Atomically resolved images and spectroscopy of superconducting Ba(Fe$_{1-x}$Co$_x$)$_2$As$_2$ single crystals

N.-C. YEH, M.L. TEAGUE, Dept. of Physics, Caltech, Pasadena, CA 91125, P. CHENG, H.H. WEN, Inst. of Physics, Chinese Academy of Sciences, CHINA — We report atomically resolved images and spectroscopy of electron-doped superconducting Ba(Fe$_{1-x}$Co$_x$)$_2$As$_2$ single crystals, with $x = 0.12$, 0.08 and 0.06 corresponding to $T_c = 20$ K, 24 K and 14 K, respectively. Scanning tunneling microscopic images of the crystals reveal somewhat disordered atomic arrangements of the Ba, As and Fe/Co layers, with averaged lattice constant $\sim 0.40$ nm for Ba and As layers, and $\sim 0.28$ nm for the Fe/Co layers. In contrast, spectroscopic studies indicate relatively homogeneous tunneling conductance at constant bias voltages, which differ from the findings on hole-doped (Ba$_{1-x}$K$_x$)Fe$_2$As$_2$. Two types of spectra are observed, corresponding to two energy gaps $\sim 5$ meV and $\sim 10$ meV for Ba(Fe$_{0.88}$Co$_{0.12}$)$_2$As$_2$, and the spatial distribution of the larger gap exhibits quasi super-modulations. The smaller gap may be attributed to superconductivity and the larger gap may be related to remnant spin density waves. Finally, doping dependent spectral evolution of Ba(Fe$_{1-x}$Co$_x$)$_2$As$_2$ will be discussed.

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Marcus Teague  
Caltech

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