[Ⅱ-8]

The variation of lattice constants of AlN on Si (111) during the growth

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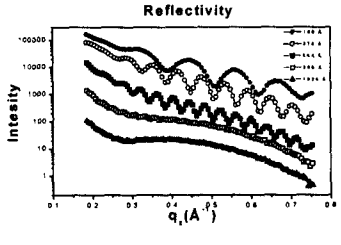
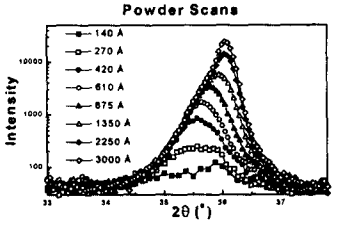
Aluminum nitride(AlN) thin films are of interest for high temperature applications, optoelectronic devices, and surface acoustic wave devices. AlN thin film shows various attractive physical properties such as wide direct band gap (6.2eV), high thermal stability, high thermal conductivity, piezoelectricity, and hardness. It is very difficult to obtain high quality AlN(002) thin film due to thermal and lattice mismatch between the film and ordinary substrates such as silicon and sapphire.

AlN thin films were grown by reactive magnetron sputtering methode using pure Al(99.9999%) target with argon and nitrogen gas on silicon substrate. Before the growth, the chamber was evacuated to 2.0 X 10^{-6} Torr by turbomolecular pump. We used in-situ x-ray scattering system to study for the variation of lattice constant.

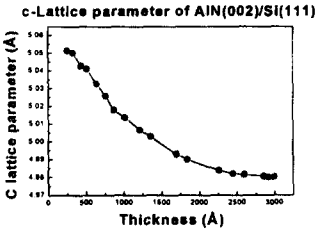
Figure 1 shows the increase of roughness of surface and interface with increasing the film thickness. During the measurement of reflectivity, we also obtained x-ray powder diffracion profile which is shown in figure 2. The data suggest that the C-lattice constant is decreasing as the deposition proceeds. Figure 3 clearly represents the lattice variation. This result explains the strain relaxation and initial growth mode. We will also compare the initial growth mechanism of the AlN thin film on Si with on sapphire which had already reported before.



Fig(1) In-situ x-ray reflectivity curves



Fig(2) In-situ AlN (002) diffraction profiles



Fig(3) Thickness dependence of lattice parameter