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# Lattice melting in finite size superconductors

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Lattice melting is a typical phenomenon of the phase transition in solid state physics. Finite size of metals and semiconductors shows a decreasing or increasing melting transition temperature with decreasing their sizes, depending on their surface conditions. To study melting transition behaviors, vortices in superconductors are an excellent candidate, because of changing the parameters almost freely. We have studied the pancake vortices in mesoscopic square shape of $Bi_2Sr_2CaCu_2O_{8+y}$ (Bi-2212) superconductor by measuring the *c*-axis resistance with using intrinsic stacks of Josephson junctions. The samples for the measurements were prepared by employing the double-side etching technique with only using a focused ion beam. The *in-plane* size of the samples is ranging from 5 to 10 μm. The melting lines were obtained to observe the kink in the c-axis resistance under the fixed magnetic fields. The melting magnetic fields show an oscillatory behavior against temperature, compared to the melting transition line in bulk samples. The melting temperatures are enhanced around the vortex numbers of $i^2$ (*i*;integer), which are identified by counting one-by-one vortex penetrations into the samples. These experimental results suggest strongly that the effect of the confinement by the square boundary of the samples makes square lattice structures more stable against the thermal fluctuations than the other configurations even with competition to the Abrikosov triangular lattice.

## Biography

Kazuto Hirata has completed his Dr. Eng. at the age of 28 years from Shizuoka University, worked at Nippon Mining Co. Ltd. (ENEOS), Kyoto University as visiting researcher and TU Munich. At present, he is the Director and group leader of NIMS, Japan. He has published more than 300 papers in reputed journals.

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