Observation of surface magnetization of magnetization reversal on magnetic thin films of ternary-metal-hexacyanide molecule-based magnet

([1]*Depatment of Materials Science, Faculty of Pure and Applied Sciences, University of Tsukuba,* [2]*Department of Chemistry, School of Science, The University of Tokyo*)
○S. Nagashima,[1] Y. Yahagi,[1] S. Ohkoshi,[2] H. Tokoro[1]
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Introduction: Magnetic domains are important properties related to the recording density of magnetic materials. On the other hand, molecule-based magnets have interesting characteristic to design magnetic functionality.[1)] In this study, we investigated the surface magnetization state of a ternary-metallic iron chromate hexacyanochromate[2)] that exhibits temperature-induced magnetization reversal.

Experiment: The target sample of $(Fe^{II}_{0.20}Cr^{II}_{0.80})[Cr^{III}(CN)_6]_{2/3}\cdot 5.3H_2O$ (**1**) were prepared by reducing aqueous solutions containing $FeCl_3\cdot 6H_2O$, $CrCl_3\cdot 6H_2O$, and $K_3[Cr(CN)_6]$. Characterization was performed using IR spectrum, SEM, and AFM. Magnetic properties were measured by a SQUID magnetometer and surface magnetization was observed using MFM.

Result: 1 was obtained as a thin film on SnO_2-coated glass. In the IR spectrum, the CN stretching mode of mixed Fe^{II}-NC-Cr^{III} and Cr^{II}-NC-Cr^{III} was observed at 2181 cm^{-1}. From the SEM image, a smooth surface with an average crystalline size of 0.52 ± 0.14 μm and a thickness of 1.76 ± 0.05 μm was observed. The magnetization vs temperature curve showed T_C = 222 K and the compensation temperature (T_{comp}) of 134 K (Fig. 1a).[2)] Below T_C, magnetic domains were observed by MFM (Fig. 1c). The magnetic domain is several μm, no strong correlation between the size of particle and the magnetic domain.

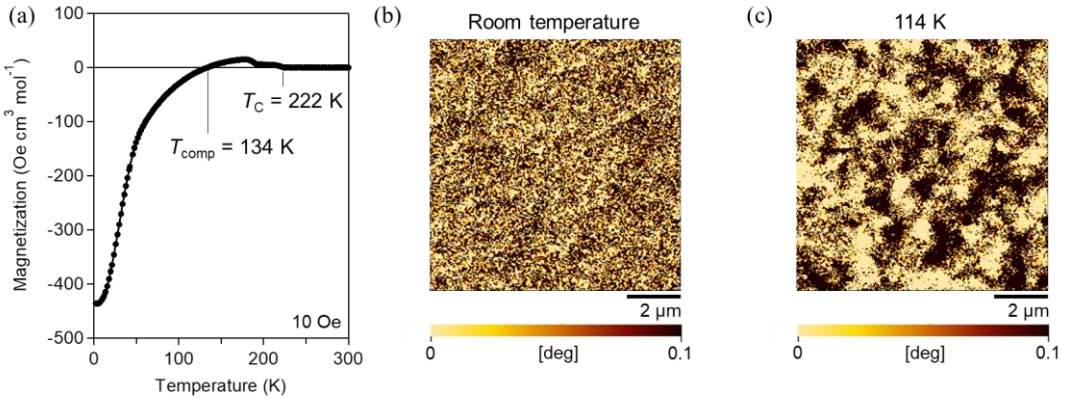

Fig. 1 (a) Magnetization vs temperature curve, MFM images at (b) R.T. and (c) 114 K.

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