Magnetic and Thermal Properties of Antiferromagnetic Insulator $\lambda$-(BETS)$_2$FeCl$_4$

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An organic field-induced superconductor $\lambda$-(BETS)$_2$FeCl$_4$ exhibits a new type of phase transition from a paramagnetic metal (PM) to an antiferromagnetic insulator (AFI) at $T_M \sim 8\text{K}$ at zero magnetic field [1]. Recently, from the specific heat measurement, a novel $\pi$-d spin structure model below $T_M$ was proposed [2]. In this model, the Fe 3d high spins maintain the paramagnetic states even at the lowest studied temperature 0.2 K, whereas the $\pi$ electrons are localized and form the AF spin configuration at $T_M$. The effective field on the 3d spin due to the AF $\pi$ spin can be estimated from the Zeeman splitting of the 3d spin. On the basis of the analysis, we investigated the angular dependence (anisotropy) of the specific heat and magnetization on the applied magnetic field to discuss about the role of Fe 3d spin on AFI ground state.