

# Ion induced segregation of indium on the InN surface

V.V. Bryzgalov<sup>\*</sup>, Yu. S.Gordeev, V.Yu. Davydov, V.M. Mikoushkin

*Ioffe Physical-Technical Institute, Polytechnicheskaya 26, St.-Petersburg, 194021, Russian Federation.*

---

Unexpected revision of the InN band gap [1-3] has turned this material into one of the most perspective for optoelectronics and has initiated a great activity in their research. This activity faced (with) the problem of fabrication of single phase and good quality InN films. To solve this problem one needs controlling not only the element composition of the material but also the chemical composition. Electron spectroscopy diagnostics, in particular plasma diagnostics of chemical composition of InN films has been developed. Study of several films grown in different laboratories showed that all of the films contained phases of metallic In, InNO alloy, amorphous carbon and even molecular nitrogen apart from the InN phase. The developed diagnostics technique led to revealing the effect of efficient release of In atoms from the InN cites followed by the segregation of In atoms into metallic phase under ion bombardment. The segregate is formed mainly on the InN surface. The effect manifests itself as a radical increase of the intensity of the In-metal plasmon peak in the electron energy loss spectra (EELS). Loss functions  $\text{Im}(1/\epsilon(\omega))$  were deduced from the EELS and the contribution of In-segregates was obtained. The observed effect proved to be strongly dependent on the structural characteristics of the studied samples: the worse crystalline structure and chemical homogeneity, the stronger effect and the thicker effective layer of the In segregate. The segregate thickness varied in the range of 1-2 ML for different samples. The efficiency of the effect was supposed to be connected with efficiency of the diffusion of In atoms through dislocations, phase and crystallite boundaries. It was assumed that the revealed effect can be used for integral characterization of the quality of InN films in the course of perfection of InN fabrication technique. This work was supported by the research programs *Low Dimensional Quantum Structures* (RAS) and *Physics of Solid State Nanostructures* (MSE).

- [1] V.Yu. Davydov, A.A. Klochikhin, et al., *Phys.Stat.Sol. (b)*, 2002, v.229, p.R1; *Phys.Stat.Sol. (b)*, 2002, v.230, p.R4; *Phys.Stat.Sol. (b)*, 2002, v.234, p.787.  
[2] J. Wu et al., *Phys.Rev.B.*, 2003, v.66, p.201403; *J.Appl.Phys.*, 2003, v.94, p.4457.  
[3] T. Matsuoka, H. Okamoto, et al., *Appl.Phys.Lett.*, 2002, v.81, p.1246.
- 

<sup>\*</sup> Corresponding author.

*Email address:* [V.Bryzgalov@mail.ioffe.ru](mailto:V.Bryzgalov@mail.ioffe.ru) ([V.V. Bryzgalov](mailto:V.V. Bryzgalov)).