



	<b>Experiment title:</b> <b>Spintronic device: study of Manganese in GaMnN epilayers as a function of Mn concentration</b>	<b>Experiment number:</b> ME-508
<b>Beamline:</b> ID26	<b>Date of experiment:</b> from: 07/10/2002 to: 10/10/2002	<b>Date of report:</b> 01/03/2003
<b>Shifts:</b> 11	<b>Local contact(s):</b> Laurent Alvarez	<i>Received at ESRF:</i>
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## Report:

### Overview

The allocated beamtime was just sufficient to realize most of the study described in our proposal. We have recorded room-temperature fluorescence EXAFS and XANES spectra at the Mn K-edge, using either the photodiode or the 13-element energy-resolved detector (provided by the detector pool). A (z-2) Chrome shield was put in front of both detectors.

For XANES, we used references of metallic manganese Mn(0), Mn(II)ZnTe, Mn(III)<sub>2</sub>O<sub>3</sub> and Mn(IV)O<sub>4</sub>. The (220) monochromator provided us with the requested 0.3eV resolution, so that manganese pre-peaks are clearly separated.

For EXAFS, we used a reference sample of ZnMnTe.

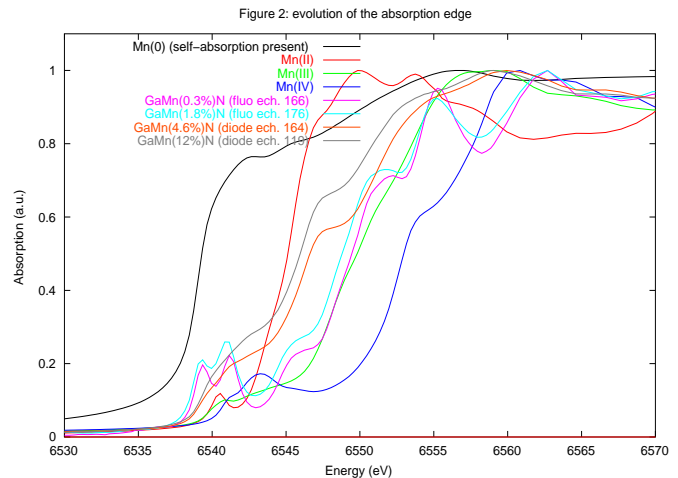
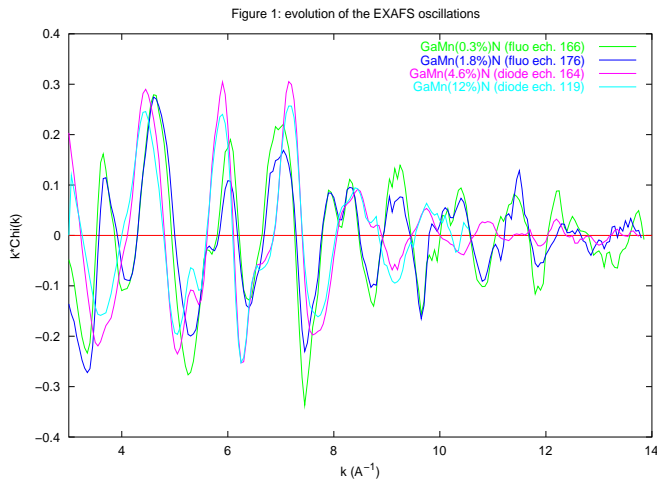
As our samples are monocrystalline, we get lot of Bragg diffraction peaks superimposed on absorption spectra. Therefore, prior to data acquisition, we have extensively used quick-EXAFS scans to adjust X-ray incident angle on sample to minimize the number of (annoying) Bragg peaks.

## Studied samples

Studied samples are made of Wurtzite GaN, doped with different amount of Mn. We were able to record spectra at different Mn concentrations : around 0.3% (samples E88, E166 and E178), at 2.0% (E176 and E179), at 5% (E164, E170, E165) and 12% (E119). Regretfully, we couldn't record EXAFS spectra at 0.04% by lack of signal/available time.

## Results

**Main result:** there is a major evolution in the chemical environment and oxidation state of Mn in GaMnN epilayers as a function of its concentration. This is illustrated on figure 1 and 2. It clearly appears that below 2% of incorporated Mn, the spectra does not evolve and Mn stays incorporated substitutionally to a Ga in the Wurtzite GaN structure. Above 2%, this is no more the case and Mn is incorporated into another phase, which has to be identified.



**Secondary result:** the addition of Mg acceptor didn't bring any major change in the absorption spectra.