ESRF	**Experiment title:** High resolution Compton scattering study of $Zn_{1-x}Mg_xSe$ single crystals	**Experiment number:** HE-167
Beamline:	**Date of experiment:** from: 02.04.97 to: 10.04.97	**Date of report:** 23.02.98
Shifts:	**Local contact(s):** Abhay Shukla	*Received at ESRF:* - 3 MAR. 1998

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Report:

Wide-gap semiconductors are widely studied materials as potential candidates for blue lasers. In our research program on these materials we have already measured GaN and the present experiment involves another candidate $Zn_{1-x}Mg_xSe$, where the band gap can be controlled by the Mg-doping. Both GaN and ZnSe have the same wurzite type of crystal structure but they behave quite differently in terms of the some physical properties like long-term stability of the light emission. We have approached this problem using high resolution Compton scattering and our primary target has been the bonding mechanism.

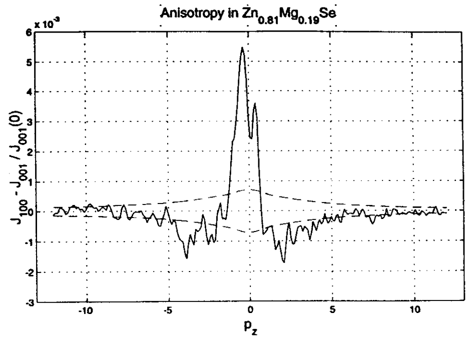
The single crystal samples with two different Mg doping levels, x=0.19 and 0.5 1, were grown in the Nicolaus Copernicus University in Torun, Poland. The quality of these crystals was checked by x-ray diffraction by measuring the rocking curves. Three samples with crystal phase orientations of (l0.0), (11.0) and (00.1) were used, all having the same thickness of 1 mm.

Compton scattering experiments were made using the high resolution spectrometer at the beamline ID 15 B. Primary x-ray energy was chosen to be 56 keV, and the scattered x-rays were analysed using a focusing Ge(440) monochromator followed by a scintillation counter. The resolution of the spectrometer was checked to be about 0.20 a.u. of momentum at the center of the Compton peak it varies slowly across the Compton profile. **A Ge** detector was also used, first of all to monitor the variations in the primary beam but also to offer a reference to the crystal spectrometer data. The resolution is lower, about 0.60 a.u. but the statistical, on the other hand significantly better than in the crystal spectrometer data.

Altogether 21 shifts were used to measure 6 samples (two doping levels, 3 crystallographic directions). The effect of doping was easy to see, with x=0.19 the whole sample shined yellow when it was irradiated with a small incident beam, whereas the colour was green for the Mg doping level x=0.5 1.

An example of the effect of the Mg doping to the electron momentum anisotropy can be seen in Figures la and lb which show the directional Compton profile differences $J_{10.0}(p_z) - J_{00.1}(p_z)$ for x=0.19 (1a) and x=0.5 1 (lb). It is easy to see that the shape of the anisotropy curve is completely different. It turns out that Mg doping produces more low momentum part of the Compton profile in all cases, the effect is largest along the c-axis and this can be seen as a dip at low momenta in Fig. 1 b.

A closer interpretation of these data and also comparison with the GaN results in terms of the band structure calculations is in progress.



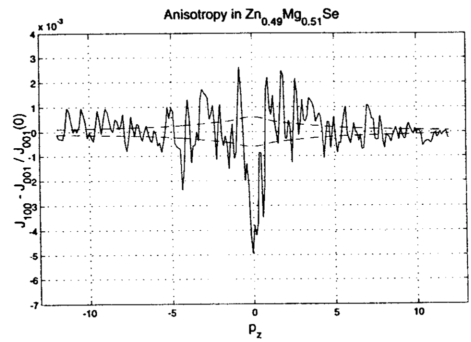


Figure 1. Compton profile difference $J_{10.0} - J_{00.1}$ with Mg doping of 0.19 (a) and 0.51 (b)