

Functionalization of High-T_c Superconductors using Nano Structures

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Background Understanding and control of the behavior of quantized vortex in superconductors are important for application to the superconducting wire (optimization of the pinning etc.) and to the devices of magnetic sensors. It also has been interested in as a physics of vortex matter with the unique superconducting state of the high-T_c superconductors.

Aim The research on pinning centers placed artificially in superconductors has been progressed along with the development of current nano-processing technology; however, the research with high-T_c superconductor has not been progressed because of the difficulties of the fabrication of single-crystal thin films. We aim to functionalize the materials by using high quality single-crystal thin films and less-damage fabrication processes.

Advanced Research Topics

Unique superconducting properties of high temperature superconductor (vortex liquid, intrinsic Josephson junctions (IJJs), *d*-wave superconductor, etc.)

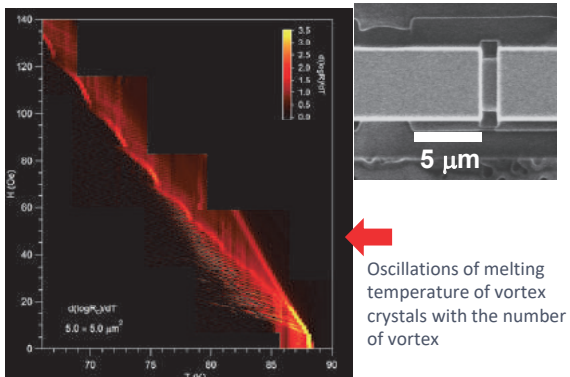


- High quality thin film from single crystals
- Introduction of nano structure by nano fabrications

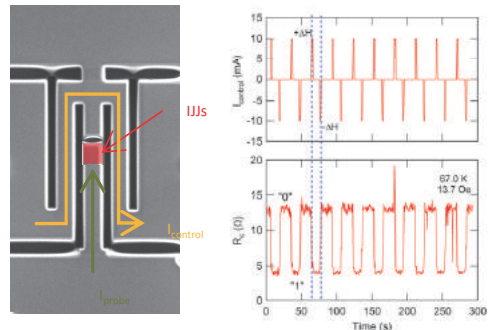


Search for novel functions of high-T_c superconductors

e.g. 1)
Oscillations of melting transition temperature of vortex lattice in Bi2212



e.g. 2)
Control of single vortex (memory effect)



Publications

- S. Ooi, T. Mochiku, M. Tachiki, and K. Hirata, Phys. Rev. Lett. 114, 087001 (2015).
- S. Ooi, T. Mochiku, M. Tachiki, and K. Hirata, Physics Procedia 81, 85-88 (2016).
- S. Ooi, T. Mochiku, M. Tachiki, and K. Hirata, Journal of Physics: Conference Series. 871, 012019 (2017).

Summary

- Success of simultaneous observation of individual vortex penetrations and the melting transition of vortex lattice in micron-scale Bi2212 single crystals.
- Demonstration of single vortex memory in Bi2212.

Research outcome

- Both explication of flux pinning mechanism and manifestation of novel properties of the high temperature superconductor have been aimed by making nano-processing (10 nm~100 nm) possible at the high-T_c superconductor.