

Experimental report

30/01/2024

Proposal: CRG-3025

Council: 4/2023

Title: Structural and magnetic properties of $\text{YNi}_{3-x}\text{Fe}_x$ compounds ($x = 0.25$ and 0.8)

Research area: Physics

This proposal is a new proposal

Main proposer: Valerie PAUL-BONCOUR

Experimental team: Valerie PAUL-BONCOUR

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Local contacts: Vivian NASSIF

Samples: $\text{YNi}_{2.2}\text{Fe}_{0.8}$

$\text{YNi}_{2.75}\text{Fe}_{0.25}$

Instrument	Requested days	Allocated days	From	To
D1B	2	2	20/11/2023	22/11/2023

Abstract:

The abstract is in the scientific case pdf file.

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Intrument : D1B

Requested days : 2 **Allocated days :** 2

In this study, we wanted to investigate the change of structural and magnetic properties induced by the substitution of nickel by iron in $\text{YNi}_{3-x}\text{Fe}_x$. These compounds crystallize in PuNi_3 structure type (space group $R\bar{3}M$), and Ni substitution by Fe leads to a linear increase of lattice parameter a but a break in the slope is observed for c parameter. In this PuNi_3 -type structure, Ni can occupied 3 different Wyckoff sites (3b, 6c and 18h). The “anormal” evolution of the lattice parameter indicates that there may be occupation ordering for Fe substitution. Thus neutrons diffraction was necessary to determine occupation site of iron. This $\text{YNi}_{3-x}\text{Fe}_x$ system also shows interesting magnetic properties with a phenomenon of magnetic reentrance below 50 K for $x < 0.6$. The Curie temperatures increases versus Fe content, but a change of slope was observed near $x = 0.82$.

Two samples ($\text{YNi}_{2.7}\text{Fe}_{0.3}$ and $\text{YNi}_{2.25}\text{Fe}_{0.75}$) have been characterized by neutron diffraction on D1B beamline from 2K to room temperature with two wavelengths: 1.28 Å and 2.52 Å. Rietveld analysis of room temperature diffractograms show that Iron is not statistically distributed across the three Wyckoff sites. Meanwhile, we performed Mössbauer spectrometry measurements on these samples. The Mössbauer results show that only 2 sites over 3 are occupied by Fe with 1/3 and 2/3 occupation weight percentages. This help us to find in which site Fe substitute to Ni for these given concentration.

Below the Curie temperature T_C , we observe the increase of intensity of magnetic peaks at low angle, which can be linked to the ferromagnetic behavior of thse compounds as shown in figure 1 for $\text{YNi}_{2.25}\text{Fe}_{0.75}$.

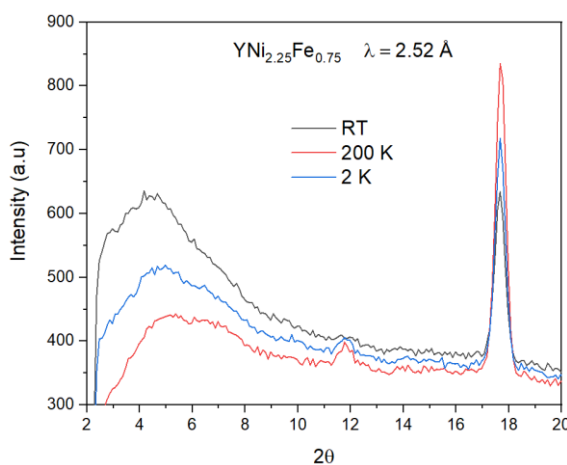


Figure 1 $\text{YNi}_{2.25}\text{Fe}_{0.75}$ data files at RT, 200K and 2K