Experimental report

16/02/2023

Proposal: EASY-1057 **Council:** 4/2021

Title: Doping induced change of magnetic structure in BaFe2Se3

Research area: Physics

This proposal is a new proposal

Main proposer: Wengen ZHENG

Experimental team:

Local contacts: Claire COLIN

Samples: BaFe2Se3

Instrument	Requested days	Allocated days	From	To
D1B	8	8	10/10/2021	11/10/2021

Abstract:

The Iron-based spin ladder BaFe2Se3 displays an exotic block-like magnetic state. Previous inelastic neutron scattering unveiled the connection between the block magnetic state and an orbital-selective Mott phase (OSMP). Besides, the electron doping of the OSMP could induce new block magnetic states. Thus, the Ni doping of BaFe2Se3 should change the magnetic structure of BaFe2Se3. We plan to use neutron powder diffraction to investigate this transformation which could help us understand the origin of the block magnetism and its relation to the OSMP. We have already measured the 0.5% Ni-doped one, the Neel temperature is decreased to 170 K. This time we want to measure the 1% doped one. We expect a further decrease in Neel temperature.

Doping induced change of magnetic structure in $BaFe_2Se_3$

- Objective & expected results : **-**

The main aim of this proposal was to perform powder neutron diffraction (PND) experiments on $Ba(Fe_{0.99}Ni_{0.01})_2Se_3$. By Rietveld refinements, the magnetic structure under different temperatures will be determined. Meanwhile, the transition temperature T_N will be clarified.

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

Recently, the Iron-based spin ladder $BaFe_2Se_3$ has attracted much attention due to its superconductivity under pressure. Besides, $BaFe_2Se_3$ displays an exotic block-like magnetic state which is unique in its family. Previous inelastic neutron scattering unveiled the connection between the block magnetic state and an orbital-selective Mott phase (OSMP). Besides, the electron doping of the OSMP could induce new block magnetic states. Thus, the Ni doping of $BaFe_2Se_3$ should change the magnetic structure of $BaFe_2Se_3$.

In this proposal, we used PND measurement to investigate the possible magnetic transformation on low doped compound $Ba(Fe_{0.99}Ni_{0.01})_2Se_3$. The sample was measured at the temperature range 2-300 K. By the Rietveld refinement, we can get the magnetic structure and the magnetic moment per Fe at each temperature. As shown in Figure 1, the block magnetic order persists up to 153 K. No obvious magnetic structural transition was observed. The present experiment shows that the low doped (1%) compound may not enough to change the magnetic order. Higher doped sample is need to be investigated.

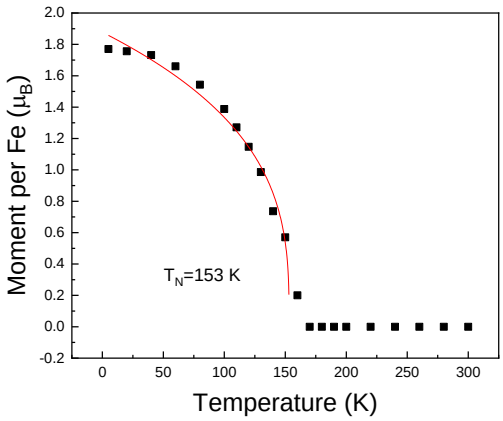

Figure1: Temperature dependent of moment per Fe for $Ba(Fe_{0.99}Ni_{0.01})_2Se_3$. The data was extracted from the refinements of PND patterns.