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Magnetic Properties associated with Ferroelasticity in Organic-inorganic Layered Perovskite-like Compound

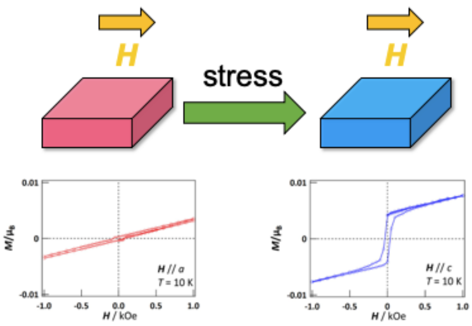
Naoto Tsuchiya,[1] Saya Aoki,[1] Yuki Nakayama,[1] Kseniya Maryunina,[2] Sadafumi Nishihara,[1,2] Takashi Suzuki,[2,3] Katsuya Inoue[1,2]

[1] Department of Chemistry, Graduate School of Science, Hiroshima University
[2] CResCent (Chirality Research Center), Hiroshima University
[3]Graduate School of Advanced Sciences of Matter, Hiroshima University

The multiferroic materials are interest in by fascinating physical properties and huge potential for technological applications. These exhibit two or more ferroic ordering states such as ferromagnetism, ferroelectricity and ferroelasticity. However, the current trend is coupling between ferromagnetism and ferroelectricity, that is, magnetoelectric effect. While, research of relationship between ferromagnetism and ferroelasticity has not been interested.

In our laboratory, this relationship has been investigated in organic-inorganic layered perovskite-like compounds. Recently, organic-inorganic layered perovskite-like compound $(C_6H_5C_2H_4NH_3)_2[Fe^{II}Cl_4]$ described as a multiferroic exhibiting canted antiferromagnetism and ferroelasticity[1]. The direction of magnetic hysteresis loop and spontaneous magnetization of the crystal can be well controlled by applying uniaxial stress along certain direction. However, this compound has high ferroelastic phase transition temperature compare with the temperature of magnetic long range order and iron(II) is oxidized air, then investigate the coupling between magnetism and ferroelasticity in detail are difficult. Therefore, it is highly important to decrease ferroelastic phase transition temperature and avoide for oxidation. Here we report the results of $H_3NC_3H_6NH_3[Mn^{II}Cl_4]$ in order to reveal potential correlation between magnetism and ferroelasticity.

This compound undergoes two structural phase transitions at 300 and 340 K. Low temperature phase *Pnma* (phase I) would be ferroelastic phase because mirror planes in ac plane of *Fmmm* (phase II) are vanished throughout the structural phase transition. Actually, polarization microscopy confirmed that ferroelastic domain structures were controlled by applying mechanical stress in room temperature. Magnetization measurements as a function of temperature and field confirmed canted antiferromagnetism below T_c = 43 K. Unlike $(C_6H_5C_2H_4NH_3)_2[Fe^{II}Cl_4]$, switching spin canting direction by applying stress in room temperature was observed.



[1] Y. Nakayama, et al, *Angew. Chem. Int. Ed.*, **2017**, 56, 1-5

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