Anisotropic H_{c2} of $K_{0.8}Fe_{1.76}Se_2$ determined up to 60 T

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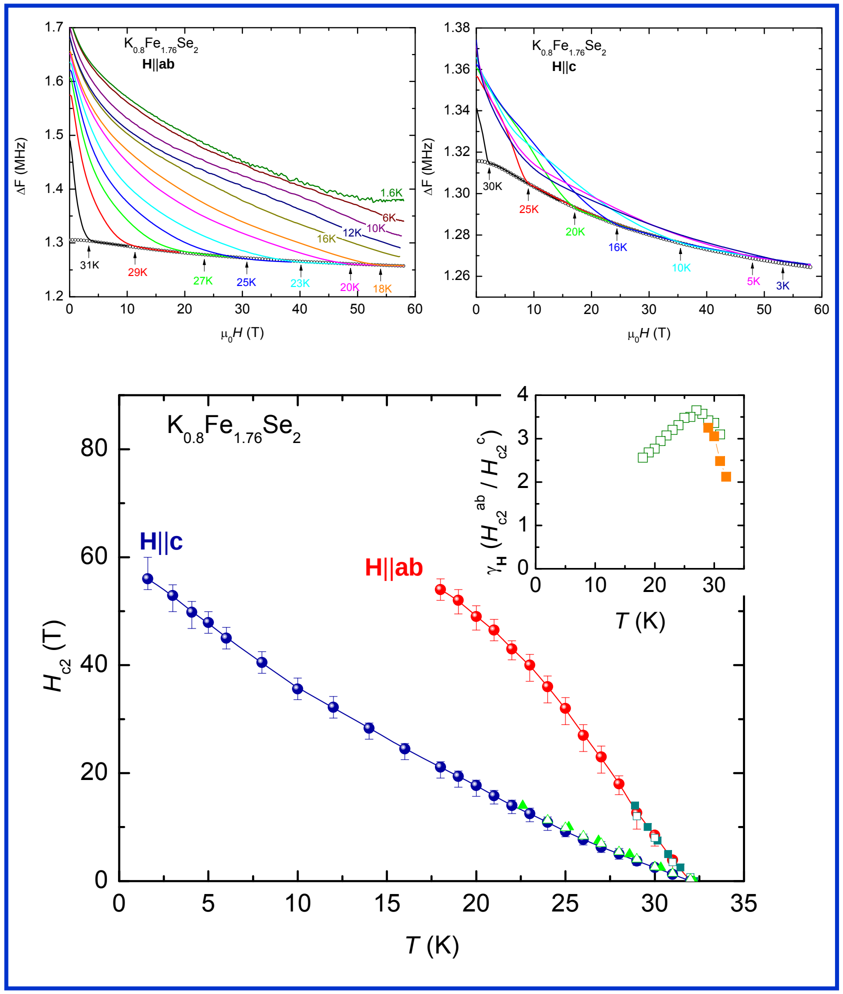
A superconductor excludes a magnetic field until superconductivity is destroyed. The upper critical field, H_{c2}, means that the flux penetrates completely and superconductivity vanishes.

The discovery of superconductivity in $K_{1-x}Fe_{2-y}Se_2$ materials with the same $ThCr_2Si_2$ crystal structure as $BaFe_2As_2$ has given rise to a multitude of measurements, theories, and questions.

By taking advantage of the pulsed field magnet and highly sensitive radiofrequency contactless penetration depth measurements, displayed in the top panels, the anisotropic $H_{c2}(T)$ curves for $K_{0.8}Fe_{1.76}Se_2$ are determined over a wide range of temperatures down to 1.5 K and magnetic fields up to 60 T. The H_{c2} of $K_{0.8}Fe_{1.76}Se_2$ is as high as H^{ab}_{c2} (18 K) ~ 54 T and H^{c}_{c2} (1.6 K) ~ 56 T (bottom panel). The anisotropy parameter, γ_H, initially increases with decreasing temperature, passes through a maximum of ~3.6 near 27 K, and then decreases to ~2.5 at 18 K. The observed γ_H values show a weakening anisotropic effect at low temperatures. Although the Fe-based superconductors have a layered crystal structure, a weak anisotropy of H_{c2} may be a common feature, suggesting that the interlayer coupling and the three-dimensional Fermi surface may play an important role in the superconductivity of this family.



The determination of H_{c2} can be extended up to 95 T using pulsed field facility at LANL by taking advantage of the NHMFL user support program, allowing the users to explore the temperature-magnetic field phase space.

Facilities: 60 T short-pulse field at LANL
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