Giant Negative Magnetoresistance in Low-dimensional Conductors Based on Axially Substituted Metallophthalocyanine

Manabu Ishikawa[1*], Toshio Naito[1], Masaki Matsuda[2], Hiroyuki Tajima[3], Tomoyuki Akutagawa[4], Takayoshi Nakamura[4], and Tamotsu Inabe[1]

[1]*Department of Chemistry, Hokkaido University, Japan*

[2] *Department of Chemistry, Kumamoto University, Japan*

[3]*Institute for Solid State Physics, University of Tokyo, Japan*

[4]*Institute for Electronic Science, Hokkaido University, Japan.*

[*]*Present Address: Research Center for Low Temperature and Materials Sciences, Kyoto University, Japan*

Email: m-ishikawa@kuchem.kyoto-u.ac.jp

Electrochemical oxidation of $[M^{III}(Pc)(CN)_2]^-$ (Pc unit; M = Co and Fe, Pc = phthalocyaninato) with appropriate counter cations gives conductors with low-dimensional π-π stacking of the partially oxidized Pc units. In the one-dimensional Fe system, antiferromagnetic interaction and negative magnetoresistance were observed in the low temperature region [1]. In this study, charge transport and magnetotransport measurements under hydrostatic pressure for two-dimensional conductors, $[PXX]_2[M(Pc)(CN)_2].CH_3CN$ (PXX = peri-xanthenoxanthene; Fig. 1(a)), were carried out. This system is moderately conducting ($\sim 10^{-1}$ Ω cm at room temperature) and exhibits semiconducting behaviour at ambient pressure for both M = Co and Fe. For M = Co ($S = 0$), stable metallic behaviour down to 5 K was observed under hydrostatic pressures above ca. 1 GPa [2]. For M = Fe ($S = 1/2$), the same trend was observed above 100 K, however, below ca. 20 K, resistivity increased rapidly and became several orders higher than that in M = Co at 5 K. By applying a 15 T of static magnetic field, giant negative magnetoresistance was observed in the low temperature region (Fig. 1 (b)). The details of the structure and physical properties will be presented.

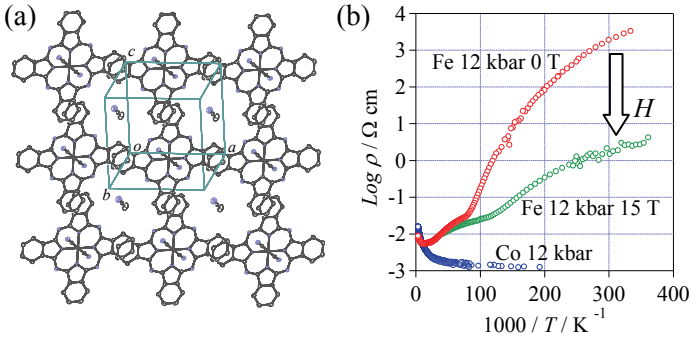

Fig. 1: Pc 2-D sheet (a) and giant negative magneto-resistance (b) in $[PXX]_2[Fe(Pc)(CN)_2] \cdot CH_3CN$

[1] T. Inabe, H. Tajima, Chem. Rev., 104 (2004) 5503.

[2] T. Asari, *et al*., Chem. Lett., 34 (2005) 936.