HRXRD AND RBS/CHANNELING DETERMINATION OF THE CORRELATION BETWEEN RADIATION DAMAGE AND INTERPLANAR SPACING IN GaN EPILAYERS

M. Wojcik[1*], J. Gaca [1], A. Turos [1,2], P. Caban [1], W. Strupiński [1], and K. Pągowska [2]

[1] *Institute of Electronic Materials Technology 01 919 Warsaw, Wolczynska 133, Poland*

[2] *Soltan Institute for Nuclear Studies, 05-400 Świerk /Otwock, Poland*

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**)e-mail:wojcik-m@itme.edu.pl*

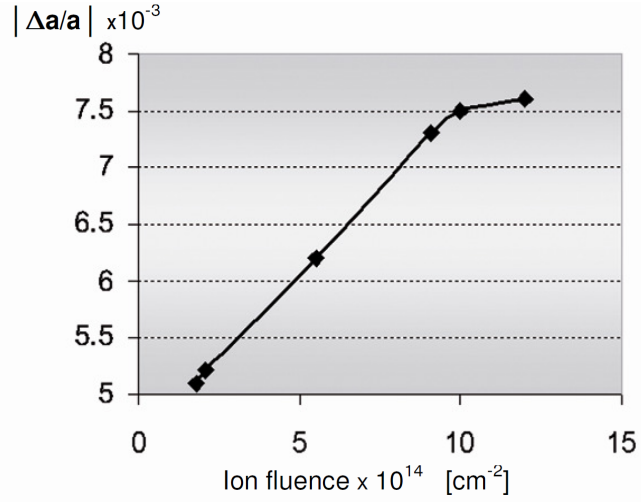

Figure 1. The lattice misfit $|\Delta a/a|$ between the ion-implantation damaged and non-damaged GaN layers as a function of the ions fluence.

Modification of the interplanar spacing profile (ISP) along the [1000] direction pro-duced by Ar-ion irradiation of 1μm thick GaN epitaxial layers have been investigated by means of HRXRD and RBS techniques. GaN layers were grown on [1000] sapphire substrates in an AIX200/4RF-S metalorganic vapor phase epitaxy low-pressure reactor (LP MOVPE). Ar ions of 320 keV energy produce radiation defects in the surface layer extending over first 400 nm. The applied ion fluences ranged from $7 \cdot 10^{13}$ cm^{-2} to $1.2 \cdot 10^{15}$ cm^{-2} are well below the amorphization threshold. ISP for each sample has been determined by simulation of the x-ray rocking curve using defect depth distributions provided by the RBS/channeling method as starting input data. The whole procedure consists of the following steps:

- determination of the defect density profile by the RBS technique,
- measurement of the rocking curve using synchrotron radiation with the wavelength $\lambda = 0.13993$ nm,
- evaluation of the interplanar spacing and planar scattering power profiles using the RBS data as a first approximation of the crystal model for rocking curve calculation,
- variation of the shape of the interplanar spacing and planar scattering power profiles until the best fit between the experimental and calculated rocking curves has been obtained.

For all investigated samples the interplanar spacing increased as a result of ion bombardment. This change proved to be a linear function of the ion fluence (see Fig. 1) for ion fluences lower than $1.0 \cdot 10^{15}$ cm^{-2}. This effect can also be closely correlated with the concentration of structural defects in the irradiated volume.

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