Angular Dependence of Magnetoresistance in $CeCo(In,Cd)_5$ at High Magnetic Fields

C. Capan (UC Irvine, Physics), R.G. Goodrich (LSU, Physics), Y.J. Jo (NHMFL), L. Balicas (NHMFL), A.D. Bianchi (UC Irvine, Physics), L.D. Pham (UC Davis, Physics), Z. Fisk (UC Irvine, Physics) and J.F. Ditusa (LSU, Physics)

$CeCoIn_5$ has a unique H-T phase diagram where non-Fermi Liquid behavior is observed in the vicinity of the upper critical field H_{c2} [1]. The origin of the putative quantum critical point (QCP) is still under investigation. It was recently shown that Cd substitution induces antiferromagnetism for x>10% [2]. We have investigated the angular dependence of the magnetoresistance in $CeCo(In_{1-x}Cd_x)_5$ in an effort to understand the effect of Cd on the electronic properties. We have measured the resistivity in single crystals of $CeCo(In_{1-x}Cd_x)_5$ for x=5%,10%,15% in the portable dilution refrigerator, using the 35T magnet at NHMFL. The field was rotated from c-axis to in-plane, perpendicular to the current (TMR).

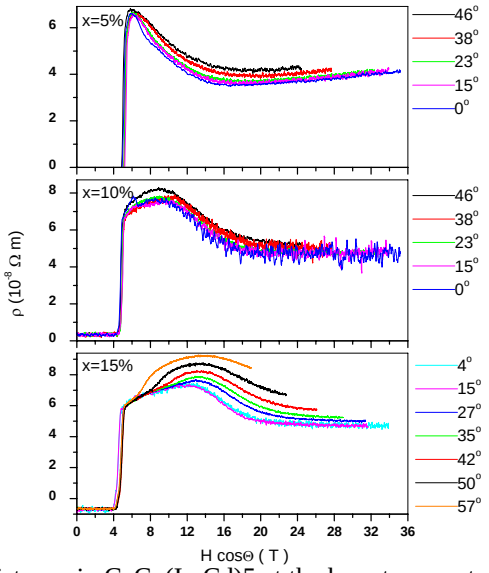

Fig. 1: Transverse magnetoresistance in CeCo(In,Cd)5 at the base temperature T=50mK for x=5%, 10% and 15% with the field orientation Θ ranging from 0° (H||[001]) to 57°. The field is perpendicular to current and rotated towards in-plane.

Figure 1 shows the TMR as a function of the field component along the c-axis (HcosΘ) for 5% 10% and 15% Cd doped CeCoIn5, with the Tc's of 2.07K, 1.93K and 1.8K. The 10% and 15% samples also have a Neel temperature of 3K and 3.8K respectively. The field dependence of the TMR in the 5% sample is very similar to CeCoIn5, with a crossover from a negative MR above Hc2 (likely due to the quenching of spin fluctuations) to a positive MR at higher fields (corresponding to the orbital MR). In contrast, the TMR exhibits a maximum around 10T (14T) for the 10% (15%) antiferromagnetic sample, even though no anomaly is observed in the torque magnetization of samples from the same batches. The scaling of the TMR with respect to HcosΘ suggests that the main contribution to the MR comes from the 2D sheets for the 5% and 10% samples. A similar scaling in TMR was reported in the low field regime (T>Tc) in pure CeCoIn5. The breakdown of the scaling for the 15% sample is not well understood at present.

Acknowledgements

J.F.D. and Z.F. acknowledge support by the NSF through grants DMR-0406140 and DMR-0533560. C.C. acknowledges postdoctoral fellowship from ICAM, supported by the NSF International Materials Institute Program.

References

[1] Bianchi, A.D., *et al*., Phys. Rev. Lett., **91**, 257001 (2003).
[2] Pham, L.D., *et al*., Phys. Rev. Lett., **97**, 056404 (2006).
[3] Hu, T., *et al*., Phys. Rev. B, **73**, 134509 (2006).