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Charge carrier localization induced by excess Fe in the $\mathbf{Fe_{1+y}(Te_{1-x}Se_x)}$ superconductor system JIN HU, TIJIANG LIU, Tulane University, XIANGLIN KE, The Pennsylvania State University, QIAN BIN, DAVID FOBES, ERIN VEHSTEDT, HUY PHAM, Tulane University, JINHU YANG, MINGHU FANG, Zhejiang University, LEONARD SPINU, University of New Orleans, PETER SCHIFFER, Pennsylvania State University, YING LIU, The Pennsylvania State University, ZHIQIANG MAO, Tulane Unversity — Iron chalcogenide $Fe_{1+y}(Te_{1-x}Se_x)$ is the simplified version of Fe-based superconductors. Its non-superconducting parent compound $Fe_{1+y}Te$ exhibits an AFM structure distinct from those seen in undoped FeAs compounds. Understanding of the superconducting properties of this system has been considered critical. We have investigated the effect of Fe nonstoichiometry on properties of the $Fe_{1+y}(Te_{1-x}Se_x)$ superconductor system by means of resistivity, Hall coefficient, magnetic susceptibility, and specific heat measurements. We find that the excess Fe at interstitial sites of the (Te, Se) layers not only suppresses superconductivity, but also results in a weakly localized electronic state. Together with neutron scattering studies and recent DFT calculations, our results suggest that such weak charge carrier localization originates from the magnetic coupling between the excess Fe and the adjacent Fe square planar sheets.

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