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Optimized growth of lattice-matched InAlN/GaN heterostructures by molecular beam epitaxy STEFAN SCHMULT, THEO SIEGRIST, MIKE SERGENT, MIKE MANFRA, Bell Labs - Lucent Technologies, RICH MOLNAR, MIT Lincoln Lab — A fundamental problem in the epitaxial growth of hexagonal group III/Nitride heterostructures along their c-axis is the in-plane lattice-mismatch between the binary compounds GaN, AlN and InN. This mismatch is responsible for stress and strain formation and leads in its extreme to cracking, deteriorating the optical and electrical properties of the samples. The ternary compound $In_xAl_{1-x}N$ with x$\sim$0.17 is expected to have an identical in-plane lattice constant as GaN. Here we report on the MBE growth of lattice-matched $In_xAl_{1-x}N$ on thick GaN templates. Optimizing the growth conditions and systematically investigating the influence of the flux ratio between Aluminum, Indium and Nitrogen leads to high quality layers, as assessed by x-ray diffraction. The extracted full widths at half maximum of the InAlN peak in ω-2θ and rocking curve scans are 190arcsec and 300arcsec respectively and the lattice-match is confirmed by reciprocal lattice mapping. Sharp, intense high-order satellite peaks as well as the occurrence of interface interferences in the x-ray diffraction spectra confirm the high crystalline quality and abrupt interfaces of short period GaN/InAlN superlattices. These simple heterostructures are preludes to more complex structures like distributed Bragg reflectors and micro cavities.

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