2017B0327: Determination of magnetic and crystal structures in frustrated spinel $FeCr_2O_4$

Tohoku University, Keisuke Tomiyasu

1. Introduction

Frustrated magnets are promising sources for exotic spin-orbit-lattice states, such as the underlying structures for multi-ferroics, orbital ordering, and spin-orbit molecule organization. Spinel materials have been the typical and colorful series. In $FeCr_2O_4$, Cr^{3+} (d^3, spin $S = 3/2$, no orbital degree of freedom) forms a highly frustrated corner-sharing tetrahedral lattice called a pyrochlore lattice and is coupled with magnetic and Jahn-Teller active Fe^{2+}. The magnetic structure was studied by angle-dispersive powder neutron diffractometry [e.g., G. Shirane (1964)]. However, even the magnetic propagation vector is yet to be indexed. Furthermore, recent careful high-resolution powder synchrotron x-ray diffraction experiments revealed the new slight orthorhombic lattice deformation in the *Fddd* space group below magnetic transition temperatures [e.g., S. Ohtani *et al.* (2011)]. This prompted us to determine the magnetic structure by combining SuperHPRD and irreducible representation analysis.

2. Experiment

Neutron diffraction experiments were performed on the Super-High-Resolution Powder Diffractometer (SuperHRPD) at the MLF of the J-PARC. Approximately 3 g of the sample was sealed in a 6-mm-diameter thin V cylinder with He exchange gas, which was positioned under the cold head in a He closed-cycle refrigerator. The crystal and magnetic structures were analyzed using the FullProf and SARAh software.

3. Results and Conclusions

Figure 1 shows the measured data at elevated temperatures. The peak splitting is well resolved, the magnetic propagation vector is determined, and the transition temperatures that are consistent with specific heat data are obtained. This study is now under structural analysis and will be presented and discussed at JPS meeting in this autumn prior to the paper submission.

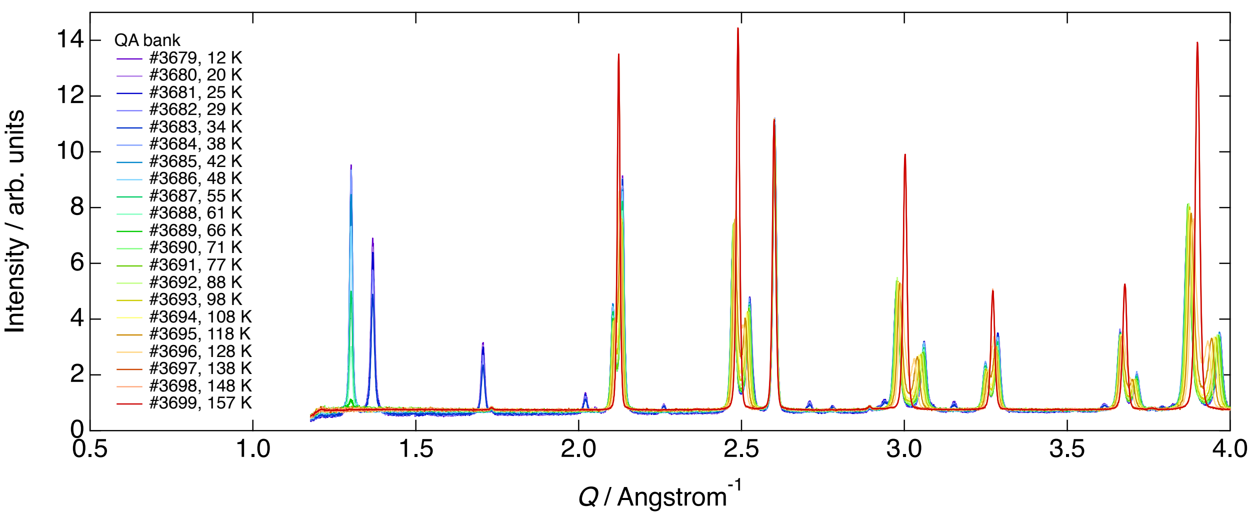

FIG. 1: Powder neutron diffraction patterns measured in the middle bank at elevated temepratures.