Experimental report

23/12/2022

Proposal: 5-31-2892 **Council:** 4/2021

Title: First determination of the magnetic structure of the [(CH3)2NH2]Fe(HCOO)3 metal-organic framework with possible multiferroicity

Research area: Materials

This proposal is a resubmission of 5-31-2818

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Samples: [CH3)2NH2]Fe(HCOO)3

Instrument	Requested days	Allocated days	From	To
D1B	2	1	20/09/2021	21/09/2021

Abstract:

In this work, we plan to measure the magnetic structure of a Fe based Metal-oxide framework with multiferroic properties at low temperature. We will perform a powder neutron diffraction experiment using the D1B beamline. Thanks to this experiment, we expect to explain the microscopic origin of the magneto-electric properties of this MOFS.

First determination of the magnetic structure of the

$[(CH_3)_2NH_2]Fe(HCOO)_3$ metal-organic framework with possible multiferroicity

- Objective & expected results : **-**

The main aim of this proposal was to determine the magnetic structure of $[(CH_3)_2NH_2]Fe(HCOO)_3$. The powder neutron diffraction experiments were performed on D1B. The magnetic transition should occur around 20 K. By Rietveld refinements, the magnetic structure could be determined.

- Results and the conclusions of the study (main part): **-**

In our previous research, high quality $[(CH_3)_2NH_2]Fe(HCOO)_3$ sample has been synthesized and characterized, as exemplified by the temperature dependence of the heat capacity presented Fig. 1(a). Two transition temperatures, T_C=159 K corresponding to ferroelectric transition and T_N=20 K to the Neel temperature, were observed. In the neutron diffraction measurement on D1B, we collected the patterns at 200, 25, and 2 K [Fig. 1(b)]. As we can see, the peak around 24° split to 2 peaks which indicate a structural transition from $R-3C$ to $P\,2_1/n$. This transition is compatible with T_C=159 K in the heat capacity measurement. And then, when the temperature decreased to 2 K, a magnetic peak emerged around 24° which indicates a magnetic transition. However, the magnetic structure still remain to be solved.

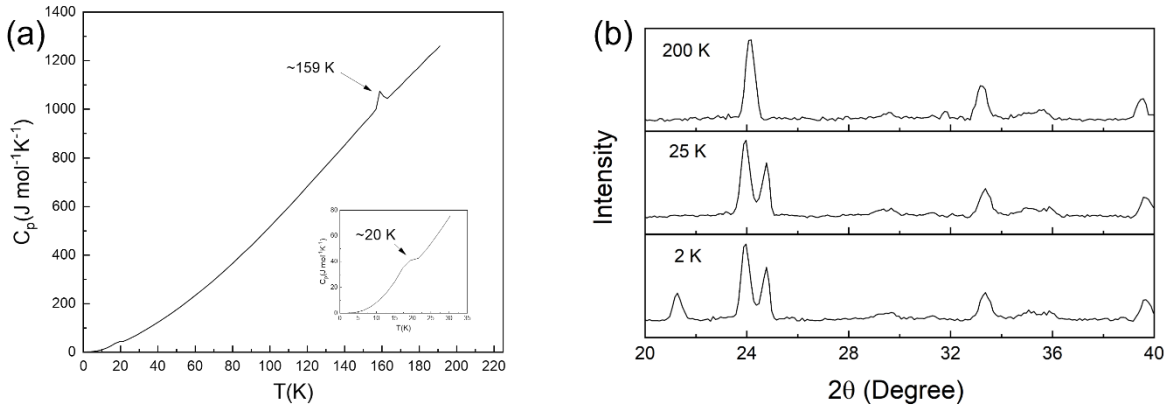

Figure 1: (a) Temperature dependence of heat capacity for $[(CH_3)_2NH_2]Fe(HCOO)_3$, inset show the curve between 5 K and 35 K. (b) Powder neutron diffraction patterns at 200, 25, and 2 K.