A Method for the Analysis of Physical Processes on the Interface between Meissner and Vortex Domains in HTSCs

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To detect the trapping of a magnetic flux solely due to the front of the magnetic field, a decaying ac magnetic field is created in an LC oscillatory circuit. Since the amplitude of an oscillation from H to $-H$ exponentially decays to zero, the trapping of the magnetic flux occurs due to the field H rather than due to the ac field. The measurement of the magnetic-field dependence of the density of the trapped magnetic flux $B(H)$ by a Hall probe has shown that the method proposed allows one to observe qualitatively new results on samples with different microstructures.

1. In contrast to the conventional methods, the function $B(H)$ passes through a maximum, rather than reaches a saturation value, as the field increases.

2. As the field decreases, the maximal value of the function $B(H)$ is not stored as the field increases, but this function exhibits strong hysteresis.

3. Under further cycling of the field, the function $B(H)$ shows complete reversibility.

4. The curves $B(H)$ exhibit a steplike behavior.

The features observed are attributed to the manifestation of vitreousness of the crystal structure of HTSCs. The enhancement of short-range ordering with the improvement of the quality of samples, as well the fact that the critical current in crystallites and subcrystallites is much higher than that in a sample, lead to a qualitative difference between the local and integral properties of HTSCs.

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