Anomalous antiferromagnetic resonance observed in λ-$(BETS)_2FeCl_4$

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The organic conductor λ-$(BETS)_2FeCl_4$ is composed of the conducting π-electrons in BETS molecules and the magnetic d-electrons in $FeCl_4$. Thanks to the strong exchange interaction between the conducting π-electrons and the magnetic d-electrons, λ-$(BETS)_2FeCl_4$ has a fascinating phase diagram such as a paramagnetic metal phase, and antiferromagnetic insulating (AFI) phase and a field-induced superconducting phase. From previous reported, a metal to insulator (MI) transition occur at T_{MI}=8.3 K, and MI transition is associated with the antiferromagnetic order of Fe d-spins [1]. However, the nature of AFI phase is under debate. Recent specific heat measurement observed a broad Schottky anomaly below T_{MI} [2]. and its origin was explained by the existence of the paramagnetic d-electrons. However, this explanation contradicts with the previous electron spin resonance (ESR) measurements. Moreover, anomalous dielectric behavior due to the metastable state of π-electrons is the AFI phase was reported [3], and its relation with other measurements is not clear. Hence, to have more information about the AFI ground state, we have investigated the AFI phase using ESR spectroscopy.

When we measured angular dependence of antiferromagnetic resonance (AFMR), we have observed the easy-axis of λ-$(BETS)_2FeCl_4$ is changing with temperature. (Fig. 1) Moreover, when we measured frequency dependence of AFMR at 2 K, we have also observed the easy-axis of λ-$(BETS)_2FeCl_4$ is changing above 5 T (Fig. 2). These results might suggest that the metastable state of π-electrons relate to the change of the easy-axis. In my poster, I will explain our measurement results.

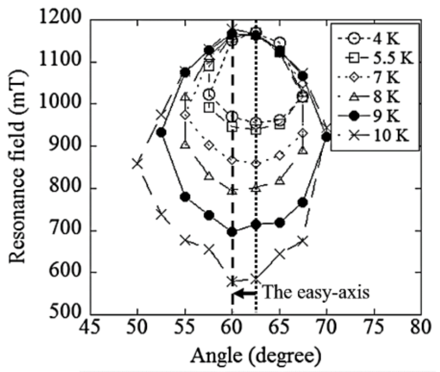

Fig. 1. Angular dependence of AFMR

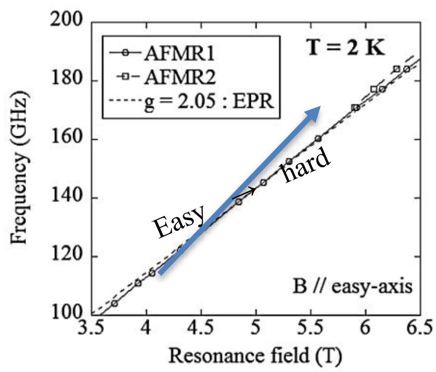

Fig. 2. Magnetic field dependence of AFMR

Reference

[1] L. Brossard et al., Eur. Phys. J. B 1 (1998) 439

[2] H. Akiba et al., J. Phys. Soc. Jpn. 78 (2009) 033601

[3] I. Rutel et al., Phys. Rev. B 68 (2003) 144435

I am Ph. D student of Hokkaido university and member of condensed molecular materials Lab. in RIKEN. My field is condensed physics, I have studying magnetic properties of organic conductor using ESR spectroscopy.