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Local topography and spectroscopy of the doped chalcogenide $\mathbf{FeTe}_x\mathbf{Se}_{1-x}$[1] XIAOBO HE, GUORONG LI, JIANDI ZHANG, RONGYING JIN, Louisiana State University, Baton Rouge, LA 70803, USA, A.S. SEFAT, M.A. MCGUIRE, B.C. SALES, Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA, D. MANDRUS, University of Tennessee, Knoxville, TN, 37996, E.W. PLUMMER, Louisiana State University, Baton Rouge, LA 70803, USA — The atomically resolved structural and electronic properties of FeTe and $FeTe_{0.55}Se_{0.45}$ have been investigated using scanning tunneling microscopy/spectroscopy. The STM topography of the doped sample clearly distinguishes two types of atoms. Statistically the topography shows the correct concentration of the two species and reveals that they are not randomly distributed but prefer to congregate with tens of identical atoms in nanometer scale. Consequently, in contrast to extremely flat surface of parent compound FeTe, $FeTe_{0.55}Se_{0.45}$ shows structural phase separation globally breaking the pure *p4/nmm* symmetry. Surprisingly the local density of states on tellurium and selenium atoms in $FeTe_{0.55}Se_{0.45}$ are identical, but not the same as that in pure FeTe. This indicates an itinerant (rather than localized) electronic character in this doped system. This behavior is opposite to phase separation in many other doped materials.

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