Anisotropy of the specific heat of $YBa_2Cu_3O_{7-\delta}$ in the mixed-state and vortex lattice melting in strong magnetic field (0-26 Tesla)

C. Marcenat, F. Bouquet and R. Calemczuk

CEA/Grenoble, DRFMC/LCP, 17 rue des martyrs, 38042 Grenoble 9, France

U. Welp, W.K. Kwok and G.W. Crabtree

Center for Superconductivity, Argonne National Laboratory, Argonne, IL 60439

N.E. Phillips, R.A. Fisher and A. Schilling

Lawrence Berkeley National Laboratory, Berkeley,CA 94720

Abstract

We have measured the specific heat, C, of a naturally untwinned $YBa_2Cu_3O_{7-\delta}$ single crystal using a modulation (a.c) technique for $H \parallel c$ and $H \parallel ab$, this up to 26 Tesla. For $H \leq 10.5T \parallel c$, a small secondary maximum in C is present at slightly lower temperature than the peaks associated to the melting. The first order character and the hysteretic behavior ($T_{melting} > T_{freezing}$) disappears above 10.5T and instead, broad jumps in C are detected up to 26 Tesla, confirming the existence of a topologically disordered field-induced vortex phase. The transition from the vortex lattice into this high-field state is also marked by a gradual cross-over in the field dependence of the specific heat during field sweeps. For $H \parallel ab$, an anisotropy ratio , of 8 rescales (with respect to $H \parallel c$) both the location of the melting line and the field dependence of C in the fluctuation-dominated regim (liquid state) but not in the solid state which appears to be much less anisotropic.