New Aspects of Pressure-induced Superconductivity in Anoin Radical Salts of $Pd(dmit)_2$ (dmit=1,3-dithiole-2-thione-4,5-dithiolate)

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Metal dithiolene complexes have provided a variety of molecular conductors [1]. Among them, most of $Pd(dmit)_2$ salts belong to a strongly correlated two-dimensional system with a quasi triangular lattice of $[Pd(dmit)_2]_2^-$ dimers. Their electronic state is associated with various degrees of freedom (including charge, spin, orbital, and lattice) and can be modified by pressure. Me_4N salt was reported in the early stage of the research on the $Pd(dmit)_2$ salts [2]. Two forms, α (triclinic, P -1) and β (monoclinic, C2/c), were known. Recently, we have found the third form, the γ form (monoclinic, Cc). Although these three forms share common structural properties, anisotropies of inter-dimer interactions in the conduction layer are different from each other. At ambient pressure, they are all Mott insulators. Temperature dependent resistivity of the α form shows an anomaly at ~110 K and a peak around 20 K with sample dependence, which is different from the previous report. Surprisingly, the application of hydrostatic pressure to the γ form induces an irreversible structural change toward the α form. In addition, rapid application of pressure induces superconductivity (T_c ~ 4 K at 3 kbar). Since the α form under the uni-axial strain along the *a*+*b* direction exhibits superconductivity with T_c ~ 7 K at 3 kbar, it is plausible that this superconductivity originates from the α form domain under non-hydrostatic situation. The β form is known to show superconductivity under hydrostatic pressure [3]. Intra-layer resistivity shows metallic behavior with T^2-dependence below 32 K in the pressure range of 4.5-11 kbar, while Inter-layer resistivity remains insulating and exhibits a sharp increase at ~ 70 K. This highly anisotropic behavior suggests a pressure-induced structural transition which results in alternation of metallic (superconducting) and insulating $Pd(dmit)_2$ layers.

References

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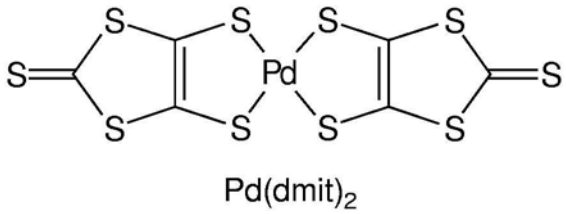

$Pd(dmit)_2$

Figure 1. .