Vortex Phase Diagram of $PrFeAsO_{0.60}F_{0.12}$ Superconductor

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We have measured the resistivity and magnetization of the $PrFeAsO_{0.60}F_{0.12}$ polycrystalline sample as functions of temperature and magnetic field (H) in the normal and superconducting state. The superconducting onset transition temperature T_c^{on} determined from resistivity shifts by $\sim$4 K as H is increased from 0 to 14 T. The zero-temperature upper critical field $H_{c2}(0)$ estimated by using the Ginzburg-Landau theory and the Werthamer-Helfand-Hohenberg equation exceeds 100 T. The resistivity below T_c^{on} exhibits Arrhenius behavior due to thermally activated flux flow of vortices. The activation energy U_0, determined from the Arrhenius plot of the resistivity, shows a power-law decrease ($U_0 \propto H^{\alpha}$) with magnetic field. The observed total magnetization is the sum of a superconducting irreversible magnetization and a paramagnetic magnetization. Analysis of dc susceptibility $\chi(T)$ in the normal state shows that the paramagnetic component of magnetization comes from the Pr^{3+} magnetic moments. The intragrain critical current density (J_L) derived from the magnetization data is large. The $J_L(H)$ curve displays a second peak which shifts towards the high-field region with decreasing temperature. In the low-field region, a plateau up to a field H^* followed by a power law $H^{5/8}$ behavior of $J_L(H)$ is the characteristic of the strong pinning. A vortex phase diagram for the present superconductor has been obtained from the magnetization and resistivity data.