XV Krajowa Szkoła Nadprzewodnictwa
"Stulecie Nadprzewodnictwa"
Kazimierz Dolny, 9-13 października 2011 r.

Critical state stability and flux jumps' dynamics in a single crystal of $YBa_2Cu_3O_{7-\delta}$

A. NABIAŁEK[1] S.V. VASILIEV[2], V.V. CHABANENKO[2],
X. YAO[3], Y.Q. CAI[3], L. GUO[3]

[1]Institute of Physics, PAS, al. Lotników 32/46, 02-668 Warsaw, Poland

[2]Institute for Physics and Engineering, NASU, 72 ul. R. Luxemburg, 83114, Donetsk , Ukraine

[3]Department of Physics, Shanghai Jiao Tong University, 800 Dong Chuan Road, Shanghai200240, China

We studied the critical state stability and the dynamics of the flux jumps, caused by thermomagnetic avalanches, in a large (3 x 3 x 1 mm^3) single crystal of $YBa_2Cu_3O_{7-\delta}$ superconductor. Flux jumps were observed only at the lowest temperatures attainable in our system (at about 2 K) and for the external magnetic field parallel to the *c*-axis of the investigated crystal. It is shown that thermomagnetic avalanches are initiated in dynamic conditions, for which the magnetic diffusivity is much smaller than the thermal diffusivity. In the case of large single crystals of $YBa_2Cu_3O_{7-\delta}$ immersed directly in liquid helium the analysis of the critical state stability can be performed in isothermal approximation. The conditions of the critical state stability can, however, change dramatically by improving the thermal isolation between the sample and the surrounding coolant.

The dynamics of the flux jumps was analyzed in the framework of the model of magnetic diffusion. It is shown that the magnetic diffusivity changes dramatically during the process of the thermomagnetic avalanche. We also studied the influence of the external magnetic field and of the magnetic history on the duration of the following stages of the flux jumps.