High Field Study of Angle-Dependent Magnetoresistance Oscillations of a Multiple Fermi Surface System

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Introduction

The layered oxide superconductor Sr_2RuO_4 has three cylindrical Fermi surfaces. Angular magnetoresistance was extensively studied by Ohmichi *et al*.[1]. Prominent Kartsovnik-Kajita-Yamaji (KKY) oscillations are readily observed with a well developed coherence peak when the magnetic field lies parallel to the conducting layer. However, attribution of KKY peaks to each Fermi surface has never been seriously studied. Depending on the azimuthal angle in which the plane of polar rotation was placed, a wide spectrum of the KKY oscillations were observed. In an effort to resolve KKY oscillations arising from three different Fermi surfaces, we carried out the angular magnetoresistance measurements under a field up to 31 T.

Experimental

A superconducting magnet up to 18 T and a resistive magnet up to 31 T were used. Because there is only single-axis rotation available, we put four samples with slightly different azimuthal direction in the plane side by side and measured simultaneously. Precise determination of azimuthal direction is to be made separately in the double-axis rotator probe at lower magnetic field.

Results and Discussion

Figure 1 shows angular magnetoresistance from four samples put side by side measured at 0.5 K. In addition to the principal series of KKY oscillations peaks, there are secondary peaks around -60 degree and close to 90 degree. Secondary peaks are much smaller than the principal peaks and it is difficult to assign them to any specific Fermi surface even at 31 T.

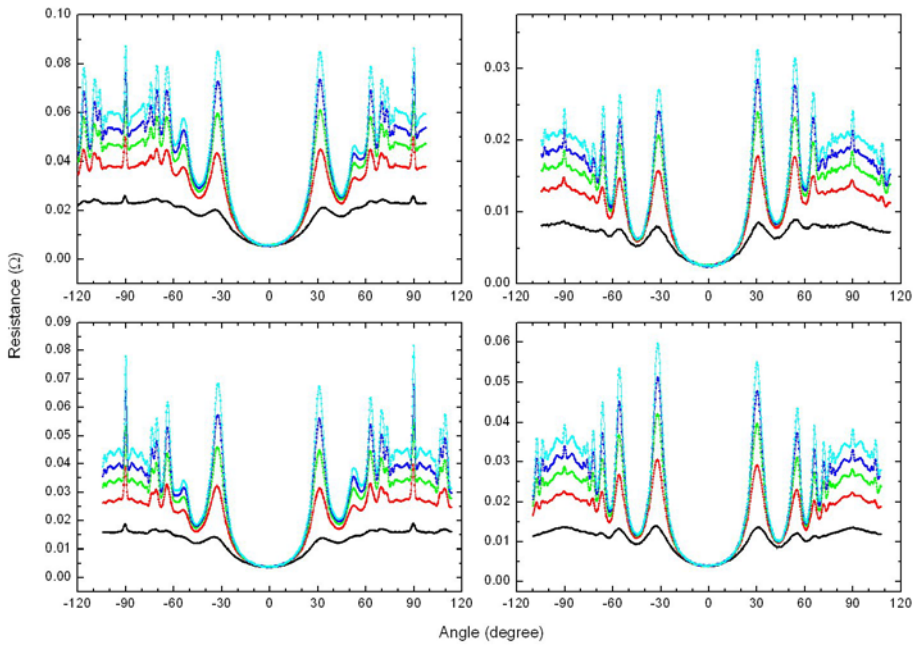

Figure 1. Angular magnetoresistance of four different samples from the same batch of Sr_2RuO_4 put side by side with different azimuthal directions. Magnetic fields are 10, 18, 23, 27, 31 T from below. T = 0.5 K.

Conclusions

Although we could resolve more KKY peaks at high field and at high tilted angular positions, it is not possible to identify the source of their origin. We believe that knowledge on the detailed azimuthal evolution of these peaks is crucial to determine their origin. It is highly desirable to develop double axis rotation system for high field magnets.

Acknowledgements

This work was supported by Korean National Research Foundation Grant 2012-008974.

References

[1] Ohmichi, E., *et al*., Phys. Rev. B, **59**, 7263-5 (1999).