The control of growth mode and strain in Al-rich AlGaN by MOCVD

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High-Al content AlGaN has much attention for high frequency and power electronic applications leading to an increase interest in the research of high-quality, thick AlGaN layers. In this work, we present a systematic study of strain, dislocations and surface morphology of 1.5 μm thick, Al-rich AlGaN layers with ~63% Al content grown by hot-wall MOCVD. Various buffer layers and different growth conditions are employed for the growth of AlGaN. The AlGaN crystalline quality is found to directly follow that of the AlN buffer layer. By controlling the buffer growth mode, we improve the surface morphologies of both the buffer and the AlGaN, while at the same time produce a significant reduction in both screw and edge dislocations in the main AlGaN. A detailed discussion of growth mechanisms leading to the improvement of the surface morphology and reduction of dislocations in AlGaN and conclusions on the optimized growth conditions will be presented.