Electrical Resistance of Quasi-1D $Li_{0.9}Mo_6O_{17}$ at Very High Magnetic Field

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Introduction

Recently photoemission experiments [1], band structure calculations [2], and the description of the electrical resistivity by two power law temperature terms [3] have shown that $Li_{0.9}Mo_6O_{17}$ is the best-known example of a Luttinger-liquid (LL) metal [4]. An important issue regarding $Li_{0.9}Mo_6O_{17}$ is the cause of the crossover from metallic to semiconductor-like behavior near T_M at ~ 28 K. This crossover was addressed by high resolution thermal expansion experiments which suggested that a dimensional crossover from 1 to 3D sets the stage for superconductivity in the compound at 1.9 K [5]. To obtain more information about the crossover at T_M, magnetoresistance measurements were performed under very high magnetic field using the NHMFL facility.

Experimental

Single crystals of $Li_{0.9}Mo_6O_{17}$ were grown using a temperature-gradient flux method as described in reference 3. Four-probe electrical resistance measurements were performed in four crystals in the range 0.5 to 300 K under applied magnetic up to 25 T using a 30 T hybrid magnet available at the NHMFL in Tallahassee.

Results and Discussion

Crystals with typical crossover from metal to semiconducting near 28 K and superconducting transition at 1.9 K at zero magnetic field were used to measure resistance as a function of temperature, R(T), under very high applied magnetic fields. R(T) for four different applied magnetic fields are displayed in Fig. 1. The results unambiguously show the strong magnetic field dependence of the minimum in the electrical resistance (R_M). Furthermore, a power law dependence of the $R_M(H)$ with $T_M(H)$ is observed. This result agrees with that observed at low magnetic field measurements (up to 8 T).

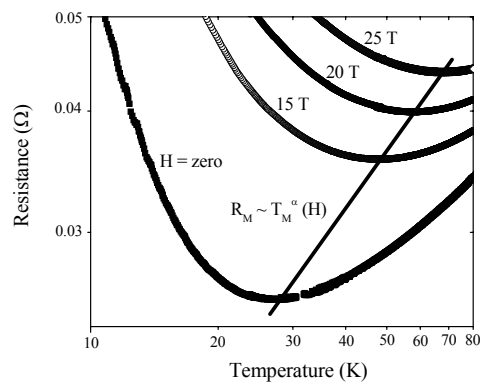

Figure 1 – R(T) curves at very high magnetic field illustrating the field dependence of T_M.

Conclusions

The results show that the minimum at T_M increases with increasing H. The power-law temperature dependence of the electrical resistance at $T_M(H)$ is observed.

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References

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