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Structural properties and evolution of the deformation state in GaN/AlN superlattices grown on vicinal GaN(0001) substrates

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GaN/AlN superlattices (SLs) are nowadays perspective for high-performance photonic devices operating in the spectral regions from ultraviolet to infrared [1]. Among other factors such as growth and design parameters, the structural and consequently optical properties of GaN/AlN SLs are strongly influenced by both the substrate type and strain relaxation in the SLs [2].

We present the peculiarities of strain relaxation in GaN/AlN SLs grown on vicinal GaN(0001) surface by plasma-assisted molecular beam epitaxy (PAMBE). Structural properties and evolution of the deformation state as a result of changes in the number of periods in GaN/AlN SLs is investigated by X-ray diffraction (XRD), X-ray reflectivity (XRR) and atomic force microscopy (AFM).

We have shown that the increase of SL's period number leads to the partial relaxation of SL's layers. In addition, this leads to an increase of the energy barrier for the replacement of the Al surface atoms by Ga adatoms, and as a consequence the well/barrier thickness ratio changes. Thus, the deviation in the thickness of the actual SL layers from the nominal is explained by an exchange mechanism between Al adatoms and Ga surface atoms.

1. *Morkoз H.* Handbook of Nitride Semiconductors and Devices: Electronic and Optical Processes in Nitrides. Berlin: Wiley-VCH; 2008.
2. *Kladko V.P., Kuchuk A.V., Lytvyn P.M. et al.* Substrate effects on the strain relaxation in GaN/AlN short-period superlattices // Nanoscale Res. Lett.-2012.-**7**.-P. 289.