High pressure resistivity and x-ray crystal structure analysis of $FeSe_{0.5}Te_{0.5}$

K. Horigane[1], K. Ikeuchi[2], A. Nakao[2], H. Nakao[2], N. Takeshita[3,4], H. Hiraka[5] and Y. Murakami[2]
[1]WPI-AIMR Tohoku University, [2]KEK-PF, [3]AIST, [4]JST-TRIP, [5]IMR Tohoku University

The iron-based superconductors have been intensively studied with respect to the interplay between crystal structure and superconductivity. Recently, Lee *et al*. have reported that T_c becomes maximum when $FeAs_4$-lattices form a regular tetrahedron (As-Fe-As angle α=109.47°) [1]. On the other hand, theoretical calculation shows that T_c increases with increasing the pnictogen height [2]. These result indicated a relationship between crystal structure and superconductivity. In this study, high pressure experiments were carried out for $FeSe_{0.5}Te_{0.5}$ to get direct evidence between crystal structure and superconductivity.

Figure 1 shows the temperature dependence of the resistivity of $FeSe_{0.5}Te_{0.5}$ at various pressures up to 7.5GPa. In the superconducting state, T_c increased rapidly exhibiting the enhanced from 13.5K (12.5K) to 26.2K (21.5K). At pressure higher than 2GPa, a reduction of T_c is observed. T_c decreases linearly above 2GPa at a rate of -2.8GPa, which is considerably smaller than that of the ratio derived below 2GPa.

In order to compare the relationship between T_c and crystal structure, we were performed on high pressure x-ray crystal structure analysis. Figure 2 shows the pressure dependence of angle α and calcogen height in $FeSe_{0.5}Te_{0.5}$. In the T_c-α relation, it is expected that T_c will increase with increasing α. However, our result can not be explained this relation. On the other hand, calcogen height tends to increase with increasing pressure. This result suggests that anion height is the important factor for the superconductivity.

[1] C. H. Lee et al., JPSJ **77**, 083704 (2008)
[2] K. Kuroki et al., PRB **79**, 224511 (2009)

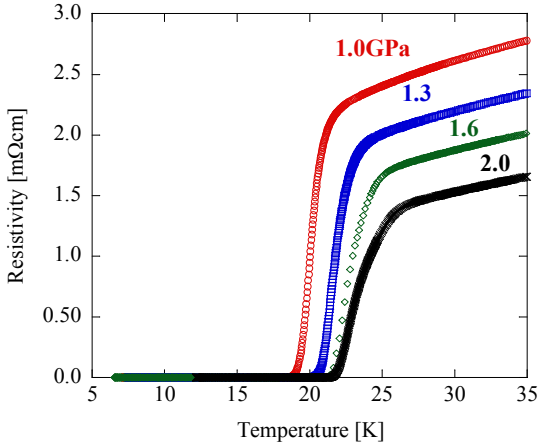

Fig.1 T_c in $FeSe_{0.5}Te_{0.5}$ under high pressure

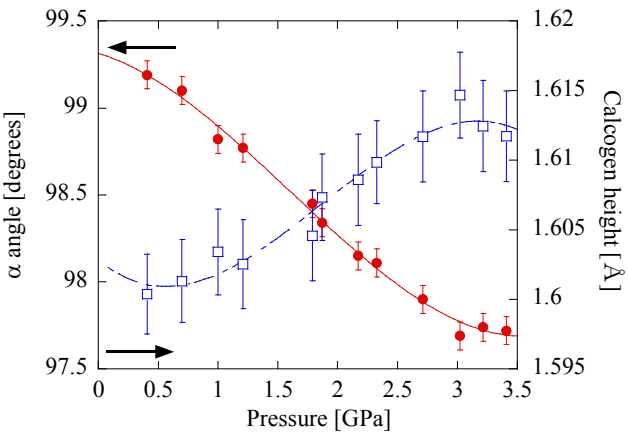

Fig.2 Pressure dependence of α and calcogen height in $FeSe_{0.5}Te_{0.5}$