Shape dependence of occurrence conditions of spontaneous half-quantized vortices in d-dot[1] NORIO FUJITA, MASARU KATO, Department of Mathematical Sciences, Osaka Prefecture University, TAKEKAZU ISHIDA, Department of Physics and Electronics, Osaka Prefecture University — A d-dot is a nano-sized composite structure that consists of a d-wave superconductor (SC) embedded in an s-wave matrix. Since the phase of the superconducting order parameter in the d-wave SC depends on direction, phase difference appears at the corner junctions between d- and s-wave SCs in d-dot's. Due to quantization of fluxoids including this phase difference, spontaneous half-quantized vortices (SHQVs) appear at the each corner in d-dot's. [1]. We can use Pb as s-wave SCs and YBa2Cu3O7-δ (YBCO) as d-wave SCs. But it is pointed out that the SHQVs may not appear if there exist some defects, especially twin boundaries (TBs) in YBCO. In order to analyze effects of TBs on SHQVs, we introduce orthorhombic structure of YBCO into two-components Ginzburg-Landau(GL) equations [2] in terms of anisotropy of effective mass. Using the finite element method [1], we showed that fractional vortices appear on edges of TBs. In this study, we calculate magnetic field distribution in d-dot models with several TBs and investigate shape dependence of effects of TBs on SHQVs. [1] M. Kato, T. Ishida, T. Koyama, M. Machida, Superconductors – Materials, Properties and Applications. (InTech 2012) Chap. 13. [2] N. Fujita, M. Kato, T. Ishida, Physica C, 518, (2015) 44.

Norio Fujita
Department of Mathematical Sciences, Osaka Prefecture University

Date submitted: 09 Nov 2016   Electronic form version 1.4