Experimental report

20/12/2022

Proposal: 5-31-2837 **Council:** 10/2020

Title: Doping induced change of magnetic structure in BaFe2Se3

Research area: Physics

This proposal is a new proposal

Main proposer: Wengen ZHENG

Experimental team: Claire COLIN

Local contacts: Claire COLIN

Samples: Ba(Fe1-xCox)2Se3

Instrument	Requested days	Allocated days	From	To
D1B	5	2	24/06/2021	26/06/2021

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 Co/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 understanding the origin of the block magnetism and its relation to the OSMP.

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 experiments on Ni/Co doped $BaFe_2Se_3$. By Rietveld refinements, the magnetic structure under different doping percentage 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 Co/Ni doping of $BaFe_2Se_3$ should change the magnetic structure of $BaFe_2Se_3$.

In this proposal, we used neutron powder diffraction to investigate the possible magnetic transformation from a block-type to other ones. Four samples [$Ba(Fe_{0.95}Ni_{0.05})_2Se_3$, $Ba(Fe_{0.9}Ni_{0.1})_2Se_3$, $Ba(Fe_{0.85}Co_{0.15})_2Se_3$, $Ba(Fe_{0.8}Co_{0.2})_2Se_3$] were measured at the temperature range 2-300 K. Figure 1 shows the powder diffraction patterns at 2 K of the four doped samples and the pure $BaFe_2Se_3$. For $BaFe_2Se_3$, a magnetic peak emerges at this temperature (indicated by the star). However, for the doped ones, no obvious magnetic peak was observed. This indicates that the magnetic order is totally suppressed at these high doped samples. Therefore, more neutron diffraction measurements are required on the low doped samples.

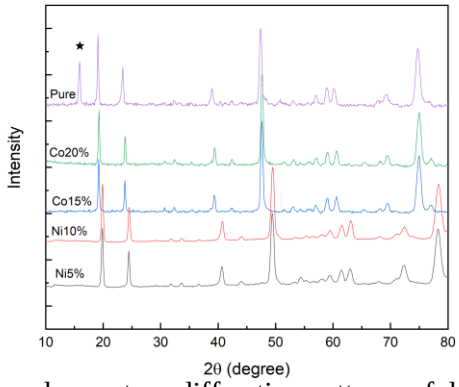

Figure1: Powder neutron diffraction patterns of doped samples and pure $BaFe_2Se_3$ at 2 K. The star indicates the magnetic peak.