Magneto-optical Imaging of Flux Turbulence in $Ba(Fe_{1-x}Co_x)_2As_2$ Crystals

S. Mohan[a], **Y. Tsuchiya**[a], Y. Nakajima[a, b], and T. Tamegai[a, b]

[a]Department of Applied Physics, The University of Tokyo, Tokyo, Japan
[b]JST-Transformative Research-Project on Iron Pnictides (TRIP), Tokyo, Japan

A type-II superconductor which has been remagnetized by a magnetic field of opposite polarity contains both vortices and antivortices. In the 123-type high-T_c cuprates the remagnetization flux front exhibits macroscopic turbulence[1]. However, it is still debated whether this turbulent instability is a generic feature of type-II superconductors[2]. Here we report remagnetization studies on thin single crystals of optimally doped $Ba(Fe_{0.925}Co_{0.075})_2As_2$ ($T_c = 24$ K) using magneto-optical imaging. We observe enhanced irregular penetration of the remagnetization front above 15 K. Unlike in the 123-system, the irregular flux front patterns appear to conform to the pinning in the sample and are sustained even after successively recycling the temperature to above T_c and cooling down. However, the remagnetization front is accompanied by the appearance of slight humps in the magnetic induction profiles around $B_z = 0$. This could be generated due to the excess current flowing around a "Meissner hole" in the superconductor. The time evolution of the annihilation front shows that it takes ∼90 seconds to almost stabilize. The remagnetization features in underdoped and overdoped $Ba(Fe_{1-x}Co_x)_2As_2$ single crystals are also discussed. Finally these results are compared with those in both conventional and high-T_c cuprate superconductors.

[1]V. K. Vlasko-Vlasov *et al.*, Phys. Rev. B **56**, 5622 (1997).
[2]T. Frello *et al.*, J. Low Temp. Phys. **36**, 39 (2010).