Highlights

Superconductivity - 2016

Competition between intrinsic and extrinsic effects in the quenching of the superconducting state in Fe(Se,Te) thin films

A. Leo[1,2], P. Marra[2,1], G. Grimaldi[2,1], R. Citro[1,2], S. Kawale[3], E. Bellingeri[3], C. Ferdeghini[3], S. Pace[1,2] and A. Nigro[1,2]

[1]Dipartimento di Fisica "E. R. Caianiello", Università degli Studi di Salerno, 84084 Fisciano (Salerno), Italy
[2]CNR-SPIN Salerno, 84084 Fisciano (Salerno), Italy
[3]CNR-SPIN Genova, Corso Perrone 24, 16152 Genova, Italy

PHYSICAL REVIEW B 93, 054503 (2016)

We report the first experimental observation of the quenching of the superconducting state in current-voltage characteristics of an iron-based superconductor, namely, in Fe(Se,Te) thin films. Based on available theoretical models, our analysis suggests the presence of an intrinsic flux-flow electronic instability (FFI) along with non-negligible extrinsic thermal effects. The coexistence and competition of these two mechanisms classify the observed instability as halfway between those of low-temperature and of high-temperature superconductors, where thermal effects are, respectively, largely negligible or predominant.

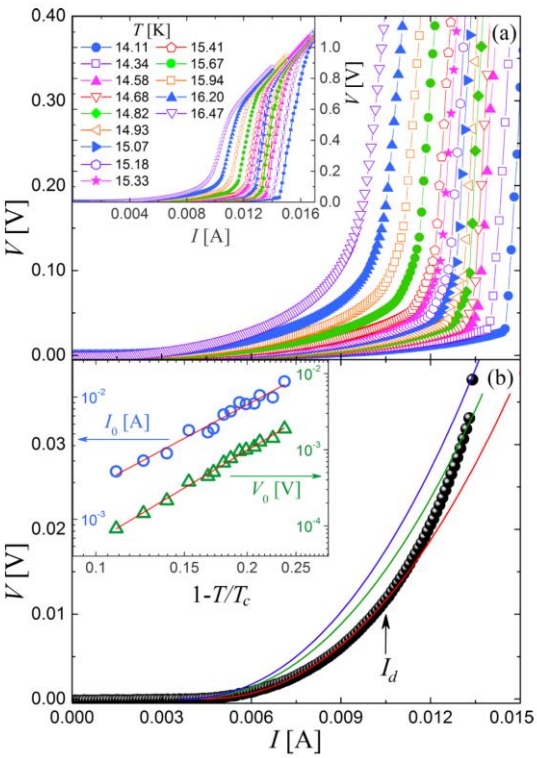

Figure 1. (a) I-V characteristics of Fe(Se,Te) microbridge at different temperatures in a magnetic field $B = 5$ T. Inset: I-V's in the full voltage range. Solid lines are guides for the eye. (b) Experimental I-V characteristic at 14.58 K. Here, solid lines are isothermal curves from model equation $V(I,T) = V_0(T)\left[I/I_{c(T)} - 1\right]^n$, with $T = 14.58$ K, 14.82 K, and 14.93 K. Inset: Temperature dependence of the critical current I_c (left scale) and of the fitting parameter V_0 (right scale) as a function of $1 - T/T_c$. Solid lines are best fits of Eq. (2).

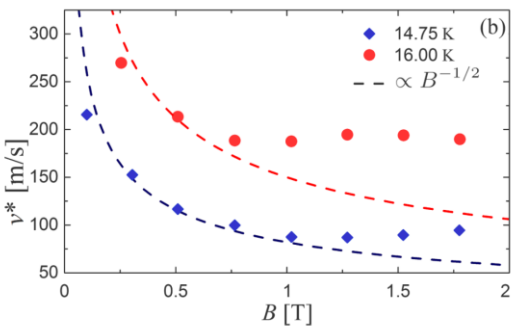

Figure 2. Critical vortex velocity v^* as a function of applied magnetic field B for both temperatures. Dashed lines are best fits of the expected behaviour $v^* \propto B^{-1/2}$ for FFI.