MAGNETO-TRANSPORT MEASUREMENTS ON $Ca_{1.5}Sr_{0.5}RuO_4$ AT LOW TEMPERATURES AND HIGH FIELDS

H.C. Choi, J.-H. Park, S.B. Cho, M.W. Meisel, Y. Lee (UF, Physics); J.S. Xia (UF, NHMFL); R. Jin, D. Mandrus (Oak Ridge National Laboratory)

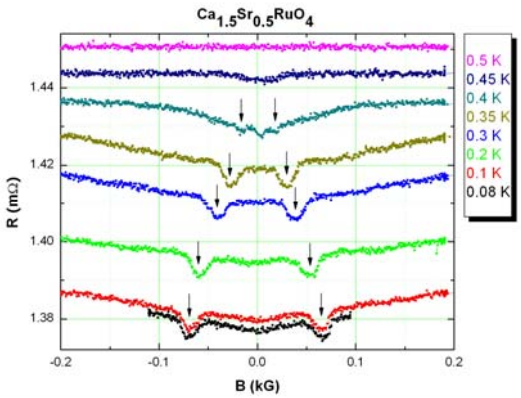
Introduction

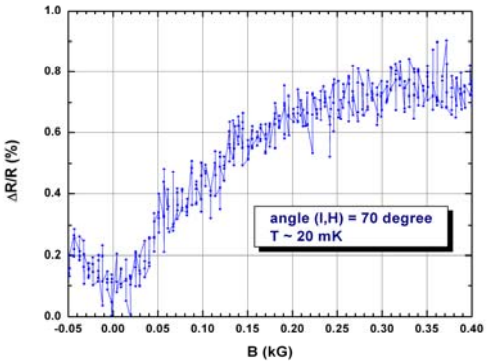
Upon substituting Sr with isovalent Ca, $Ca_{2-x}Sr_xRuO_4$ shows an intriguing phase diagram [1] ranging from *p-wave* superconductor at $x = 2$ to Mott insulator at $x \leq 0.2$. The $x = 0.5$ system investigated in this work is reported to be at the boundary between the magnetic metal ($x < 0.5$) and the paramagnetic metallic phase. A small but distinct increase in resistance was observed at $T^* \approx 450$ mK on warming. In addition, T* decreases with the applied magnetic field, and the feature in resistance disappears around 500 G. Our detailed magneto-resistance measurements reveal unusual behavior in the low temperature and low magnetic field region that, we believe, is directly related to the resistance anomaly observed near 450 mK in zero magnetic field.

Experimental

Magneto-transport measurements on this system have been conducted in the PI's laboratory at UF down to 60 mK in fields as high as 8 T applied along the c-axis. We extended our measurements to mK range and up to 15 T using the High B/T Facility. The High B/T Facility has a unique ability of rotating samples inside an immersion cell, which allows us to investigate angle dependence of the magneto-resistance. We conducted experiments from 05/12/05 to 08/25/05. Among 4 samples studied, only one sample survived through cooling. We confirmed low field measurements and extended our measurements to 15 T applied in the c-direction and 20 degree rotated out of the c-direction. Unfortunately, the 15 T experimental magnet was quenched during a field sweep. As a result, we lost electrical contacts on the sample and the experiment ended prematurely.

Results and Discussion





Magneto-resistance was measured at 20 mK up to 15 T applied along the c-axis and the results show smooth extention to higher fields from the low field meaurements. However, substantial changes in magneto-resistance at 20 mK was observed in the field direction, $\angle(\mathbf{c}, \mathbf{H}) = 20°$. Especially in the low field region, small dips observed in fields along the c-axis (see figure in the left) completey disappeared in the rotated field as shown in the right figure.

Acknowledgements

This work was partially supported by an Alfred P. Sloan Research Fellowship (YL), NSF grants DMR-0239483 (YL) and DMR-0305371 (MWM). ORNL is managed by UT-Battelle, LLC, for the U.S. DOE under contract DE-AC05-00OR22725.

References

[1] S. Nakatsuji, *et al*., PRB, **90**, 137202 (2003).