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Growth and Fabrication of III-Nitride Deep Ultraviolet Emitters
T.M. AL TAHTAMOUNI, M.L. NAKARMI, M. KHIZAR, Z.Y. FAN, J.Y. LIN, H.X. JIANG, Department of Physics, Kansas State University, Manhattan, Kansas 66506 — In recent years, there has been a great effort to develop AlGaN based compact deep ultraviolet (UV) light-emitting diodes (LEDs) ($\lambda < 300$ nm) for applications such as bio-chemical agent detection and medical research/health care. To obtain deep UV emission with $\lambda < 300$ nm, AlGaN quantum well (QW) based LED structures require an active layer with Al composition higher than 40%. As a result, the alloy composition for p- and n-cladding layers should be more than that of the active layer. The high Al composition introduces dislocations and leads to poor p- and n-type conductivity in the cladding layers, which limits current injection. We report here on the epitaxial growth of deep UV LEDs with operating wavelengths ranging from 300 nm to 270 nm by metal-organic chemical vapor deposition (MOCVD). Our UV LED structure was deposited on AlN/sapphire templates. We have achieved deep UV LEDs with an output power of 1.4 mW at 350 mA dc driving at 280 nm. The use of AlN epilayers as templates to reduce the dislocation density and enhance the LED performance will be discussed. Different device architectures for enhanced LED performances will also be presented.

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