Magnetic Properties of Organic-Inorganic Perovskites with Ferroelasticity

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Keywords: *Magnetic Properties*; *Ferroelasticity*; *Multiferroics; Organic-Inorganic Perovskites*;

Ferroic orders including ferromagnetism, ferroelectricity and ferroelasticity exhibit spontaneous magnetization, polarization and strain, respectively. Multiferroic properties, coupling of two or more ferroic orders, have been attracting recent interest. Especially, multiferroic materials in which ferromagnetism and ferroelectricity are coupled, showing electrically induced magnetism and magnetically induced electric polarization,[1] have been studied extensively. On the other hand, there are fewer studies about the coupling between ferromagnetism and ferroelasticity. We reported the organic-inorganic $(C_6H_5C_2H_4NH_3)_2FeCl_4$ perovskites, which exhibit ferroelasticity and canted antiferromagnetism.[2]

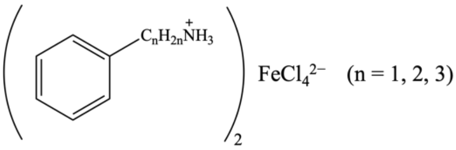

Fig. 1. Crystal formula of salts.

Herein, we synthesized $(C_6H_5C_nH_{2n}NH_3)_2FeCl_4$ (n = 1, 2, 3) (Fig. 1) to investigate the coupling of ferroelasticity and magnetic ordering. Field dependence of magnetization of n = 2 shown the hysteresis displacements only after cooling in a magnetic field (Fig. 2). Single crystal X-ray structure analysis revealed that n = 1, 2 and 3 have perovskite-like structures. Magnetic and DSC measurements suggested there is canted antiferromagnetic phase transition at 75K (Fig. 3) but no structural phase transitions in n = 1. In this presentation, we will discuss the presence or absence of ferroelasticity and magnetic properties in detail.

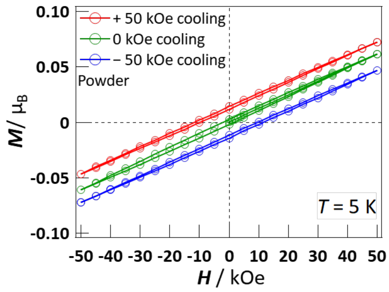

Fig. 2. Field-dependence magnetization of n = 2 for powder after zero-field cooling (ZFC) and field-cooling (FC).

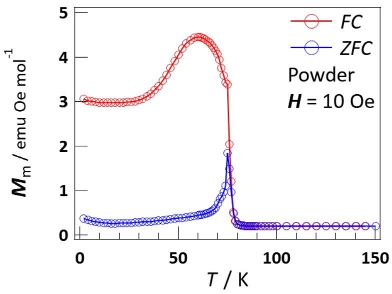

Fig. 3. Temperature-dependence magnetization of n = 1 for powder after ZFC and FC.

1) T. Kimura, T. Goto, H. Shintani, K. Ishizaka, T. Arima and Y. Tokura, *Nature*. **2003**, *426*, 55–58. 2) Y. Nakayama, S. Nishihara, K. Inoue, T. Suzuki and M. Kurmoo, *Angew. Chem. Int. Ed.* **2017**, 56, 9367–9370.