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AM-MEE growth of InAlN on Si(111) using RF-MBE

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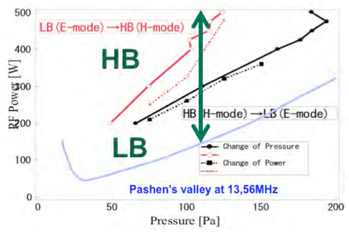
Objective

Growing lattice matiching HEMT $In_{0.17}Al_{0.83}N$ /GaN on a Si substrate using RF-MBE !

- Improve Si substtrate forinterface reaction epitaxial growth of β-Si_3N_4
- Seek continuous process system from a Si wafer to AlN, GaN, InN and their alloy using PA-MBE
- Improve AM-MEE growth of ally group III nitrides (InAlN and InGaN) using HB and LB SS-jet flux

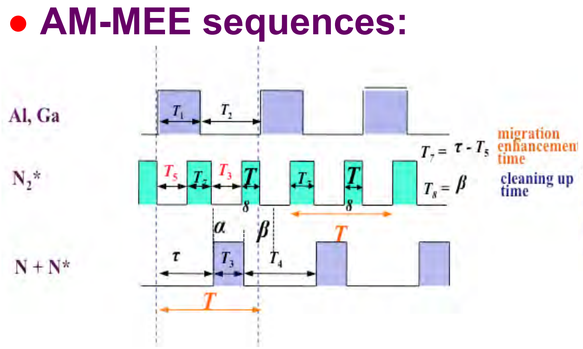
Method and Principle

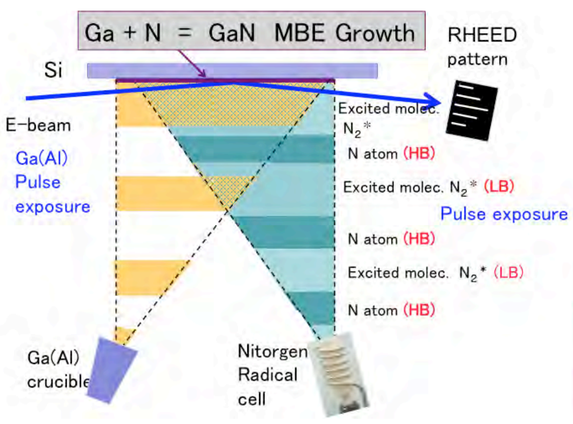
Mode control for AM-MEE:



As maximum power of power supply is 5 00W, mode change control is possible under about 120Pa

AM-MEE sequences:



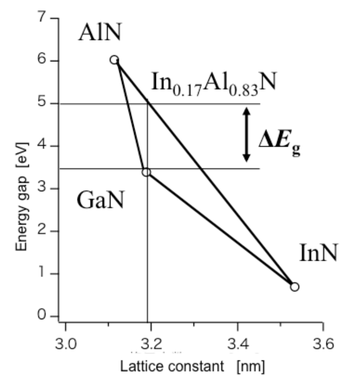


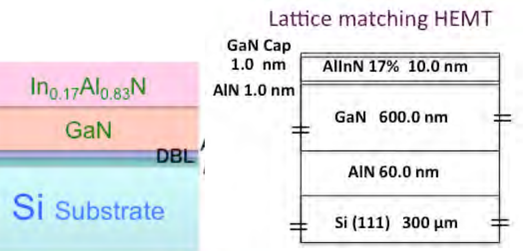
Physical and Chemical Activities:

Molecules N_2* Physically : migration and evaporation
Atoms N + N* Chemically: chemical reaction

Direct and indirext exposure of N and N_2*:

Direct exposure: Super sonic jet flow
Indirect exposure: Uniform & interface reaction epitxy (IRE)

