Professors Y. Ikuhara and M. Kawasaki -- Clarification of Insulator-Metal Transition Mechanism in Oxides --

- A new avenue to obtain next-generation superconductor and hermoelectric devices -

Research groups led by Prof. Yuichi Ikuhara and Prof. Masashi Kawasaki at the WPI Advanced Institute for Materials Research, TohokuUniversity, have discovered an unexpected and unprecedented insulator-to-metal transition that is triggered by an *insulating* unit cell at an atomic scale. This observation is a significant step toward the revolution of our view on the role played by insulating layers on inducing insulator to metal transition. This transition works well on the La-doped $SrTiO_3$ Ruddlesden-Popper (RP) series as its number of insulating layers increases, which would add new practical routes for the design of sophisticated devices.

A novel growth technique has been developed to conquer the long-standing issue of intergrowth in the RP phase, thereby offering a first-time possibility to investigate precisely intrinsic nature of individual members in the RP family. The study combines the experimental studies of atomic-resolution imaging and quantum Hall measurement with the high-precision density-functional-theory calculations to clarify the scientific mechanism behind the unique transition, which can be attributed to the interplay between electron-phonon coupling and electron correlations. We believe that this work provides an unconventional strategy to obtain metallicity or even superconductivity in oxides that are normally expected to be insulators, and is thus of potential interest to nano-device designers.

The results will be published as online publication in *Nature Communications*, a British scientific journal by Nature Publishing Group, on November 2, 2010. The paper is entitled “Dimensionality-driven insulator-metal transition in A-site excess non-stoichiometric perovskites”.

[Contact for query with the research]
Zhongchang Wang, Assistant Professor
WPI Advanced Institute for Materials Research, Tohoku University
Address: 2-1-1 Katahira, Aoba-ku, Sendai 980-8577, Japan.
TEL: +81-22-217-5933; FAX: +81-22-217-5930
E-mail: zcwang*wpi-aimr.tohoku.ac.jp(Replace * with @)

Yuichi Ikuhara, Professor
WPI Advanced Institute for Materials Research, Tohoku University
(& Institute of Engineering Innovation, The University of Tokyo)
Address: 2-1-1 Katahira, Aoba-ku, Sendai 980-8577, Japan.
TEL: +81-22-217-5933; FAX: +81-22-217-5930
E-mail: ikuhara*sigma.t.u-tokyo.ac.jp (Replace * with @)

Masashi Kawasaki, Professor
WPI Advanced Institute for Materials Research, Tohoku University
Address: 2-1-1 Katahira, Aoba-ku, Sendai 980-8577, Japan.
TEL: +81-22-217-5933; FAX: +81-22-217-5930
E-mail: Kawasaki*imr.tohoku.ac.jp(Replace * with @)