Korea

Glazer tilting system with tilting and rotation of oxygen octahedron, can describe ABO3 perovskite structure effectively. In highest symmetry, Pm-3m(No. 221) crystal structure is a0a0a0 without tilting and rotation. If temperature is lower, the different atomic radius of A and B causes tilting and rotation of BO6 octahedron. Glazer tiling notation of Pbnm(No. 62, cab lattice) orthorhombic structure is a-a-c+ with antiphase tilting along [110]cubic and in-phase rotation along [001]cubic for neighboring octahedron. SrRuO3 is rare example of itinerant ferromagnetic among 4d oxides. It shows zero thermal expansion, so called Invar effect below ferromagnetic transition(Tc=165 K). Otherwise, paramagnetic CaRuO3 has same Pbnm crystal structure without magnetic transition. To understand Invar effect and ferromagnetism of SrRuO3, We carried out high resolution Time-of-flight powder neutron diffraction using SuperHRPD beamline in J-PARC, with the best resolution Δd/d=0.03% of backscattering bank. Itinerant ferromagnetic SrRuO3 shows 50 fetometer increase of <Ru-O> mean bond below ferromagnetic transition while paramagnetic CaRuO3 shows decrease of <Ru-O> and follows well by the usual thermal expansion. For SrRuO3, Glazer tilting with deformation of RuO6 octahedron explains Invar effect and why lattice a is larger than lattice b in Pbnm structure. The increased <Ru-O> mean bond is considered as coupled order parameter with ferromagnetic transition. The band width of CaRuO3 is almost constant in the whole temperature range whereas ones of SrRuO3 decrease at low temperature. Then more localized Ru 4d orbitals probably contribute ferromagnetic transition.

[1] *Sanghyun Lee, J R Zhang, S. Torii, et al., J. Phys.: Condens. Matter 25 482885 (2013)*



Keywords: Itinerant ferromagnetism, Glazer tilting, SrRuO3