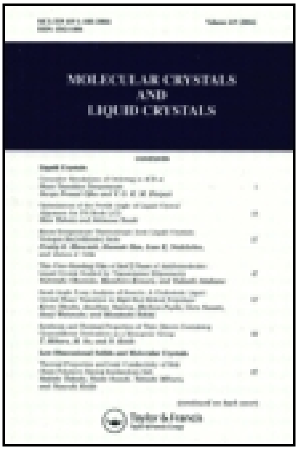

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Transport and Magnetic Properties on the Family of Perylene-Dithiolate Conductors

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TRANSPORT AND MAGNETIC PROPERTIES ON THE FAMILY OF PERYLENE--DITHIOLATE CONDUCTORS

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Abstract Thermoelectric power and e.s.r. results on the family of organic conductors $(Perylene)_2M(mnt)_2$ (mnt=1,2-dicyanoethylene 1,2-dithiol) (M=Au, Pt, Pd) are reported.

INTRODUCTION

The main features of the $(Perylene)_2$ metal-bis 1,2 dicyano 1,2-ethylenedithiolate family, here abreviated as $Per_2\,M(mnt)_2$ are reviewed elsewhere in this Conference[1].

The members of the family with M=Au, Pt, Pd exhibit metal--like electrical conductivity[2,3] and are studied here concerning their magnetic properties by electron spin resonance and their thermoelectric power.

THERMOELECTRIC POWER

The thermoelectric power of the samples has been measured between 300 and 77K by a slow a.c. technique (10^{-2} Hz) similar to that described by Chaikin and Kwak[4,6], using gold wire leads attached to the sample by Acheson gold paint The temperature gradient was measured with a differential copper-constantan thermocouple. The behavior of thermopower in function of temperature is similar for the three compounds (Figure 1).

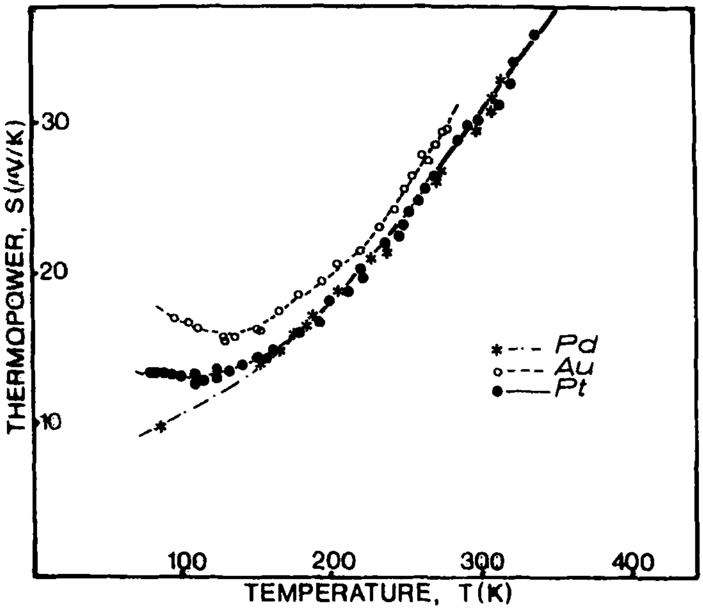

FIGURE 1 The variation of thermopower with temperature

In a preliminar experiment on $Per_2\ Pt(mnt)_2$ in the temperature range 4.2 - 77 K, using the same technique, we observed that the thermopower passes through a minium where the electrical conductivity has its maximum and then increases below the transition temperature (6.5 K), remaining always positive. In the intermediate temperature range there are upwards deviations from linearity, as currently observed in some metals, which are attributed to phonon-drag[5].

ELECTRON SPIN RESONANCE

$Per_2\ Au(mnt)_2$

The e.s.r. spectrum of a single crystal of this compound is a narrow line with g = 2.003. The variation of linewidth and signal intensity with temperature is plotted in Figure 2, for H_o perpendicular to the stacking axis.

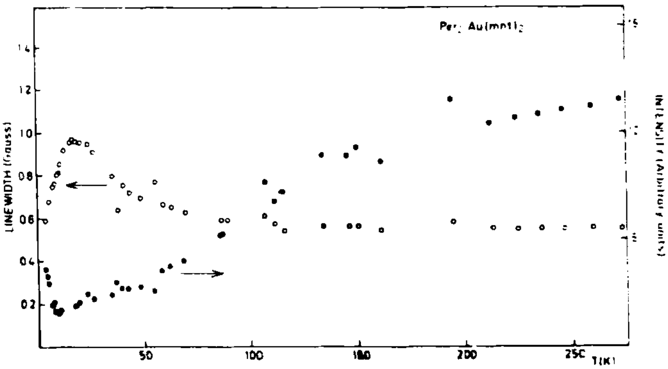

FIGURE 2 The e.s.r. signal intensity (right, closed circles) and linewidth (left, open circles) for $Per_2\ Au(mnt)_2$.

