abstract

The goal of this research was to reduce dislocations and strain in high indium content bulk InGaN to improve quality for optical devices. In an attempt to achieve this goal, InGaN pillars were grown with compositions that matched the composition of the bulk InGaN grown on top. Pillar height and density were optimized to facilitate coalescence on top of the pillars. It was expected that dislocations within the pillars would bend to side facets, thereby reducing the dislocation density in the bulk overgrowth, however this was not observed. It was also expected that pillars would be completely relaxed at the interface with the substrate. It was shown that pillars are mostly relaxed, but not completely. Mechanisms are proposed to explain why threading dislocations did not bend and how complete relaxation may have been achieved by mechanisms outside of interfacial misfit dislocation formation. This research focused on the InGaN pillars and first stages of coalescence on top of the pillars, saving bulk growth and device optimization for future research.