Crystal Structure and Magnetic Property of Chiral Linear Chain Rhodium(I)-Semiquinonato Complex

Minoru Mitsumi, Shota Yamasaki, Shingo Itoda, Hiroshi Arashiro, and Koshiro Toriumi

Graduate School of Material Science, University of Hyogo, Japan.
E-mail: mitsumi@sci.u-hyogo.ac.jp

Recently, multiferroic materials exhibiting ferromagnetic and ferroelectric properties have attract much attention because of the control of a magnetism by an electric field and/or the control of an electric polarization by a magnetic field. [1] In order to realize such a system, it is important to construct the chiral magnetic structure using the chiral crystal structure and magnetic anisotropy. Along this strategy, we are studying the syntheses and the correlation between crystal structures and solid-state properties of a series of chiral linear chain rhodium(I)–semiquinonato complexes using chiral semiquinonato ligands. Here we report the crystal structure and magnetic property of a chiral linear chain rhodium(I)-semiquinonato complex, $[Rh(3,6\text{-DBSQ-}4,5\text{-}(2R,4R)\text{-PDO})(CO)_2]_\infty$ (**1**) (3,6-DBSQ-4,5-(2*R*,4*R*)-PDO) = 3,6-di-*tert*-butyl-4,5-(2*R*,4*R*)-pentandedioxy-1,2-benzosemiquinonato).

Complex molecules of **1** are stacked by the Rh–Rh interactions to form a linear chain structure. This compound undergoes first-order phase transition in the temperature range of 167–177 K. Magnetic property changes from an antiferromagnetic interaction (room temperature (RT) phase) to a ferromagnetic one (low temperature (LT) phase, θ = +56 K) with the first-order phase transition (Fig. 1). Ac magnetic susceptibility shows a remarkable frequency dependence in both χ' and χ'' associated with a spin freezing/blocking transition at temperature below 6K. Furthermore, χ'' shows a two-step magnetic anomaly at near 5~3 K and below 2 K (Fig. 2). Spin freezing temperature is determined to be T_f = 4.5 K according to the results of FCM, ZFCM, and RM. The observed two-step magnetic anomaly would be attributable to the chiral magnetic structure.

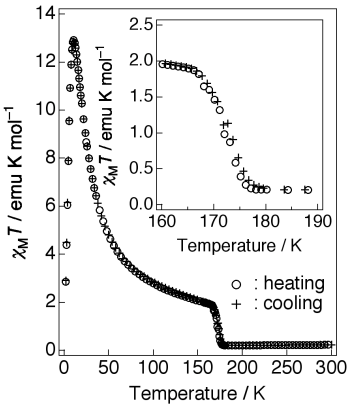

Fig. 1. $\chi_M T$ vs. T plot.

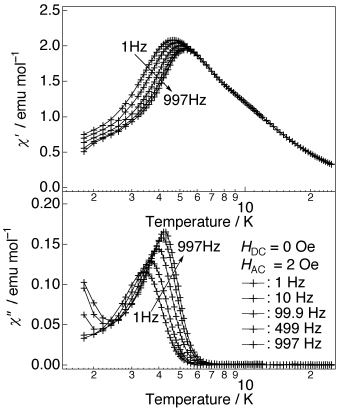

Fig. 2. χ' vs. T and χ'' vs. T plots.

[1] Y. Tokura, *Science*, 312 (2006) 1481.