

Highlights

Novel superconducting and functional materials for energy and environment - 2019

Improvements of high-field pinning properties of polycrystalline Fe(Se,Te) material by heat treatments

C. Fiamozzi Zignani^{1,2}, G. De Marzi², V. Corato², A. Mancini², A. Vannozzi², A. Rufoloni², A. Leo^{1,3}, A. Guarino³, A. Galluzzi¹, A. Nigro¹, M. Polichetti¹, A. Della Corte², S. Pace¹, G. Grimaldi^{3*}

¹Department of Physics "E. R. Caianiello", Università di Salerno, Salerno, Italy

²ENEA for EUROfusion – Via Enrico Fermi 45, 00044 Frascati (RM), Italy

³CNR-SPIN c/o Università di Salerno – Via Giovanni Paolo II, 132, I-84084 Fisciano (SA), Italy

JOURNAL OF MATERIAL SCIENCE 54 (2019) 5092

In this manuscript, we present the study on the peak-effect observation in polycrystalline Fe(Se,Te) superconductor grown by self-flux method. In particular, the fabrication of Fe(Se,Te) crystals is explored by choosing a different heat treatment (HT) in the two-steps solid state reaction route, thus determining the proper cooling ramp of the second HT in order to obtain samples which display an enhanced peak-effect in the vortex phase diagram as inferred by magnetization, magneto-resistance and heat capacity measurements.

Our experimental findings are compared with results in literature obtained on both High Temperature Superconductors, such as YBCO compounds, and Iron Based Superconductors of several families, thus suggesting a common origin of the peak-effect in different materials. Moreover, the study on the structural, morphological and compositional properties, as well as on the critical currents have revealed that in our Fe(Se,Te) samples the peak-effect phenomenon is strictly correlated to the manufacture process, since a tunable heat treatment leads to the observation of the peak-effect in the vortex phase diagram of the material. This fabrication route offers the way to increase systematically the critical current density that can turn useful for the production of superconductors in view of applications.

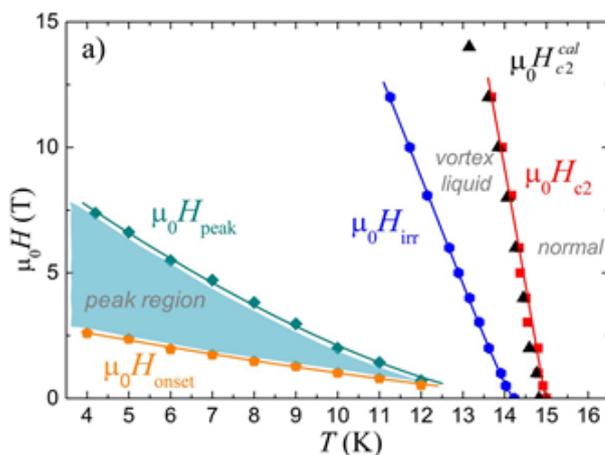


Fig. 1: Calorimetric measurements of the upper critical field at increasing magnetic field for the best Fe(Se,Te) sample realized by the two-step solid-state reaction process, successfully modified by increasing the temperature of the heat treatment and by slowing down the cooling rate.

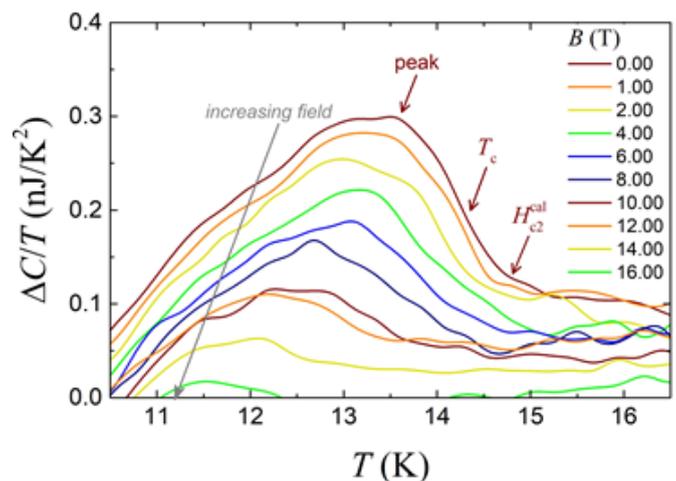


Fig. 2: H - T phase diagram for external field applied perpendicular to the surface of the sample; the peak region between H_{peak} and H_{onset} is highlighted for the best-investigated sample.