

Magnetic state in λ -(BEST)₂FeCl₄ and the path of π - d interaction

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The λ -type quasi-two-dimensional organic conductors, in which donor and anion layers are alternately stacked, exhibit various physical properties. λ -(BETS)₂GaCl₄, where BETS is bis(ethylenedithio)tetraselenafulvalene, undergoes a superconducting transition at low temperatures [1]. On the other hand, λ -(BETS)₂FeCl₄, which contains magnetic anions (FeCl₄[−]), undergoes an antiferromagnetic (AF) transition with a magnetic anisotropy at around 8 K [2]. Specific heat measurements revealed that the π electrons undergo the AF transition and 3d electrons are passive under the exchange fields through the π - d interaction [3]. The π - d interaction plays an important role in the emergence of the magnetic anisotropy. Since different ground states between GaCl₄[−] and FeCl₄[−] salts complicate the understanding of π - d interaction, salts with the same ground state between GaCl₄[−] and FeCl₄[−] are desired in order to understand the mechanism of the interaction. We focus on BEST (BEST = bis(ehtylenediseleno)tetrathiafulvalene) salts, which are on the negative-pressure side of BETS salts. λ -(BEST)₂GaCl₄ undergoes the AF transition at 22 K [4]. BEST salts would be good candidates for the systematic study of π - d interaction in the λ system if λ -(BEST)₂FeCl₄ also undergoes the AF transition.

To investigate the ground state of λ -(BEST)₂FeCl₄ and the path of π - d interaction, we measured x-ray diffraction, magnetic susceptibility, and Mössbauer spectroscopy on λ -(BEST)₂FeCl₄. We found the AF transition occurs at around 26 K. Figure 1 shows the temperature dependence of the magnetic susceptibility of λ -(BEST)₂FeCl₄. This behavior is similar to that observed in systems with weakened the π - d interaction in BETS salt [5]. Considering the results of x-ray diffraction and the magnetic susceptibility measurement, we concluded that the inner chalcogen of donor molecules is important as the path of π - d interaction [6]. In addition, we are now performing ¹³C NMR measurements on λ -(BEST)₂FeCl₄ in order to determine the exact transition temperature and examine the magnetic structure in the AF state. In this conference, we will explain these findings in detail and the results of the ¹³C NMR measurements.

References

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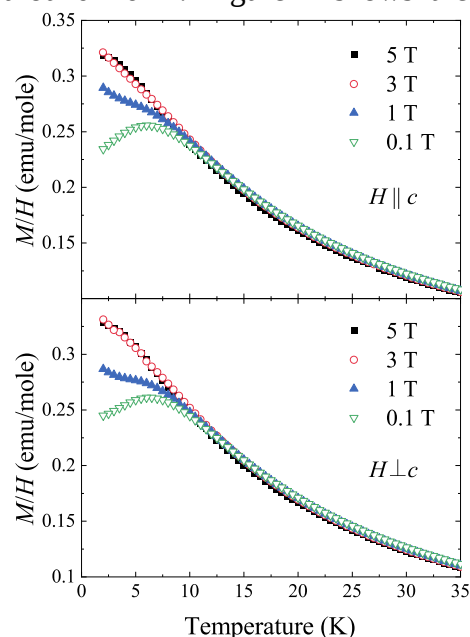


Fig. 1. Temperature dependence of the magnetic susceptibility of λ -(BEST)₂FeCl₄.