μSR Study of Organic Antiferromagnet β'-(BEDT-TTF)$_2$ICl$_2$ under High Pressure

K. Satoh[1], K. Sato[1], T. Yoshida[1], H. Taniguchi[1], T. Goko[2], T. U. Ito[3], K. Ohishi[3] and W. Higemoto[3]

[1] *Graduate School of Science and Engineering, Saitama University, Saitama City, Saitama 338-8570, Japan*
[2] *TRIUMF, 4004 Wesbrook Mall, Vancouver, B.C., V6T 2A3, Canada*
[3] *Advanced Science Research Center, Japan Atomic Energy Agency, Tokai, Ibaraki 319-1195, Japan*

Organic antiferromagnetic insulator, β'-(BEDT-TTF)$_2$ICl$_2$, whose Néel temperature is 22 K at ambient pressure, becomes metallic and shows the superconducting transition at 14.2 K by application of 8-GPa pressure[1]. This is the highest superconducting transition temperature among organic superconductors to date. Origin of superconductivity is not clear at present, but antiferromagnetic correlation is considered to play an important role from the similarity of the temperature-pressure phase diagram to those of the κ-phase organic superconductors. In order to study the detailed nature of superconductivity, it is important to clarify the microscopic magnetic property of β'-(BEDT-TTF)$_2$ICl$_2$ under high pressure. We performs a μSR study of β'-(BEDT-TTF)$_2$ICl$_2$ under high pressures up to 1.37 GPa to investigate the change in magnetic properties under high pressure.

Although major contribution of μSR spectrum comes from the high-pressure cell (MP35N), we can detect precession signals from β'-(BEDT-TTF)$_2$ICl$_2$ in the antiferromagnetic state. It is estimated that roughly 20 % of injected muons are stopped at samples. This low stopping rate comes from the low density of organic compounds (about 2 g/cc). From temperature dependence of spectrum, we estimated that Néel temperature at 1.37 GPa was about 48 K, which roughly agrees with the result of previous ESR study[2] and confirmed that the Néel temperature increased with increasing pressure. Precession frequency above 0.7 GPa is about 1 MHz and almost pressure-independent. This frequency is 5 times larger than that at ambient pressure. Below 0.7 GPa, however, asymmetry of precession signal becomes small and we can not detect precession signal. This result suggests that a phase transition to another magnetic phase occurs around 0.7 GPa. In order to clarify nature of magnetic properties under high pressure completely, further experiments with high S/N ratio are strongly desired.

[1] H. Taniguchi *et al.*, J. Phys. Soc. Jpn., 72 (2003) 468.
[2] K. Mizoguchi, unpublished.