

Nanoobjects microscopy

Cross-sectional electric field mapping in the AlGa_N/Ga_N structures with 2D/3D localization of carriers

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Achieving a high hole concentration in III-nitride material to develop highly conductive p-type GaN and AlGa_N has a grate practical importance for development up-to-date electronic and optoelectronic devices. It was demonstrated efficiency of p-type doping by ionizing acceptor dopants using the built-in electronic polarization in bulk uniaxial semiconductor crystals [1,2]. This so called, polarization doping could be developed for pn-junction making without any impurity doping.

We investigated graded AlGa_N/Ga_N structures with a house-like Al distribution in alloy by Kelvin probe force microscopy (KPFM). 2D/3D electron/hole gas and pn-junction localization illustrated and peculiarities of electric field distributions reviled and analyzed using corresponding simulations.

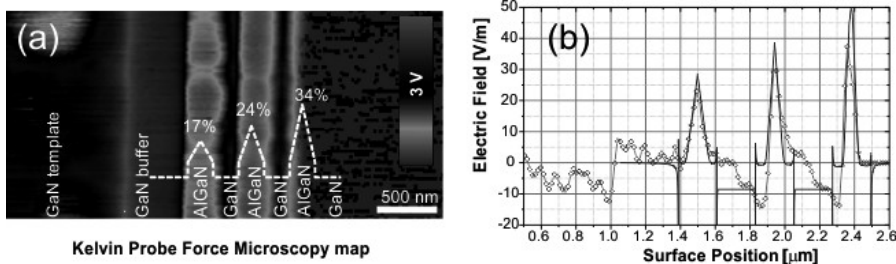


Fig.1. KPFM diagnostic of Al_xGa_{1-x}N layers: surface potential map of multilayer AlGa_N/Ga_N structure cross-section (a); experimental data of electric field profile (points) and corresponding simulation (line) (b). Pattern of structure and composition indicated over KPFM map.

1. Simon J., Protasenko V., Lian C., Xing H., Jena D. Polarization-Induced Hole Doping in Wide – Band-Gap Uniaxial Semiconductor Heterostructures // Science.- 2010.-327.-P. 60-64.
2. S. Li, M. Ware, J. Wu, P. Minor, Z. Wang, Z. Wu, G. Salamo. Polarization

induced pn-junction without dopant in graded AlGa_N coherently strained on GaN.//
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