

Observation of metamagnetism in nickel–octacyanotungstate 1D magnet

(¹University of Tsukuba, ²The University of Tokyo) ○Shintaro Akagi,¹ Junhao Wang,¹ Kenta Imoto,² Shin-ichi Ohkoshi,² Hiroko Tokoro²

Keywords: Cyano-bridged assembly, Molecule-based magnet, Spin-Flop transition

Introduction: Crystal engineering of molecular magnetic materials can lead to novel magnetic functionalities such as photomagnetism, gas-sensitive magnet and so on.¹⁾ In this study, we synthesized $[\text{Ni}^{\text{II}}(\text{imidazole})_6]\{[\text{Ni}^{\text{II}}(\text{imidazole})_4][\text{W}^{\text{V}}(\text{CN})_8]\}_2 \cdot 4\text{H}_2\text{O}$ (**NiW**) containing anionic chains with short interchain distance, and report the crystal structure and magnetic property.

Experiment: Target crystals were prepared by slow diffusion of $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ (0.4 mmol) and imidazole (0.8 mmol) aqueous solution into $\text{Cs}_3[\text{W}^{\text{V}}(\text{CN})_8] \cdot 2\text{H}_2\text{O}$ (0.2 mmol) aqueous solution at room temperature for two weeks. Crystal structure was determined by single crystal X-ray structural analysis (Rigaku R-axis rapid). Magnetic measurements were conducted using a Quantum Design MPMS-XL SQUID magnetometer.

Result and Discussion: Single crystal X-ray analysis revealed that **NiW** crystallizes in a monoclinic $C2/m$ space group, which has an ionic supramolecular crystal structure consisting of an anionic coordination chain of $\{[\text{Ni}^{\text{II}}(\text{imidazole})_4][\text{W}^{\text{V}}(\text{CN})_8]\}_n^{n-}$, a cationic mononuclear complex $[\text{Ni}^{\text{II}}(\text{imidazole})_6]^{2+}$, and water of crystallization from solvent (Figure 1a, b). Magnetic study on the compound showed that Ni^{II} ($S = 1$) and W^{V} ($S = 1/2$) are ferromagnetically coupled within the chain via cyanido bridges. However, magnetization is canceled out by antiferromagnetic interchain interaction below Néel temperature of 8.5 K. Such antiferromagnetic interaction can be overcome by applying external magnetic field of 0.9 T at 2 K and a step spin-flop transition is observed as shown in Figure 1c.

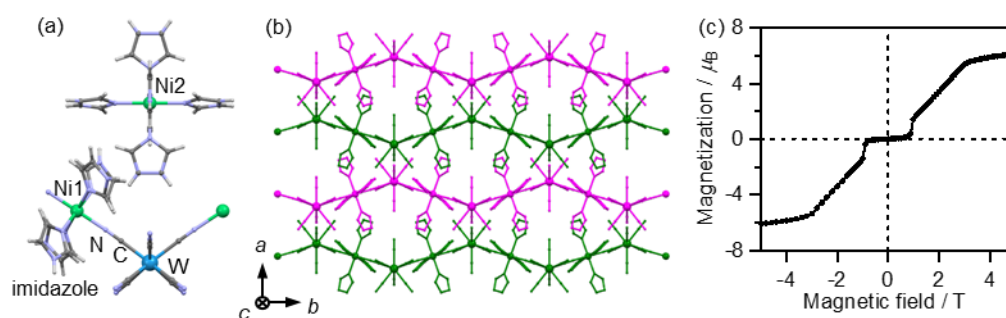


Figure 1. (a) Coordination environments around Ni and W, (b) view along c axis, only the Ni–W chain are shown. (c) M – H curve of single crystal of **NiW** after removing contribution from $[\text{Ni}^{\text{II}}(\text{imidazole})_6]^{2+}$ under the applied field perpendicular to ab plane.

1) S. Ohkoshi, S. Takano, K. Imoto, M. Yoshikiyo, A. Namai, H. Tokoro, *Nat. Photonics* **8**, 65–71 (2014).