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Vortex phase diagram and electromagnetic anisotropy of cation composition controlled Bi2212 single crystals JUN-ICHI SHIMOYAMA, TAKANORI MAKISE, YOSHIAKI KAGESHIMA, SHIGERU HORII, KOHJI KISHIO, Department of Applied Chemistry, University of Tokyo — In the present study, vortex phase diagram and pinning properties of Bi2212 single crystals under $H // c$ have been systematically studied as functions of cation and oxygen compositions, while these matters were well understood for slightly cation-nonstoichiometric samples almost ten years ago. We confirmed that cation stoichiometry largely affects vortex state and pinning strength. A particular crystal with a cation composition of nearly 2:2:1:2 “Bi2212” exhibited strong bulk pinning behaviors even in the high temperature region, resulting in disappearance of magnetic reversible region below the first-order-transition (FOT) temperature of vortex state. In addition, entropy change of the vortex at FOT of “Bi2212” crystals was found to be apparently larger than that of conventional ones. On the contrary, Bi and Ca-rich and Sr-poor single crystals showed poor pinning behaviors with low irreversibility fields and critical current density. Systematic enhancement of in-plane anisotropy in resistivity, decreases in ρ_c and increases of penetration depth with approaching the cation stoichiometric composition suggested that disordered crystal lattice due to partial substitutions of Bi and Ca for Sr-site, which is common for conventional Bi2212 single crystals, degraded superconducting properties of Bi2212.

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