Intrinsic and pinning anisotropy from surface impedance measurements in superconducting YBCO and Fe(Se,Te) thin films

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The sources of anisotropy in layered type II superconductors $YBa_2Cu_3O_{7-\delta}$ (YBCO) and Fe-based compound like $FeSe_xTe_{1-x}$ (FeSeTe) have different physical origin: the anisotropic electron effective mass (giving rise to anisotropic coherence length) determines what we call here *intrinsic anisotropy* γ. Extended structures, including the layered structure itself, twin planes, grain boundaries, columnar or some artificial pinning centres (APC), introduce a complex vortex pinning landscape and then they give rise to the *pinning anisotropy*.

Using microwave measurements of the complex surface impedance $Z=R+iX$ in a dc magnetic field we are able to distinguish the intrinsic from pinning anisotropy. In particular, the changes in $Z(H)$ are due to vortex drag (the origin of flux-flow resistivity ρ_{ff}, which depends on the anisotropy through the effective vortex mass), to the recall of the vortex from the pinning centre (given by the pinning constant k_p), and to flux-creep jumps (quantified by a normalized dimensionless parameter χ) [1]. Measurements of Z at different dc magnetic fields H and field orientations θ, and at different frequencies, allow to extract ρ_{ff}, k_p and χ, whence the intrinsic and pinning anisotropies [2].

We measure $Z(H,\theta)$ using a dielectric-loaded resonator technique in different setups [3], at 16, 27 and 47 GHz, up to a dc field of 1.3 T. We present results obtained in YBCO thin films grown by Pulsed Laser Deposition (PLD) [4], and in pristine $FeSe_xTe_{1-x}$ thin films grown by PLD from $FeSe_{0.5}Te_{0.5}$ targets [5]. We extract the intrinsic anisotropy γ, obtaining in YBCO consistent values $\gamma = 5.0\pm0.5$ [6], and $\gamma \approx 2$ in FeSeTe. On the other hand, we obtain very different pinning anisotropies in all compounds. In YBCO, the defects affect in a complex fashion the anisotropic k_p, while in FeSeTe $k_p(\theta)$ does not show significant departures from the effective mass effect. Interestingly, we do not find signatures of the multigap nature of FeSeTe in the angular dependence of the flux-floe resistivity: a single-band scaling approach [7] applies.

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