Experimental report

11/02/2017

Proposal: 5-31-2471 **Council:** 4/2016

Title: Determination of the magnetic structures of six Yb1-xLuxMn6Sn6 (0.1 ≤ x ≤ 0.9) compounds between 320 and 2K.

Research area: Materials

This proposal is a new proposal

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Samples: Yb1-xLuxMn6Sn6

Instrument	Requested days	Allocated days	From	To
D1B	3	3	16/06/2016	18/06/2016
			08/10/2016	09/10/2016

Abstract:

We aim at determining the magnetic structures of some Yb1-xLuxMn6Sn6 (0.1 ≤ x ≤ 0.9) representatives with neutron powder diffraction experiments performed on the D1B high-flux diffractometer. We recently showed a ferromagnetic to antiferromagnetic transition of Mn sublattice in Yb1-xLuxMn6Sn6 compounds when intermediate valent Yb (υ ~ 2.6) is replaced by trivalent Lu. Neutron diffraction data are necessary to clarify magnetic structures, especially in the antiferromagnetic region of the magnetic phase diagram. Indeed, Mn sublattice could adopt helimagnetic and/or collinear antiferromagnetic structures as in the ternary LuMn6Sn6. This study will help understanding influence of the valence electron concentration on the Mn sublattice magnetic behavior.

Experimental report ILL experiment 5-31-2471:

A beam time of 3 days was devoted to the study of the temperature dependence of the magnetic structures of some $Yb_{1-x}Lu_xMn_6Sn_6$ representatives in the 2 – 320 K temperature range using the D1b diffractometer.

We recently showed a ferromagnetic to antiferromagnetic transition of Mn sublattice in $Yb_{1-x}Lu_xMn_6Sn_6$ compounds when intermediate valent Yb ($\upsilon \sim 2.6$) is replaced by trivalent Lu. The results confirm a prevailing role of valence electron concentration on Mn magnetic behavior in this family of compounds. Neutron diffraction data have allowed us to determine magnetic structures, especially in the antiferromagnetic region of the magnetic phase diagram.

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.

We built the $Yb_{1-x}Lu_xMn_6Sn_6$ (x, T) magnetic phase diagram. It forecasts the occurrence of interesting multicritical points where several magnetic phases meet. The behavior of the richer Lu alloys is somewhat nontrivial since they have shown helimagnetic structures at low temperature with two different wave vector $\mathbf{k} = 0\ ;\ 0\ ;\ q_Z$.

Results of the ILL experiment 5-31-2471 have been published in ref [1].

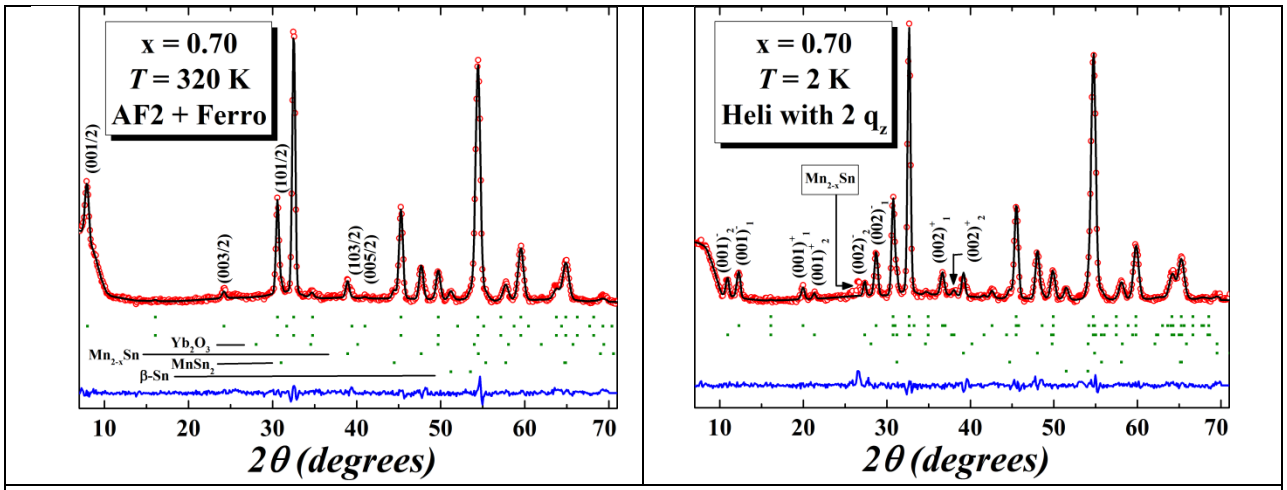

Fig. Neutron diffraction patterns of $Yb_{0.3}Lu_{0.7}Mn_6Sn_6$. at 320 K and 2 K.

[1] L. Eichenberger, G. Venturini, B. Malaman, L. Nataf, F. Baudelet, T. Mazet, J. Alloys Compd. 695 (2017) 286.