



	Experiment title: Origin of magnetic structures in single crystalline Ni-Mn based Heusler alloys detected by X-ray detected resonance	Experiment number: 3783
Beamline: ID12	Date of experiment: from: 18.07.12 to: 24.07.12	Date of report: <i>Received at ESRF:</i>
Shifts: 18	Local contact(s): Fabrice Wilhelm	
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Report:

This proposal is aimed to investigate the nature of magnetic structures in Ni-Mn based Heusler alloys using X-ray detected ferromagnetic resonance (XDMR) with the experimental setup of ID12.

For this beamtime we decided to study $\text{Ni}_{50}\text{Mn}_{35}\text{Sn}_{15}$ and $\text{Ni}_{50}\text{Mn}_{37}\text{Sn}_{13}$ samples as they, despite the small difference in Sn concentrations, have significantly different transition temperatures for the matensite austenite states and also a different temperature-dependence for the magnetic interactions. Figure 1 shows the XANES and XMCD spectra for the $\text{Ni}_{50}\text{Mn}_{35}\text{Sn}_{15}$ sample for the Mn and Ni K-edge at the temperatures $T=120\text{K}$ and $T=260\text{K}$ for comparison.

As one can see there are significant changes in the spectral shape of the XANES at the Mn and Ni edge corresponding to a significant change in the local environment of the Mn and Ni atoms.

For the XMCD at the Mn edge the signal is reduced for the lower temperature as expected from the temperature-dependence measured in SQUID. (Interesting is the second XMCD above the edge corresponding to a two electron excitation) However for the Ni edge the XMCD is almost unchanged.

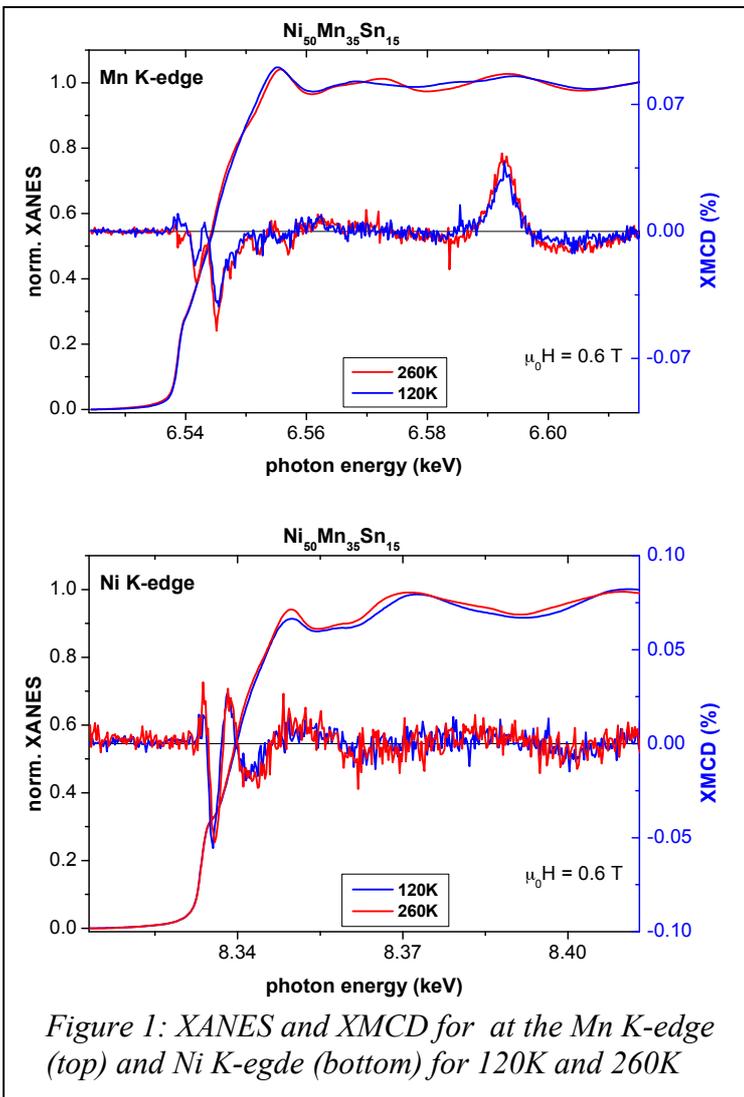


Figure 1: XANES and XMCD for at the Mn K-edge (top) and Ni K-edge (bottom) for 120K and 260K

