Objective

- Group III nitride devices on a large diameter Si substrate
- Continuous process system from a Si wafer to AlN, GaN, InN and their alloy using PA-MBE
- Interface reaction epitaxy (IRE) of β-Si₃N₄ and IRE-AlN
- Activity modulation migration enhanced epitaxy using HB and LB SS-jet flux

Method

- rf ICP two discharge modes: LB mode and HB mode
- Processes of DBL formation in a MBE chamber with indirect exposure of (N+N*) atoms and successive exposure of Al flux

Results and Discussion

- AFM images for 60 and 200 nm AlN films.
- GIXR patterns for 60 nm (53.8 nm by fitting) and 200 nm (171.3 nm by fitting).

Conclusion

Changing nitridation temperature of Si(111) in a MBE chamber, the thickness of β-Si₃N₄ increased from 0.18 nm to 0.35 nm at 830 °C to 680 °C, due to the relation between the surface density of (N+N*) atoms and the substrate temperature. By increasing the thickness of the AlN from 60 nm to 200 nm, the crystallinity was improved from 53.9 arcmin to 51.7 arcmin, obtained by the measurement of rocking curve of w full width at half maximum (FWHM) for AlN (0002) peak of X-ray diffraction. On the other hand, the surface roughness of AlN did not depend on the thickness of the AlN films obtained by fitting results of GIXR curves.