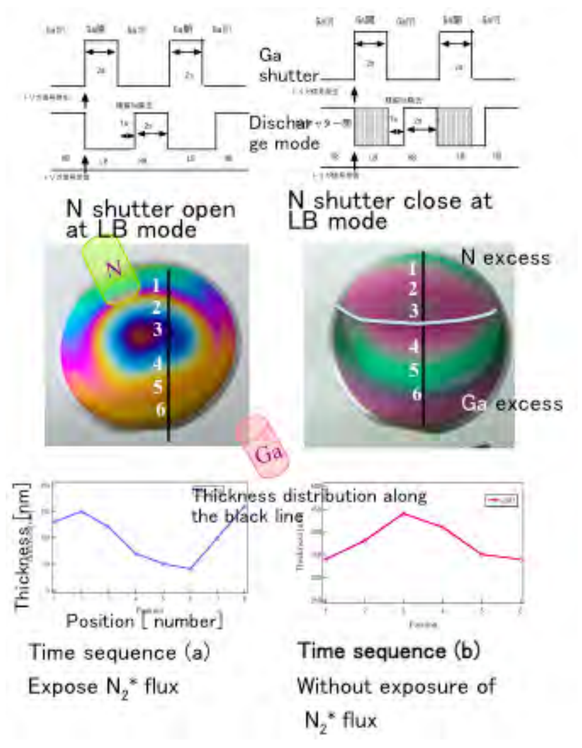




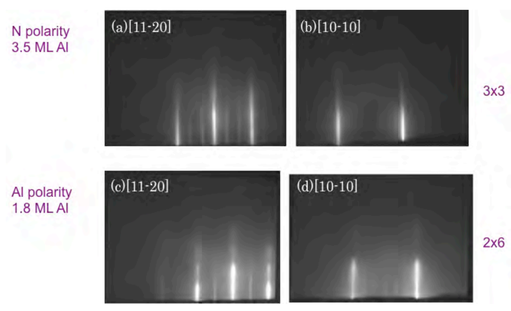
[1] T. Ohachi, N. Yamabe, M. Wada and O. Ariyada, Jpn, J. Appl. Pyhs. **50** (2011) 01AE01.
[2] T. Ohachi, N. Yamabe, H. Shimomura, T. Shimamura, O. Ariyada, M. Wada, *J. Crystal Growth* **311** (2009) 2987–2991.
[3] T. Ohachi, N. Yamabe, Y. Yamamoto, M. Wada and O. Ariyada, Phy. Status Solidi **C8(5)** (2011) 1491.
[4] T. Ohachi, N. Yamabe, Y. Yamamoto, M. Wada and O. Ariyada, *J. Crystal Growth* **318** (2011) 468.

Results and Discussion

Effect of AM-MEE : evaporation + migration

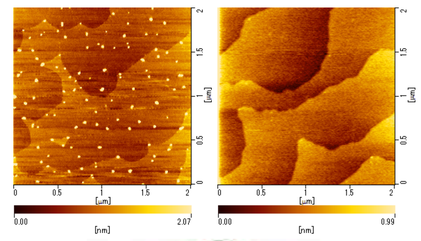


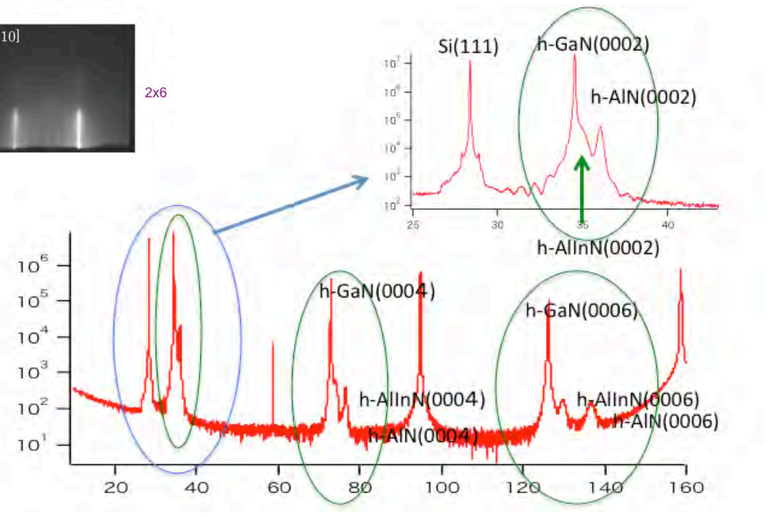
Polarit control of 2H-AlN



Wide range XRD pattern of Lattice matching InAlN/GaN HEMT

AFM images of Si surface





Conclusion AM-MEE was able to grow lattice matching HEMT of AnAlN/GaN on Si substrate.

The higher angle measurment of XRD is a good tool for lattice maching interface proof.