Experimental report

19/02/2018

Proposal: 5-31-2509 **Council:** 10/2016

Title: Magnetic structures of YbMn6-yFeySn6 (y < 1.5)

Research area: Chemistry

This proposal is a new proposal

Main proposer: Lucas EICHENBERGER

Experimental team: Arnaud MAGNETTE
Bernard MALAMAN

Local contacts: Vivian NASSIF

Samples: Cu8Fe3Sn2S12
YbMn6-yFeySn6

Instrument	Requested days	Allocated days	From	To
D1B	4	4	05/02/2017	07/02/2017
			25/02/2017	27/02/2017

Abstract:

We wish to investigate the composition and temperature dependence of the magnetic structure in YbMn6-yFeySn6 (y < 1.5). YbMn6Sn6 is an easy plane ferromagnet involving intermediate valent non-magnetic Yb. From DC magnetization it was observed that partial Fe for Mn substitution yields the emergence of a low-temperature antiferromagnetic-like state (likely helimagnetic)whose temperature extent increases with the Fe content. For high enough Fe content (x > 1), the high-temperature ferromagnetic region fully disappears. In all alloys, Yb seems to remain non-magnetic. Powder neutron diffraction is mandatory to determine the spin structure (and its changes with temperature and yFe), to precise the Mn/Fe distribution over the four available crystallographic sites and to confirm the lack of magnetic order of the Yb sublattice.

Experimental report ILL experiment 5-31-2509

A beam time of 4 days was devoted to the investigation of the composition and temperature dependence of the magnetic structure in $YbMn_{6-y}Fe_ySn_6$ ($y < 1.5$). Some $YbMn_{6-y}Fe_ySn_6$ representatives ($y = 0.50$, 0.75, 1.00 and 1.50) have been measured in the 2 – 320 K temperature range using the D1b diffractometer.

We recently showed that the Fe for Mn substitution in $YbMn_{6-y}Fe_ySn_6$ deeply alters the magnetic behavior yielding a ferromagnetic to antiferromagnetic transition of the Mn/Fe sublattice [1]. The results confirm a prevailing role of valence electron concentration on the T = Mn/Fe sublattice magnetic behavior in this family of compounds.

Neutron diffraction data have allowed us to detect magnetic structure transitions. On cooling, the intensity of the ferromagnetic contributions goes to zero and a set of satellites appears in addition to the nuclear reflections. The results will be soon published.

We investigated 4 different compositions: in each case, long duration patterns were recorded at 320 K and 2 K (figure) as well as a thermal scan between these two temperatures. For some compositions, some long duration patterns were recorded at intermediate temperatures.

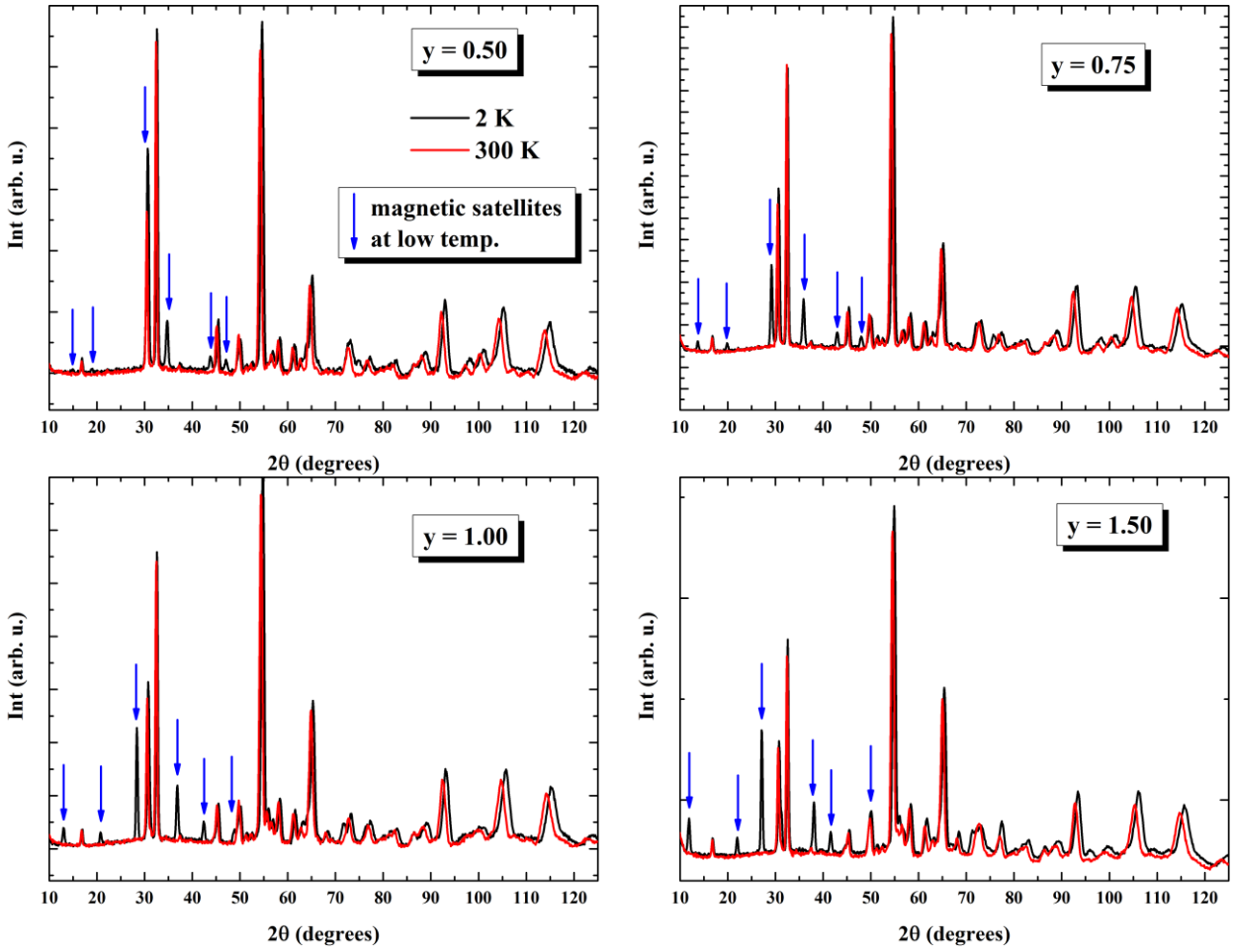

Fig. Neutron diffraction patterns of $YbMn_{6-y}Fe_ySn_6$. at 320 K and 2 K.

[1] Crystal and magnetic properties of $YbMn_{6-y}Fe_ySn_6$ ($y \leq 1$)
A. Magnette, A. Vernière, G. Venturini, L. Eichenberger, B. Malaman and T. Mazet
To be published (already submitted)