Low Temperature – High Field Performance of Iron Chalcogenides Thin Films

Carlo Ferdeghini, E. Bellingeri, R. Buzio, V. Braccini, S. Kawale, A. Gerbi, M. Adamo, C. Nappi, and E. Sarnelli

CNR-SPIN, Corso Perrone 24, 16152 Genova, Italy

E-mail: carlo.ferdeghini@spin.cnr.it

Abstract — Among the various families of Fe-based superconductors, iron chalcogenides, while presenting a transition temperature not particularly high, show great advantages for potential applications in high fields, albeit at liquid helium temperature. In thin films, the strain can push the critical temperature up to 21K, the critical field up to more than 50 T and the irreversibility field close to this value. The critical current and its anisotropy heavily depend on the type of substrate used for the deposition. It is possible to reach values up to 1 MA/cm^2 at liquid helium temperatures and self-field, with a weak magnetic field dependence and without appreciable anisotropy. In this study, we will show what defects will act as pinning centers for different kind of substrates and how the shape of the pinning centers determines the observed anisotropic currents. Finally, in the case of STO, we present the first measurements of FeSeTe thin films deposited on bi-crystals showing that, differently from HTS, the high angle grain boundary is less limiting the supercurrent. Experiments indicate that the current is not appreciably depressed up to a misorientation angle of 10 degrees.

Keywords (Index Terms) — Fe-chalcogenides, high field performances, critical currents, grain boundaries.