1st/2nd Order Phase Transitions and Latent Heat of Flux Lattice Melting

Melissa Charalambous

CRTBT, CNRS, 25Av. des Martyrs, BP 166X, 38042 Grenoble Cedex 9, France

Abstract

A latent heat is measured close to the superconducting transition of YBCO single crystals in high magnetic fields, using ultra-high resolution micro-calorimetry (dC/C 10-4, dT/T 10-5). This effect, related to flux lattice melting, corresponds to an entropy discontinuity of 0.5kB/vortex/layer from 0.25 to 7 Tesla. The presence of a critical end point in a field of 8Tesla, indicates a universal threshold value of disorder for 1st order melting. The dynamic response of the flux lattice close to melting transition was also detected on the same sample, by using ultra-sensible Hall probes (resolution: 3mG at 11T, dB/B=10-7) in order to detect the appearance of a critical current, not measureable with standard SQUID magnetometry. The very small value of critical current allows to estimate the disorder in the sample; the latter varies as a function of the position in the phase diagram. We find a universal threshold disorder value of 100 lattice spacings, indicating a collective regime close to the transition. We find a clear correlation between the transition width, the approach of the critical point and the amplitude of critical current, which establishes for the first time in a clear way the relevance of disorder on the order of the transition.