Charge-ordered Ferrimagnetism in [Fe(Pc)(CN)$_2$] Salts

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The title compounds are one-dimensional conductors which exhibit giant negative magnetoresistance (GNMR) [1, 2]. In the case of TPP[Fe(Pc)(CN)$_2$]$_2$ salt, the resistance ratio $R(H)/R(0)$ is less than 0.01 at T=20 K and H=350 kOe [3]. In order to clarify the origin of this GNMR, we have performed detailed studies on magnetic torque, heat capacity, AC susceptibility. We could successfully explained magnetic behaviors by applying the anisotropic Heisenberg model to *d* electrons. Our study for TPP[Fe(Pc)(CN)$_2$]$_2$ and PTMA$_{0.5}$[Fe (Pc)(CN)$_2$]·CH$_3$CN salt revealed that: i) the peak in the magnetic susceptibility data around 25 K is due to the antiferromagnetic short-range order of *d*-electrons [4]; ii) π electrons fall into an antiferromagnetic state below 13 K, with fluctuations of state appearing even at 17 K [4]; iii) an anomalously large spin-flop field (80 kOe at 9 K) is observed for the π-electron antiferromagnetic state [4]; iv) the spontaneous magnetization due to charge-ordered ferrimagnetism of π electrons appears below 6 K [5]; iv) the fluctuation of charge-ordered ferrimagnetism appears below 13 K [5]. Charge-ordered ferrimagnetism is a new electronic state in organic one-dimensional conductors. We discuss the origin of the GNMR in connection to the magnetic behavior.

We will also report recent studies on magnetic torque experiments for X=Br, Cl [6] salts.

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