$Per_2\ Pt(mnt)_2$

In a single crystal experiment performed with H_o perpendicular to the stacking axis $\vec{b}$, the intensity drops below 10 K while the linewidth passes by a minimum with a upturn at lower temtepatures (Fig. 3). At ca. 6 K the signal becames vaninghly small and broad and a lower temperatures a new signal appears at

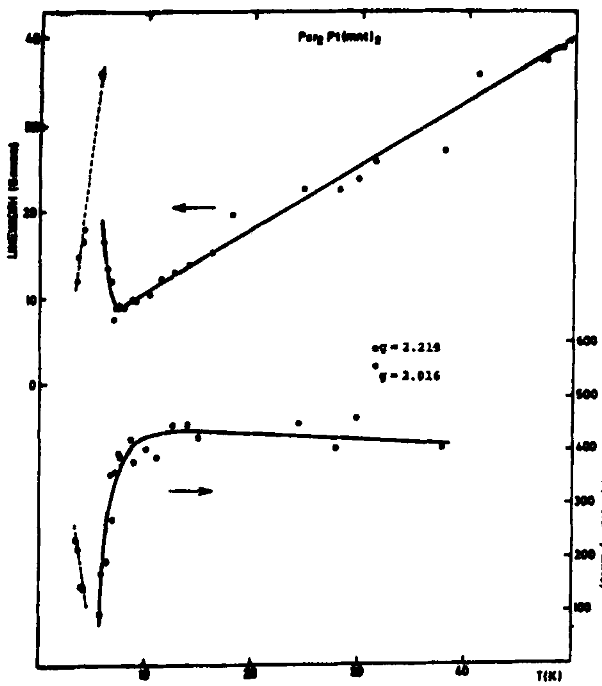

FIGURE 3 Linewidth and intensity of e.s.r. lines for M=Pt.

a higher g value g = 2.193, for the given geometry. The nature of this line is not yet clear but its attribution to an "impurity" may be an oversimplification. In fact when H_0 rotates in the $(\vec{a},\vec{c})$ plane the g-values vary from 2.065 to 2.227, that are within the g_x and g_y values for the species $Pt(mnt)_2$.[7]

Per_2 $Pd(mnt)_2$

From the double integration of the powder signal of this compound, we obtained the paramagnetic susceptibility, which is of the Curie-Weiss type and, within experimental error shows no special feature at 28 K or a 11 K, the temperature of another anomaly in the electrical resistivity. However in the experiment performed with H_0 perpendicular to $\vec{b}$ (with ten aligned crystals), the linewidth of the signal with g=2.003 diverges at ca. 11 K (Figure 4), while a new line is observable at temperatures below 28 K, with g=2.06 not far from one of the principal values of the g-tensor of $Pd(mnt)_2$.[8]

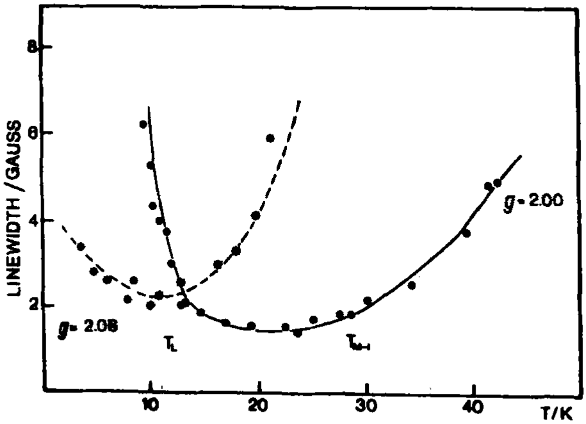

FIGURE 4 The linewidth of the two e.s.r. lines (g=2.00 and g=2.06) for $Per_2Pd(mnt)_2$

CONCLUSIONS

The e.s.r. of the three compounds evidenciates that we are not in presence of simple Peierls transitions. The anions play a role in the mechanism of the transition, the fact that $Au(mnt)_2^-$ is spinless while for M=Pd, Pt the anions are paramagnetic may explain the major differences in the resistivity curves between these two groups of compounds but e.s.r. shows that the mechanism is also different for M=Pd and M=Pt. In this compounds we have possibly a transition with some spin-Peierls character.

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