High-Pressure μSR Study on Molecular Based Materials

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Magnetic study under high-pressure is one of the frontiers in the research field of molecular based materials. High-pressure magnetic measurements provide useful information about peculiar pressure-induced phenomena, which are often observed for molecular materials, although reliable measurements are experimentally difficult. A soft nature of molecular materials makes the high-pressure experiments efficient in studying their physical properties.

A series of anion radical salts, $(DCNQI)_2Cu$, where DCNQI is *N*,*N*-dicyanoquinonediimine, have been extensively investigated because of their peculiar physical phenomena such as heavy-fermion-like behavior and the Metal-Insulator transition [1]. The hybridization between the wide 1D $2p\pi$ bands and the narrow 3*d* bands is a key factor in understanding electronic properties of these systems. One of these salts, $(DMe\text{-}DCNQI)_2Cu$, (DMe-DCNQI = 2,5-dimethyl-DCNQI) has an unusual pressure-temperature (*P*-*T*) phase diagram (Fig. 1). At ambient pressure, this material shows metallic behavior down to 450 mK. Peculiar to $(DMe\text{-}DCNQI)_2Cu$, an insulating phase is induced by the application of pressure higher than 100 bar [2]. This unusual *P*-*T* phase diagram can be reproduced by the *chemical pressure effect* using selectively deuterated compounds [3]. The fully deuterated sample of $(DMe\text{-}DCNQI)_2Cu$, in which the chemical pressure corresponds to 512 bar, exhibits the antiferromagnetic ordering below 8 K [4].

Recently, we have developed a high-pressure μSR setup for the RIKEN-RAL Muon Facility [5] and successfully observed signs of magnetic ordering of $(DMe\text{-}DCNQI)_2Cu$ by means of the high-pressure setup. Detailed results and obtained *P*-*T* phase diagram will be presented.

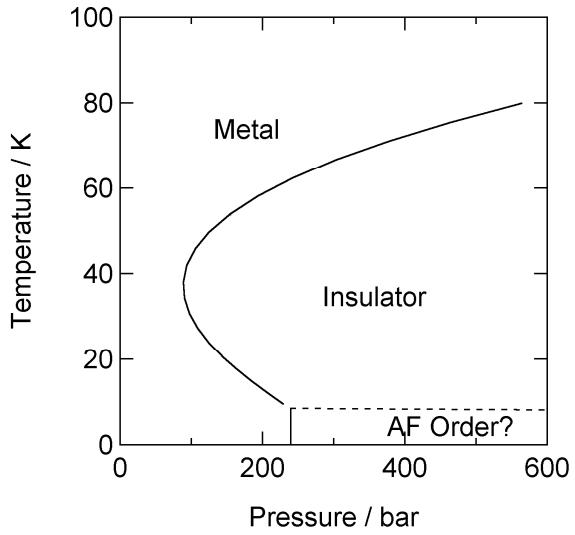

Figure 1. *P*-*T* phase diagram for $(DMe\text{-}DCNQI)_2Cu$.

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