

- Paving a way towards discovering new superconductors -

As part of the JST program, a research group led by Professor Masashi Kawasaki at Quantum-Phase Electronics Center, School of Engineering, University of Tokyo (and WPI Advanced Institute for Materials Research, Tohoku University), and Associate Professor Kazunori Ueno at Graduate School of Arts and Sciences, University of Tokyo has discovered a new superconductor through an ingenious development method using field effect, by which voltage controls the flow of electricity. Cuprate high-temperature superconductor, which was found a quarter century ago, has been created by a chemical method, adding impurities to base material of insulator. In the present study, the first example of superconductor made from insulator by an electrical method has been developed.

Field effect has been put to practical use in development of transistor of semiconductor integrated circuit. This kind of transistor can store conduction carriers like electrons by voltage. In the present study, conduction carrier has been successfully stored in a superconductor by an electrical method using electric double layer, at a concentration equal to that of a superconductor stored by a chemical method. The electrical double layer was formed spontaneously on a solid surface soaked in ionic liquid. Potassium tantalate was chosen as a candidate for superconductor due to immiscibility with impurities. Induction of 0.1 conduction carrier per a tantalum atom has produced superconductivity at temperatures below 0.05K.

The present study has opened a path toward the new developmental method of superconductor. The discovery of new materials superconducting at higher temperature is expected, by focusing on various materials which cannot be used as a superconductor by the conventional method.

This research has been conducted in collaboration with WPI Advanced Institute for Materials Research and Graduate School of Science, Tohoku University. The research result will be published online in Nature Nanotechnology on May 22, 2011. The paper's title is "Discovery of superconductivity in KTaO_3 by electrostatic carrier doping".

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(About the research)

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