Angular dependence of vortex instability in a layered superconductor: the case study of Fe(Se,Te) material

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Anisotropy effects on flux pinning and flux flow are strongly effective in cuprate as well as iron-based superconductors due to their intrinsically layered crystallographic structure. However Fe(Se,Te) thin films grown on CaF_2 substrate result less anisotropic with respect to all the other iron based superconductors. We present the first study on the angular dependence of the flux flow instability, which occurs in the flux flow regime as a current driven transition to the normal state at the instability point (I^*, V^*) in the current-voltage characteristics. The voltage jumps are systematically investigated as a function of the temperature, the external magnetic field, and the angle between the field and the Fe(Se,Te) film.

The scaling procedure based on the anisotropic Ginzburg-Landau approach is successfully applied to the observed angular dependence of the critical voltage V^*. We find out that Fe(Se,Te) represents the case study of a layered material characterized by a weak anisotropy of its static superconducting properties, but with an increased anisotropy in its vortex dynamics due to the predominant perpendicular component of the external applied magnetic field. Indeed, I^* shows less sensitivity to angle variations, thus being promising for high field applications.

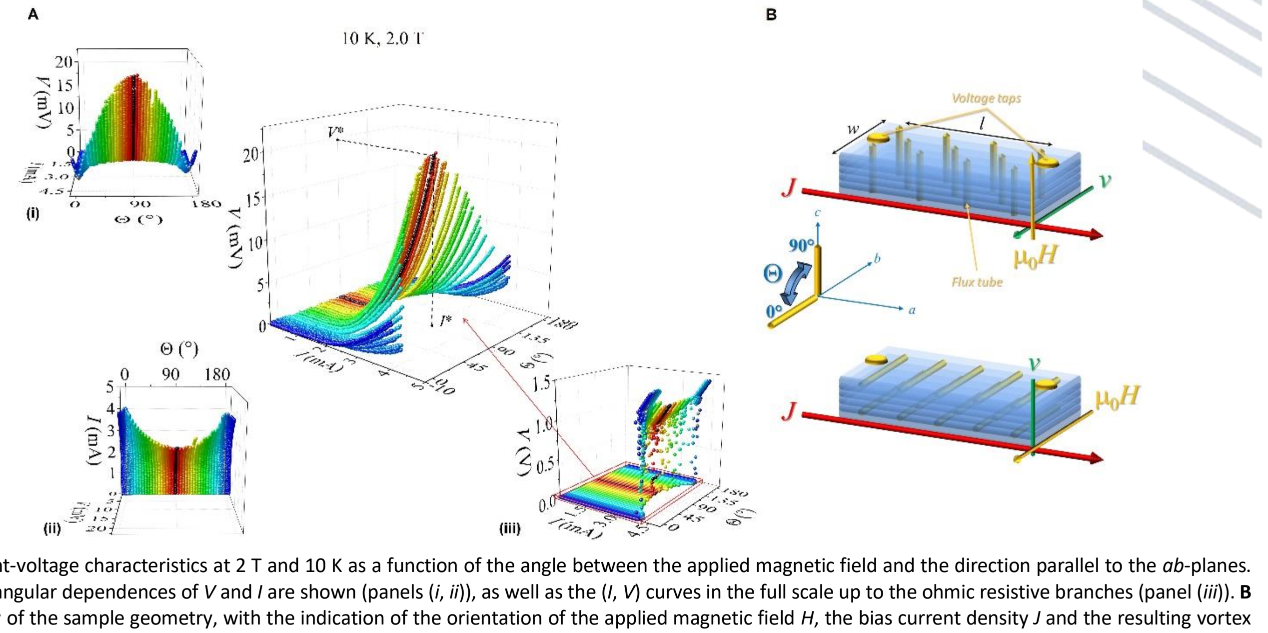

Fig. 1: **A** Current-voltage characteristics at 2 T and 10 K as a function of the angle between the applied magnetic field and the direction parallel to the *ab*-planes. The individual angular dependences of *V* and *I* are shown (panels (*i*, *ii*)), as well as the (*I*, *V*) curves in the full scale up to the ohmic resistive branches (panel (*iii*)). **B** Schematic view of the sample geometry, with the indication of the orientation of the applied magnetic field *H*, the bias current density *J* and the resulting vortex velocity *v*. The yellow dots represent the voltage taps for voltage measurements as a function of the angle θ.