



	Experiment title: Spintronic device: study of Manganese in GaMnN epilayers as a function of Mn concentration	Experiment number: ME-508
Beamline: ID26	Date of experiment: from: 07/10/2002 to: 10/10/2002	Date of report: 01/03/2003 <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)₂O₃ and Mn(IV)O₄. 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.

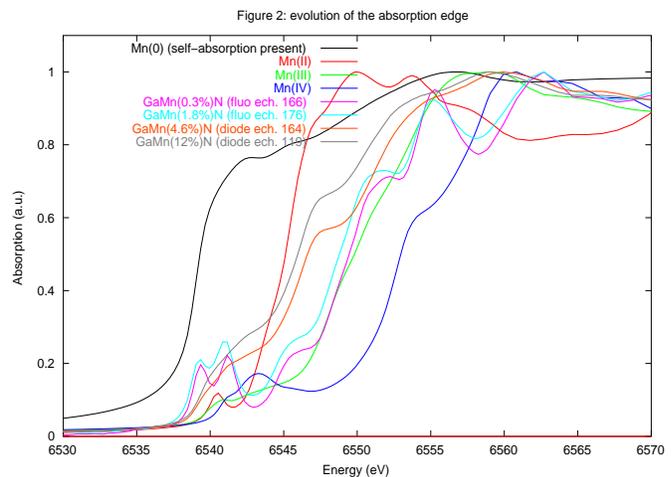
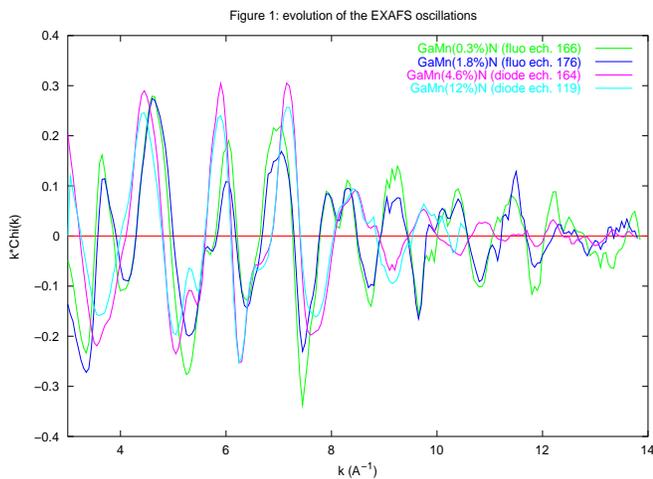
As our samples are monocrystalline, we get lot of Bragg diffraction peaks superimposed on absorption spectra. Therefore, prior to data acquisition, we have extensively used quick-EXAFS scans to adjust X-ray incident angle on sample to minimize the number of (annoying) Bragg peaks.

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.