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Cu-induced localization in the Fe-based superconductor $FeTe_{0.5}Se_{0.5}$[1] JINSHENG WEN, UC Berkeley, ZHIJUN XU, CHENG ZHANG, BNL, MASA MATSUDA, ORNL, OLEG SOBOLEV, JITAE PARK, FRM II, EDITH BOURRET, LBNL, DUNGHAI LEE, UC Berkeley, QIANG LI, GENDA GU, GUANGYONG XU, JOHN TRANQUADA, BNL, ROBERT BIRGENEAU, UC Berkeley — We report neutron scattering and resistivity results on the Cu-substitution effects in $FeTe_{0.5}Se_{0.5}$ with a T_c of $\sim$15 K. With a 2% Cu substitution, the T_c is reduced to 8 K, and for $Fe_{0.9}Cu_{0.1}Te_{0.5}Se_{0.5}$, it is not superconducting. In $Fe_{0.9}Cu_{0.1}Te_{0.5}Se_{0.5}$, the low-energy magnetic excitations around the in-plane wave vector (0.5, 0.5) is greatly enhanced. Upon heating, the magnetic scattering is weakened, which is different from the temperature dependences of the Cu-free and 2% Cu-doped sample. The spectral weight reduction upon warming decreases with increasing energy in the 10% Cu-doped sample. We take these as evidences that Cu drives the system towards localization, which is confirmed by our resistivity data. These observations probably explain why superconductivity is absent in the Cu-doped $BaFe_2As_2$ system and demonstrate the inadequacy of the rigid-band shift model on the substitution effects of the $3d$ transition metals.

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