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Enhancement of GaN crystallinity by using H_2/N_2 plasma exposure to sapphire substrate

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GaN is the key material for the applications of optoelectronic and high power devices. The crystal quality of GaN is known to be much influenced by sapphire substrate pre-treatment . In this work, the effects of plasma pre-treatment on sapphire and the properties of GaN overlayer have been investigated. Sapphire surface was pre-treated by RF plasma of H2/N2 mixture gas at 350℃ for 30min. GaN epilayers were grown in H2 ambient at 1100℃ for 1 hr after growing GaN buffer layers of about 27nm thickness at 550℃ in Metal Organic Chemical Vapor Deposition (MOCVD). The roughness of GaN buffer layers varied with the mixing ratio of H2/N2 gas as shown in Fig. 1. The properties of GaN epilayers were evaluated by Double Crystal X-Ray Diffraction (DCXRD), Photo Luminiscence (PL) and Hall measurement. The results showed that the mixing ratio of H2/N2 gas during plasma treatment affected to the structural, optical and electrical characteristics of GaN epilayer. (See Fig. 2)

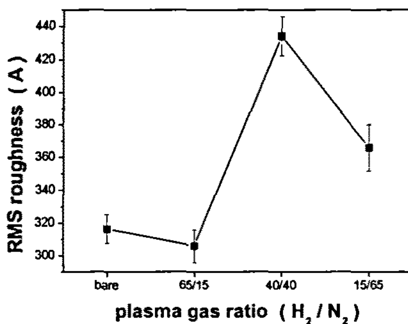

Fig. 1 RMS roughness of buffer layer

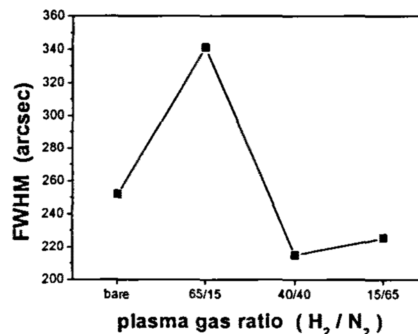

Fig. 2 FWHM of X-ray rocking curve of GaN (0002)