Phase Diagram of the Cadmium Doped Superconductor $PuRhIn_5$

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Introduction

Recent innovations in heavy fermion superconductors have renewed interest in the 5*f* electron superconductors. The localized and itinerant nature of 5*f* electrons are thought to mediate unconventional superconductivity in these materials, among them the Pu based 115 series.

Experimental

PuRhIn5 was doped with Cd up to 10%. These samples were wired in a standard 4-point configuration and placed into an oxford 18/20T magnet. The experiments were run in ^{3}He temperatures.

Results and Discussion

The parent compound PuRhIn5 is a superconductor its self with a Tc of near 1K, the addition of Cd lowered the critical temperature with increasing doping to a minimum of near 0.65K at 10%. The bump in resistance at 10% doping has been interpreted as an antiferromagnetic transition. Further analysis of the resistance scaling above the superconducting transition revealed an exponential relation with an exponent in the range of 0.9 to 1.2.

Conclusions

The superconducting transition could clearly been seen as well as the antiferromagnetic ordering in the higher doped samples. This has allowed the construction of a preliminary phase diagram as seen in figure 2. Further work focusing on tuning the system closer to the superconducting regime is currently underway.

Acknowledgements

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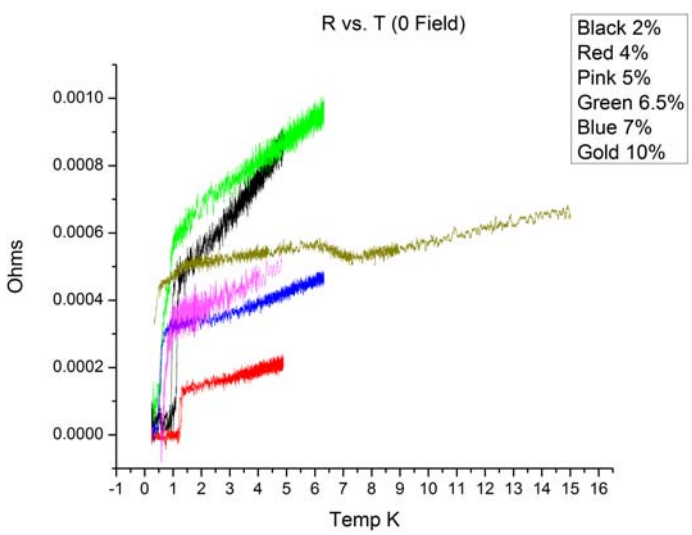

Fig. 1 Resistance vs. temperature for $PuRh(In\ Cd)_5$ showing the antiferromagnetic "bump" in the 10% doping.

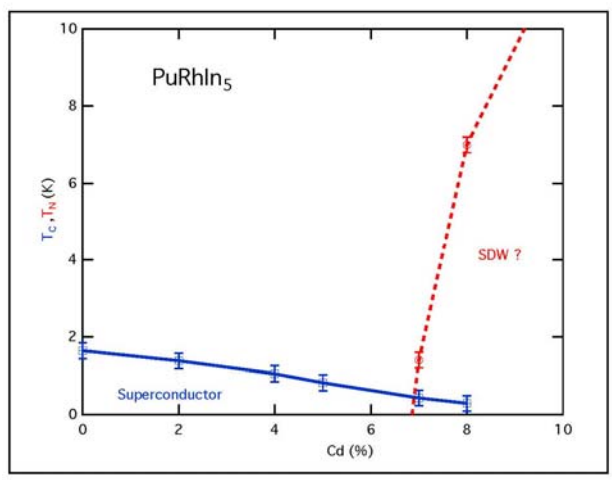

Fig. 2 Initial phase diagram of PuRh(In-Cd)5