Abstract Submitted
for the MAS17 Meeting of
The American Physical Society

Full-Color Phosphor-Free InGaN/AlGaN Nanowire Light-Emitting Diodes Grown By Molecular Beam Epitaxy. THANG BUI, MOAB RAJAN PHILIP, MEHRDAD DJAVID, HIEU NGUYEN, New Jersey Inst of Tech — III-nitride nanowires light-emitting diodes (LEDs) have been intensively investigated. Compared to thin-film structures, nanowires exhibit drastically reduced dislocations and polarization fields, promising for superior LEDs performance. However, a significant roadblock for the development of nanowire LEDs is the very low efficiency, limited by the lack of 3D carrier confinement, poor hole transport, and electron overflow. In this context, we have investigated the molecular beam epitaxial growth, fabrication and characterization of full-color InGaN/AlGaN nanowire LEDs, wherein the emission characteristics are controlled by adjusting the properties of InGaN active region. Moreover, during the epitaxial growth of the InGaN/AlGaN, multiple AlGaN downward-bending shell layers are spontaneously formed due to the diffusion-controlled growth process, leading to the greatly reduced surface nonradiative recombination, and enhanced carrier injection efficiency. The unique core-shell nanowire LEDs exhibit massively increased photoluminescence and electroluminescence intensities compared to conventional InGaN/GaN nanowire LEDs. Additionally, such core-shell LEDs emit strong white light with unprecedentedly high CRI of >95, which are ideally suited for future smart lighting applications.

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Date submitted: 30 Sep 2017 Electronic form version 1.4