Effects of Co substitution on thermodynamic and transport properties and anisotropic $H_{c2}$ in Ba(Fe$_{1-x}$Co$_x$)$_2$As$_2$.$^1$ NI NI, M. E. TILLMAN, J-Q. YAN, A. KRACHER, S. L. BUD’KO, P. C. CANFIELD, Ames Lab / Iowa State University, S. T. HANNAHS, NHMFL, Tallahassee — Single crystal samples of Ba(Fe$_{1-x}$Co$_x$)$_2$As$_2$, $x < 0.12$, have been characterized by microscopic, thermodynamic and transport measurements. With increasing Co concentration, the features of the structural and magnetic transitions are suppressed at a rate of roughly 15K per percent of Co. Superconductivity is stabilized at low temperatures for $0.038 \leq x$ and up through our highest doping level of $x = 0.114$. The superconducting region has a dome like appearance with maximum $T_c$ values ($\sim 23$ K) found near $x \sim 0.07$. The $T - x$ phase diagram shows that either the existence of superconductivity in both the tetragonal and the orthorhombic (AFM) phase or there is a structural phase separation. Anisotropic $H_{c2}$ data clearly show that the superconductivity which occurs in samples that show features associated with the transition to the low temperature orthorhombic state is 50% smaller than that found in samples that remain in the tetragonal phase. These data show that the superconductivity is sensitive to the suppression of the higher temperature phase transition.

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