Determination of the nanoscale structural properties of the InAlN based devices by advanced TEM methods

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InAlN based lattices match quantum structure as a one way to overcome the influence of the piezoelectric field and negative impact of the Stark effect in GaN based device grown in polar direction. GaN is also a promising material for the construction of the HEMT structures. The STEM, HRTEM with aberration corrected microscope and EELS/EFTEM techniques are used to determine properties of InAlN multi quantum wells grown by MOVPE at the local, atomic level. We report good quality of the interfaces and well reproductively of the compositional profile. We detect the residual strain field as well as local nanometric scale ordering inside InGaN layers. The stability for InAlN against electron beam irradiation is deduced. Using standard classical piezoelectric model the elastic and electric properties (strain, electrostatic potential, and electric field) of a these nanostructures, and their sensitivity on chemical composition variation, are determined. The effect of modulation of the chemical composition on the valence and conduction band edges is explored.

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