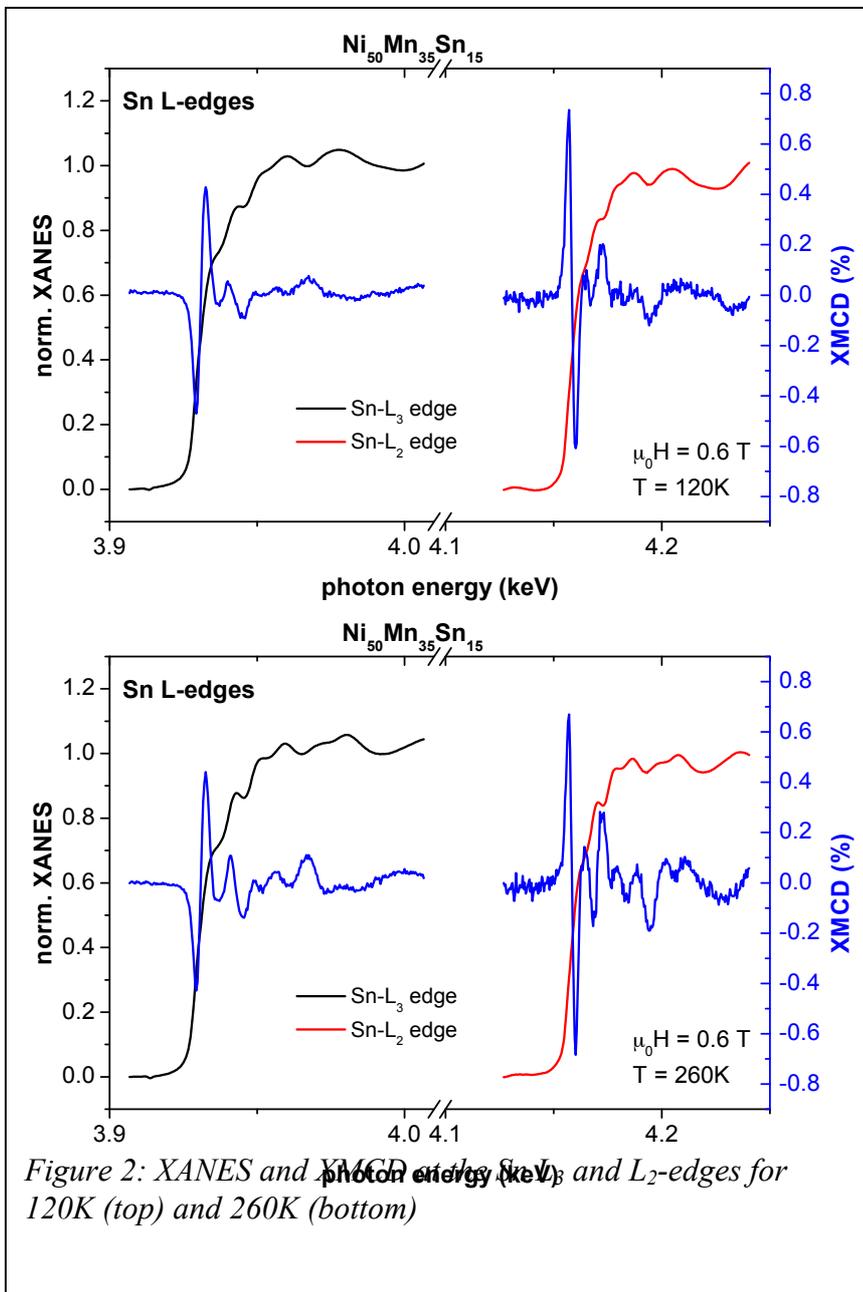


Figure 2: XANES and XMCD spectra for $\text{Ni}_{50}\text{Mn}_{35}\text{Sn}_{15}$ at 120K (top) and 260K (bottom)

In figure 2 the corresponding XANES and XMCD spectra for the Sn $L_{3,2}$ -edges are shown for 120K and 260K.

As for Ni and Mn edges the spectral changes in the XANES indicate a structural change in the Sn sublattice. A significant magnetic polarization of the Sn atoms can be concluded from the XMCD which will be further evaluated and compared with theoretical calculations which have been initiated.

An interesting result of this beamtime is, that for the different temperatures not only the size of the recorded XMCD changes but also the spectral change. This leads us to the idea to try to evaluate the temperature dependence for different photon energies.

For that we fixed the photon energy and recorded the XMCD for both polarization directions and both field directions while sweeping the sample-temperature. This has not been done before. Such a

measurement is shown in figure 3 for a photon energy at the Sn L_3 -edge. (The temperature-dependence for other photon energy is different and needs further investigation for clarification of its origin)

Unfortunately due to an unfixed problem with the computer necessary for controlling the XDMR setup at ID12 we could not use the experimental setup during this beamtime. However the static XANES and XMCD measurements already illustrate how important elementspecific measurements are in these materials for a microscopic understanding.

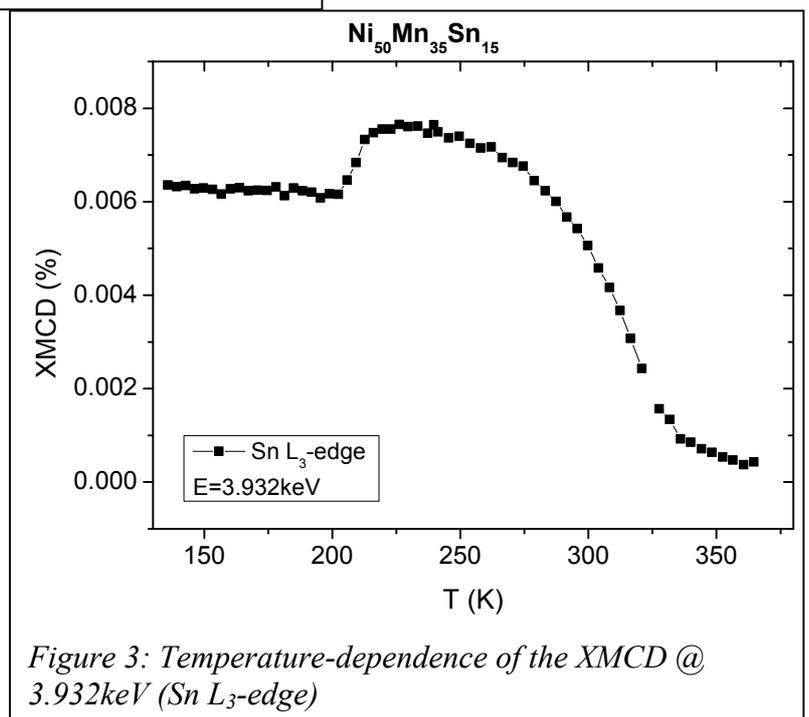


Figure 3: Temperature-dependence of the XMCD @ 3.932keV (Sn L_3 -edge)