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Vortex Phases in Mesoscopic $Bi_2Sr_2CaCu_2O_{8+\delta}$ Single Crystals in Magnetic Fields Near *ab*-plane JOVAN MIRKOVIC, Inst. of Materials Science, Univ. of Tsukuba, Tsukuba 305-8573, Japan, and Faculty of Sciences, Univ. of Montenegro, 81000 Podgorica, Montenegro, YUIMARU KUBO, MASAHI KOHRI, KOHEI KAWAMATA, TAKASHI YAMAMOTO, ITSUHIRO KAKEYA, KAZUO KADOWAKI, Institute of Materials Science, University of Tsukuba, Tsukuba 305-8573, Japan — In order to study the vortex matter in the layered superconductors in magnetic fields parallel to the *ab*-plane, we performed the in-plane resistivity and the *c*-axis resistivity measurements on the bulk and mesoscopic $Bi_2Sr_2CaCu_2O_{8+\delta}$ single crystals. In the bulk samples, a boundary between the strong pinning phase and the weak pinning vortex phase was found at about 3^o away from the *ab*-plane, indicating possible crossover from the vortex chain + lattice phase into tilted (vortex chain) phase. The vortex phase in the parallel magnetic fields, exhibited a strongly non-Ohmic behavior, indicating the possible two-stage melting phase transition. It was found that the vortex lock-in transition in mesocopic crystals, becomes considerably broad in high magnetic fields, while exhibiting the sharp features in low magnetic field region. The first penetration field of vortex pancakes demonstrates a nontrivial field dependence.

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