

Upper Critical Fields up to 60 T and the Vortex Matter Phase Diagram of Arsenic-deficient $\text{LaO}_{0.9}\text{F}_{0.1}\text{FeAs}_{1-\delta}$

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Abstract - We report resistivity, magnetization and upper critical field $B_{c2}(T)$ data for arsenic deficient $\text{LaO}_{0.9}\text{F}_{0.1}\text{FeAs}_{1-\delta}$ in a wide temperature and high field range up to 60 T. These disordered samples exhibit a slightly enhanced transition temperature of $T_c = 29.0$ K and a significantly enlarged slope $dB_{c2}/dT = -5.4$ T/K near T_c . The high-field $B_{c2}(T)$ data obtained from resistance measurements in pulsed magnetic fields follow up to about 30 T the WHH (Werthamer-Helfand-Hohenberg) curve for the orbital limited upper critical field, but show a clear flattening above 30 T. This flattening evidences Pauli limiting behavior (PLB) with $B_{c2}(0) \approx 63$ T. We compare our results with $B_{c2}(T)$ data reported in the literature for clean and disordered samples. Whereas clean samples show no PLB for fields below 70 T as measured so far, the hitherto unexplained flattening of $B_{c2}(T)$ for applied fields $H \parallel ab$ observed for several disordered closely related systems is interpreted as a manifestation of PLB. The influence of the arsenic vacancies in $\text{LaO}_{0.9}\text{F}_{0.1}\text{FeAs}_{1-\delta}$ on the vortex matter phase diagram is studied by magnetization measurements on bulk samples.

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