Normal state magnetic susceptibility of Te-annealed $Fe_{1+y}Te_{1-x}Se_x$

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Normal state properties of iron-based superconductors have been crucial in understanding the mechanism of superconductivity. We have previously reported that the magnetic susceptibility in normal state is sensitive probe to investigate the pseudogap in high-Tc cuprate. Here, we measured the normal state magnetic susceptibility of as-grown and Te-annealed $Fe_{1+y}Te_{1-x}Se_x$. In the case of $Fe_{1+y}Te_{1-x}Se_x$ systems, excess iron is inevitably incorporated in the crystals, which conceals the nature of anomalous physical properties. In previous research, we developed an annealing method to remove excess iron in which single crystals are annealed under tellurium vapor (Te anneal). With this Te-annealing, the excess iron was sufficiently removed without damaging the samples[1].

Figure 1(a) shows the temperature dependence of the magnetic susceptibility for as-grown $Fe_{1.03}Te_{0.6}Se_{0.4}$. It exhibits Curie-Weiss-like behavior at low temperatures and slight symptoms of superconductivity below 5K. The inset of Figure 1(a) illustrates the magnetic field dependence of the magnetic moment (M-H plot). It presents the linear field dependence at high temperatures, while the deviation from the linear field dependence was observed at 10 K. These results indicate that the excess Fe works as local moment at high temperatures and that the ferromagnetic interaction of excess Fe would develop below 50 K. Then, superconductivity is destroyed by ferromagnetic interaction.

Figure 1(b) shows temperature dependence of the magnetic susceptibility of Te-annealed $FeTe_{0.6}Se_{0.4}$ measured at 5T. It exhibits an almost temperature independent behavior, which implies that the local moment from excess Fe is absent and Pauli paramagnetism is dominant in the absent of excess Fe. The inset of Figure 1(b) presents a M-H plot for Te-annealed $FeTe_{0.6}Se_{0.4}$. It shows the linear field dependence indicating the absence of magnetic impurity such as Fe_3O_4, which we report previously[2]. As seen in this figure, the magnetic susceptibility decreases below T^{**}_{χ} with decreasing temperature, which imply the decrease in DOS by opening the pseudogap. In the presentation, we will discuss the phase diagram and the existence of an orbital-selective Mott phase (OSMP).

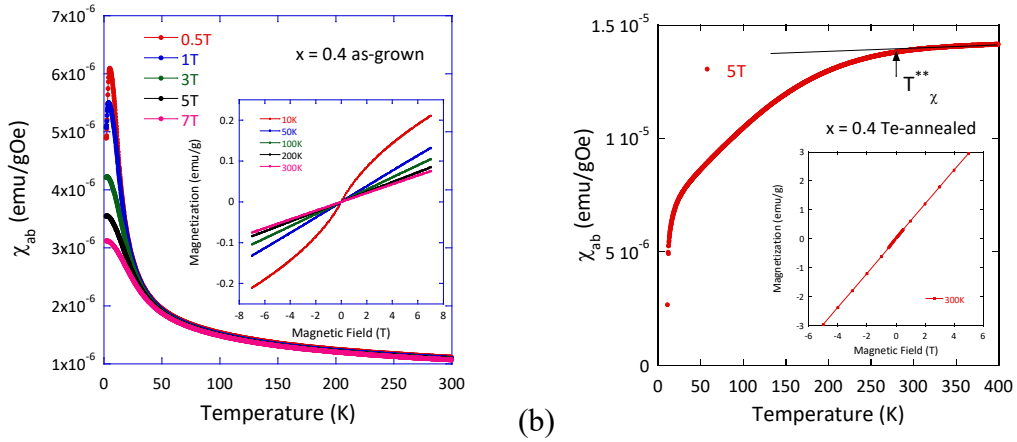

Figure 1: Temperature dependence of magnetic susceptibility for (a) as-grown and (b) Te-annealed $FeTe_{0.6}Se_{0.4}$. Inset: magnetic field dependence of the magnetic moment (M-H plot)

References

[1] Y. Koshika et al., *J. Phys. Soc. Jpn*. **82**, 023703 (2013).
[2] T. Fujii *et al*., *JPS Conf. Proc.* **38**, 011027 (2023).