Hard X-Ray Photoemission Study of Manganite Buried Layers

Koji Horiba[1], Munetaka Taguchi[1], Ashish Chainani[1], Masaharu Matsunami[1], Yasutaka Takata[1], Makina Yabashi[2, 3], Kenji Tamasaku[2], Yoshinori Nishino[2], Daigo Miwa[2], Tetsuya Ishikawa[2, 3], Akira Chikamatsu[4], Hiroshi Kumigashira[4], Masaharu Oshima[4], and Shik Shin[1,5]

[1]*Soft X-Ray Spectroscopy Laboratory, RIKEN SPring-8 Center, 1-1-1 Kouto, Sayo-cho, Sayo-gun, Hyogo 679-5148, Japan*
[2]*Coherent X-Ray Optics Laboratory, RIKEN SPring-8 Center, 1-1-1 Kouto, Sayo-cho, Sayo-gun, Hyogo 679-5148, Japan*
[3]*JASRI/SPring-8, 1-1-1 Kouto, Sayo-cho, Sayo-gun, Hyogo 679-5198, Japan*
[4]*Department of Applied Chemistry, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan*
[5]*Institute for Solid State Physics, The University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8581, Japan*

Although photoemission spectroscopy plays a central role in studying the density of states (DOS) of solids, the reliability of photoemission spectra for addressing the intrinsic electronic structure of strongly correlated electron system (SCES) has been sometimes questioned due to its surface sensitivity. The recent progress in hard x-ray photoemission spectroscopy (HX-PES) enables us to address the intrinsic electronic SCES, even deeply buried interfaces. Recently, we reported the intrinsic electronic structure of typical SCES compound $La_{1-x}Sr_xMnO_3$ (LSMO) thin films using HX-PES technique [1]. HX-PES spectra exhibit a clear additional bulk-derived peak at the low binding-energy side of Mn $2p_{3/2}$ peak. This peak is strongly related to the metallic and/or ferromagnetic physical properties of LSMO thin films and a cluster model calculation including charge transfer from doping induced DOS at Fermi level to Mn 3*d* states reproduces this bulk-derived peak observed in Mn 2*p* core-levels. In this work, we have investigated the electronic structure of LSMO layers buried below $SrTiO_3$ (STO) overlayers. In the thin LSMO layers, the low binding-energy feature in Mn 2*p* core-levels is considerably reduced. This is direct evidence that the metallicity of LSMO is suppressed at the LSMO/STO interface.

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