MICRO-CALORIMETRIC STUDY OF IRON-BASED SUPERCONDUCTOR

$BaFe_2(As_{1-x}P_x)_2$

Abstract

by

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In this thesis I present the specific heat measurements on a series of $BaFe_2(As_{1-x}P_x)_2$ single crystals with phosphorous doping ranging from near optimum doped x = 0.3 to strongly overdoped x = 0.55. These samples can be made with very high purity, the concentration of phosphorous was determined by x-ray energy dispersive spectra (EDS). A systematic study of the superconducting specific heat transitions reveal that $BaFe_2(As_{1-x}P_x)_2$ follows the scaling $\Delta C/Tc \approx T_c^2$ remarkably well. It is the first member of the iron-based layered superconductors that follows this particular trend called the BNC (Bud'ko, Ni, and Canfield) scaling of the specific heat transition. The clean-limit nature of this material imposes additional restraints on theories aimed at explaining the BCN scaling since models based on specific electron scattering mechanisms appear to be inconsistent with our results. Furthermore, we find the superconducting anisotropy is $\Gamma \approx 2.6$, independent of doping, indicative of the dominating role of the electron Fermi surface sheets in forming the superconducting state.