Study on magnetic structure of a molecular-based chiral magnet, copper L-tartrate at low temperatures

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Recently, we discovered a new candidate of chiral magnets, *L*(*D*)-copper tartrate [1]. In the compound, the crystal structure is chiral with the space group $P2_1$, reflecting the chirality of the ligand, *L*(*D*)-tartaric acid (Fig.1). Magnetic measurements in temperature between 2 and 300 K revealed the presence of ferromagnetic interactions with the Weiss temperature $\theta \sim 1.2$ K, probably due to magnetic correlations in the helical axis parallel to the *b* axis [2]. Furthermore, magnetic measurements at lower temperatures indicate that some chiral magnetic transition occurred around $T_c = 0.2$ K.

In this study, we attempted neutron diffraction experiments above the transition temperature using beam port AKANE in JRR3. Since *L*-copper tartrate is prone to crystal degradation due to the release of crystalline water, we searched for the best protocol to prepare samples with optimal grain size for the powder neutron diffraction experiments. As a result, large crystals slowly grown in its solution and finely crushed in a high humidity environment for about 5 minutes were used as samples in this experiment.

The neutron diffraction experiments performed from 0.7 to 300 K showed diffraction peaks due to nuclear scattering of the crystal, while very large constant background scattering was also observed. In addition, a large temperature variation in the (-1 0 1) diffraction peak around θ=13.99-15.99 deg. was found as shown in Fig. 2. The cause of this temperature change is unknown at present but, in the crystal, coordination polymer 2D layers of *L*-copper tartrate are spread parallel to this plane, suggesting that the structural arrangement between the layers may be modulated by temperature.

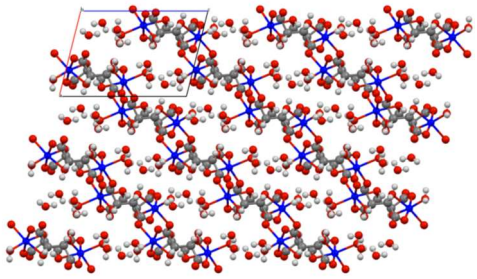

Fig. 1. Crystal structure of *L*-copper tartrate

In further experiments, partial deuteration of *L*-copper tartrate and detailed neutron experiments with it will be performed.

[1] R. Fukui, et al., JPS meeting March, 2022.
[2] Y.-H. Liu, et al., Dalton Trans. **42**, 16857 (2013).

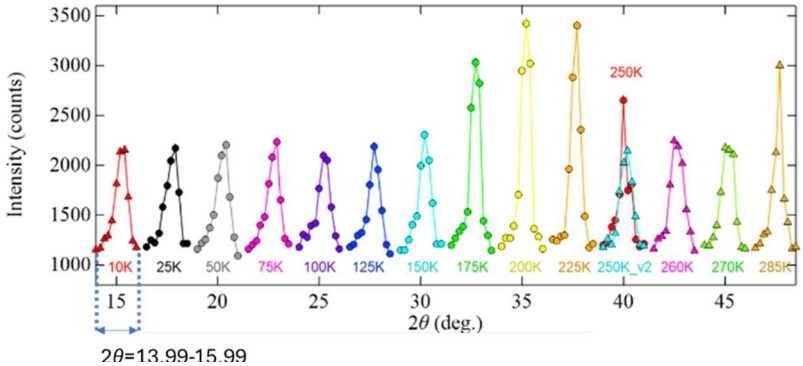

Fig. 2. Temperature dependence of neutron diffraction patterns in the range 2θ=13.99-15.99°. Data for each temperature are shifted along the horizontal axis for clarity.