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Zinc Blende Structure GaN Grown by Radio Frequency Plasma Assisted Molecular Beam Epitaxy

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Recently, interest in the group-III nitride semiconductors has attracted because of their potential for the development of light emitting devices in the visible and UV spectral regions, high temperature electronics and high power microwave devices. Bulk single crystals or wafers are not yet available and the choice of adequate substrates for heteroepitaxy has been a nontrivial problem for experimentalists. Al_2O_3 is commonly used but its large misfit with respect to GaN(14~16%) has been a limiting factor in the quality of the grown epilayers. There have been several reports that the nitridation play an important role in the growth of GaN on Al_2O_3 substrates. Most of films had a wurtzite phase. However, growing zinc blende GaN for the LD fabrication have been attracted and there have been reports using 3C-SiC substrates for the growth of zinc blende GaN.

In this study, before growing GaN on 3C-SiC coated Si(001), we investigated how the nitridation has an influence on the growth of GaN films. As a results, we present high quality of undoped zinc blende GaN on 3C-SiC coated Si(001) using a molecular beam epitaxy(MBE) in which the reactive nitrogen ion source is used 13.56 MHz radio frequency plasma radical source. The zinc blende nature of GaN films is confirmed by in situ Reflected High Electron Energy Diffraction(RHEED), X-ray diffraction(XRD), photoluminescence(PL); scanning electron microscope(SEM).

we observed mirror-like surfaces and obtained the growth rate of 0.23㎛/h. From the RHEED (2×2) streaky pattern, we are assured that the high quality zinc blende GaN films are grown. The XRD showed that (002) zinc blende GaN is observed near at $2\theta = 40.1^\circ$. At 10K, PL of the zinc blende GaN is dominated by band edge emission at 3.492 eV.

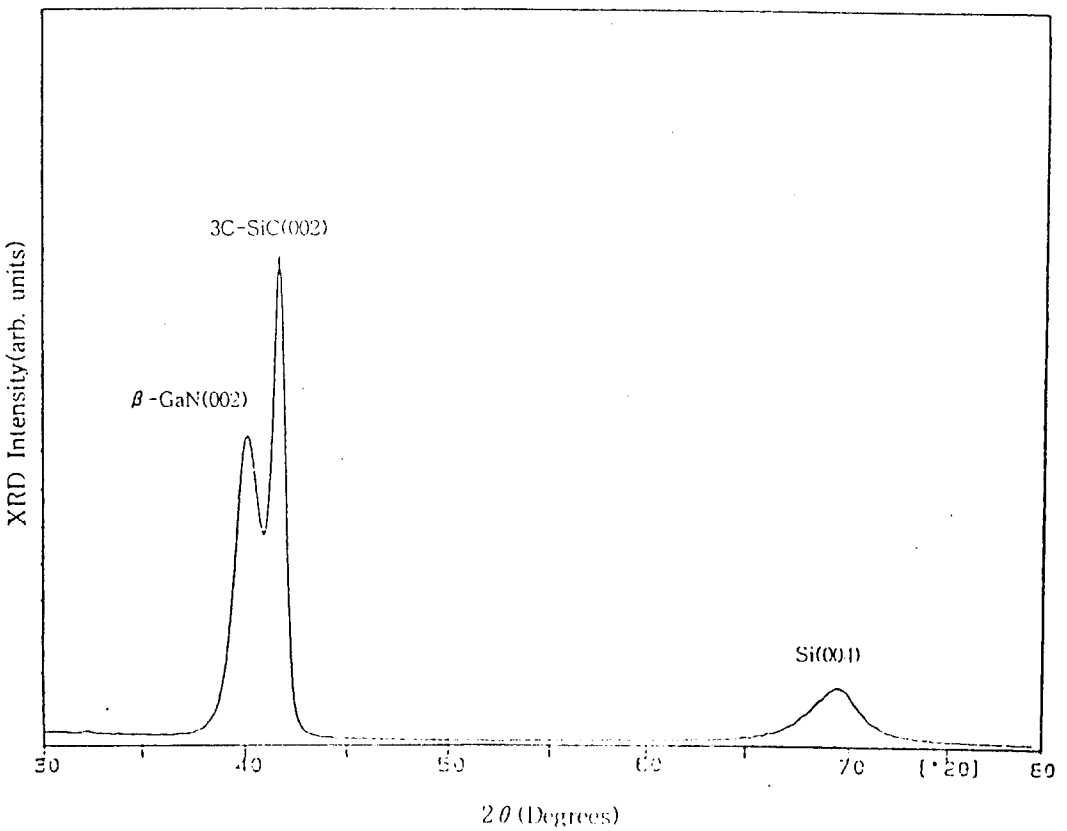

Fig 1. X-ray diffraction of GaN films grown at 600℃

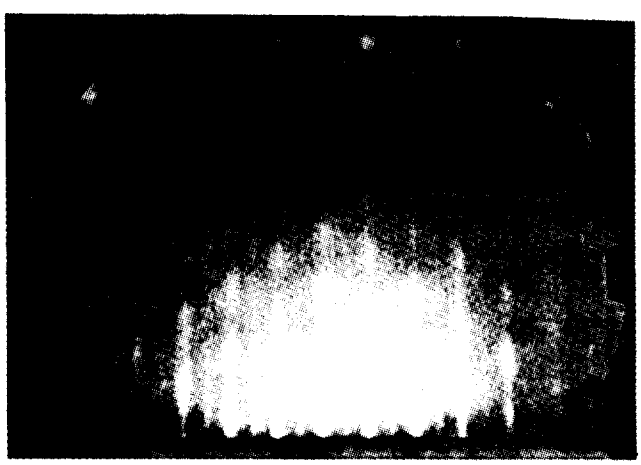

Fig. 2 RHEED (2×2) pattern of GaN films grown at 600℃