Inversion of the Upper Critical Field Anisotropy in FeTeS Films


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Abstract - We present the complete superconducting upper critical field ($H_{c2}$) – temperature ($T$) diagram of FeTeS films measured at three crystalline orientations ($H||c$, $45^\circ$ and ab). We find that $H_{c2}$ is almost isotropic in magnetic field orientations with $\mu_0H_{c2}(T=0)\approx30T$, and a transition temperature of $T_c\approx7K$. A small but clear $H_{c2}$ angular anisotropy is observed, with a crossover around $T=0.7T_c$ from $H_{c2}(||c)<H_{c2}(||ab)$ for $T>0.7T_c$ to $H_{c2}(||c)>H_{c2}(||ab)$ for $T<0.7T_c$. This change in the anisotropy is similar to that observed in FeTeS and FeTeSe single crystals but occurs at a higher $T/T_c$ for our film. We analyze the $H_{c2}(T)$ in terms of pair-breaking mechanisms and two-band superconductor theory. Understanding the inversion of $H_{c2}$, opens the possibility to adjust the effective anisotropy of superconductors for different applications.

Keywords - Fe SeTe films, iron-based superconductors, upper critical fields, anisotropy of superconductors

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