**Structural and Optical Characterization of Non-polar A-plane III Nitride Thin Films Grown on R-plane Sapphire via High-Temperature AlN Nucleation Layers by Metalorganic Chemical Vapor Deposition**

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Growth in non-polar crystalline directions is a promising way of circumventing the strong polarization-induced electric fields that exist in conventional wurtzite nitride semiconductors [1]. Although many efforts have been made to grow non-polar A-plane GaN on R-plane sapphire substrates by metalorganic chemical vapor deposition (MOCVD), most of the efforts involve a low temperature GaN nucleation layer, similar to that applied to typical C-plane sapphire. The epitaxial A-plane GaN layer grown on top of this low temperature nucleation layer shows high defect densities and poor crystalline quality [2]. To reduce the defect density, complicated process steps such as epitaxial lateral overgrowth (ELOG) and selective area lateral epitaxy (SALE) are being employed [3]. These complicated processes add considerable cost to the epitaxial growth steps, limiting the potential commercial application to high-end GaN optoelectronic devices such as lasers.

In this paper, we report the properties of non-polar (11-20) A-plane GaN thin films grown on (1-102) R-plane sapphire substrates utilizing a high-temperature AlN nucleation layer grown by MOCVD. Planar epilayer surfaces have been achieved and the potential for device-quality layers has been realized by this technique. Structural quality of the A-plane GaN film was characterized by x-ray diffraction. Typical full width at half-maximum (FWHM) of x-ray rocking curves for the (11-20) reflection was approximately 700 arcseconds, which is much lower compared to that reported on A-plane GaN epitaxial layer utilizing low temperature GaN nucleation technique [2]. Our data is close to the reported results [3] obtained using epitaxial lateral overgrowth (ELOG) on top of A-plane GaN template originally deposited by low temperature GaN nucleation on the R-plane sapphire substrate. Standard InGaN/GaN MQW structures were grown on the above non-polar A-plane GaN layer. Preliminary data indicates that In incorporation is much less efficient with this structure on R-plane sapphire compared to the same structure on standard C-plane sapphire. Further optimization of our growth process is underway to improve the bulk GaN crystal quality and InGaN MQW active layer structures.

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