# PCP4-3

## Transport properties of electron-doped $FeSe_{1-x}S_x$ and $FeSe_{1-y}Te_y$ films with electric double layer transistor

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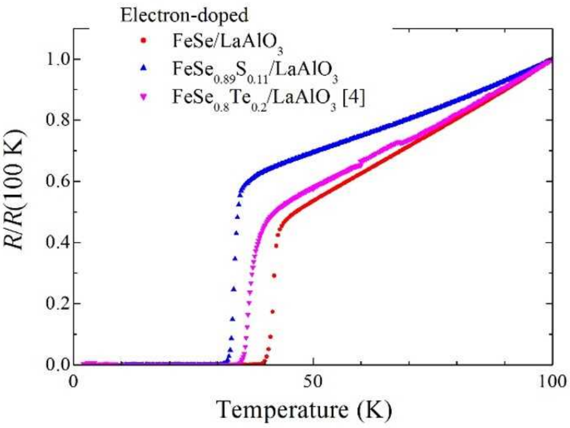
FeSe shows the structural phase transition without an antiferromagnetic transition unlike other iron-based superconductors, and provides a unique playground to study the role of the structural phase (nematic) transition. We found that $T_c$ of $FeSe_{1-x}S_x$ films monotonically decreases when the structural phase transition disappears [1], while that of $FeSe_{1-y}Te_y$ films jumps just after the structural phase transition disappears [2]. The contrastive behavior between $FeSe_{1-x}S_x$ and $FeSe_{1-y}Te_y$ may suggest that the structural phase transition does not play a universal role for $T_c$.

It is well-known that electron doping to FeSe increases its $T_c$ up to 40-45 K [3]. It is of great interest to investigate the Tc behavior in such a high Tc electron-doped FeSe upon S/Te substitution, especially at the orthorhombic-tetragonal boundary. In this study, we fabricated the electric double layer transistor(EDLT) configuration of $FeSe_{1-x}S_x$ and $FeSe_{1-y}Te_y$ films on $LaAlO_3$ substrate, and measured transport properties under gate voltage to investigate the behavior of $T_c$ of the tetragonal phase and orthorhombic phase for the electron-doped FeSe films.

Figure 1 shows the temperature dependence of the electron-doped $FeSe_{0.89}S_{0.11}$, $FeSe_{0.8}Te_{0.2}$ [4] and FeSe films. Electron-doped $FeSe_{0.89}S_{0.11}$ and $FeSe_{0.8}Te_{0.2}$ also show high $T_c$. Figure 2 shows the phase diagram of the electron-doped $FeSe_{1-x}S_x$ and $FeSe_{1-y}Te_y$ films. $T_c$'s of electron doped $FeSe_{1-x}S_x$ and $FeSe_{1-y}Te_y$ films are lower than that of FeSe. Unlike the "bulk" $FeSe_{1-x}S_x$ and $FeSe_{1-y}Te_y$ films, $T_c$ gradually decreases as $x$ or $y$ increases. We will discuss the origin of the difference in the behavior of $T_c$ at the orthorhombic-tetragonal boundary between the "bulk" and electron-doped films.



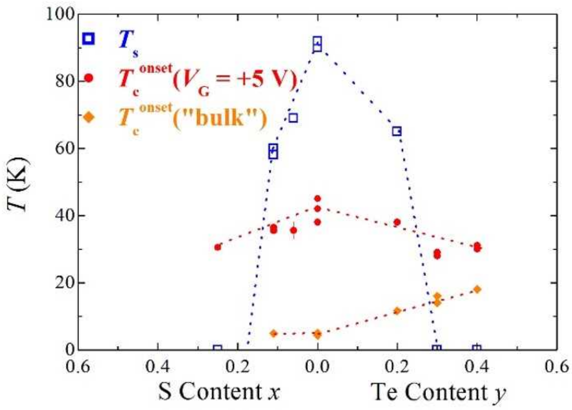




Fig. 1 Temperature dependence of resistivity of the electron-doped $FeSe_{0.89}S_{0.11}$, $FeSe_{0.8}Te_{0.2}$ [4] and FeSe under gate voltage $V_G$ = +5 V.

Fig. 2 Phase diagram of the electron-doped $FeSe_{1-x}S_x$ and $FeSe_{1-y}Te_y$ films.

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