HIGH-FIELD DENSITY WAVE STATE OF (PER)$_2$PT(MNT)$_2$ UNDER HYDROSTATIC PRESSURE

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Introduction

Previous studies have shown that high magnetic fields of order 33 T can suppress the charge-density wave state (CDW) of the quasi-one-dimensional compound (Per)$_2$M(mnt)$_2$ (where M = Au), thus increasing the conductivity of the system [1]. For M = Pt, even after the conventional low field CDW state in suppressed in fields of order 20 T, a second high resistance state results [2]. We report preliminary results of the effects of hydrostatic pressure on the M = Pt system.

Experimental Results

Samples of (Per)$_2$Pt(mnt)$_2$ were mounted in a BeCu double-clamp pressure cell which was loaded to pressures of 1, 3 and 5.3 kbar using Daphne oil as a medium. Four-terminal magnetoresistance (MR) was measured in the NHMFL 45 T hybrid magnet with temperatures as low as 0.5 K, using a He-3 cryostat. Currents on the order of 10$\mu$A were applied along the long axis (b-axis) of the needle crystal. Sample 1 was oriented such that the magnetic field was aligned with the conducting chain (B//b-axis) and sample 2 was measured with the chain perpendicular to the field (B//c-axis).

As seen in Figure 1a for sample 1, for pressures between 1 and 5.3 kbar, the zero field resistance decreases with pressure, and the sample resistance monotonically decreases for B//b. Hence unlike the results for ambient pressure [2], there is no second upturn in the resistance in this orientation. For sample 2 in Figure 1b, where the field is perpendicular to b, increasing the pressure also decreases the low field resistance by suppressing the CDW$_0$ state. However, as in Ref. [2] for ambient pressure, an intervening low resistance state occurs near 20 tesla followed by a field-induced density wave state (which is also suppressed with pressure).

Discussion and Conclusion

The current results may follow the theory of Zanchi et al., where the modification of the nesting vector in an increasing magnetic field depends on the orientation of the conducting chain to the applied field and the degree of imperfect nesting [3]. Applying hydrostatic pressure will increase the imperfect nesting of a Q1D system, thus increasing the dimensionality. The MR results indicate the orbital effects play a prominent role in the creation of the high field state in the presence of enhanced imperfect nesting, since no second high field, insulating state is observed for fields applied along the most conducting chain.

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References


Figure 1 – Magnetoresistance of (Per)$_2$Pt(mnt)$_2$ for (a) B // b-axis and (b) B ⊥ b-axis. Inset to panel (a) shows the zero-field temperature dependence of sample 1.