Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Doping - dependent anisotropic superconducting gap in $Na_{1-\delta}FeAs$ and $NaFe_{1-x}Co_xAs$ pnictides KYUIL CHO, M.A. TANATAR, N. SPYRISON, H. KIM, R. PROZOROV, The Ames Laboratory, IA, USA, G. TAN, J. YAN, P. DAI, C. ZHANG, Oak Ridge National Laboratory, TN, USA — London penetration depth, λ (T), was measured in single crystals of self electron-doped $Na_{1-\delta}FeAs$ and chemically electron-doped $NaFe_{1-x}Co_xAs$ superconductors. Doping level δ in self-doped ones was controlled by the deintercalation of Na^+ ions, stimulated by ultrasonic treatment. Use of the two doping techniques allowed us to cover the whole doping phase diagram from underdoped parent NaFeAs to heavily Co-overdoped compositions, with the optimal doping, $T_c \sim 25$ K, achieved for $x = 0.025$. Use of two protocols also allowed us to monitor the effect of disorder, introduced by chemical substitution in Fe sublattice. The low-temperature variation of λ (T), measured as a function of doping, was analyzed using a power-law fit, $\Delta\lambda = A\ T^n$. The exponent, n, changes from $n \sim 1.85$ at the optimal doping to much lower values in the underdoped, $n \sim 1.1$, and heavily overdoped, $n \sim 1.3$, samples. This doping-evolution of λ (T) cannot be explained by isotropic gap with scattering and suggests that while the superconducting gaps are isotropic at the optimal doping, at least one of them develops strong anisotropy at the dome edges. This scenario appears to be common for many other Fe-based superconductors.

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Date submitted: 08 Nov 2011 Electronic form version 1.4