# GaN Epitaxial Wafers

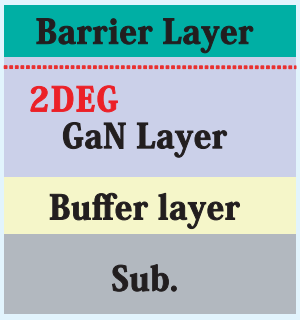
## NTT-AT provides GaN epitaxial wafers with high mobility for electronic devices

- GaN epitaxial wafers on various substrates (Si, SiC, Sapphire, GaN) grown by MOCVD.
- Novel growth technique based on the cutting-edge technologies of NTT Laboratories

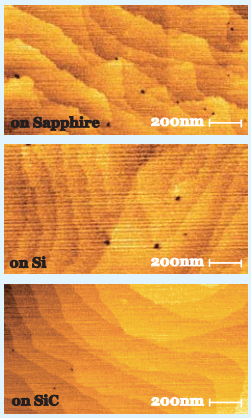
## GaN Epi Product Lineup

| Epi-products | Substrate | Wafer size |
|---|---|---|
| *AlGaN/GaN HEMT*<br>*InAlN/GaN HEMT*<br>(also other structures available, like SBD, single layer, sensor) | Si | 2~6 inches |
| | SiC | 2~4 (6) inches |
| | Sapphire | 2~3 (4) inches |
| | GaN | 2~ inches |

## Layer Structure and Typical Features (AlGaN/GaN HEMT)




AlGaN/GaN Surface



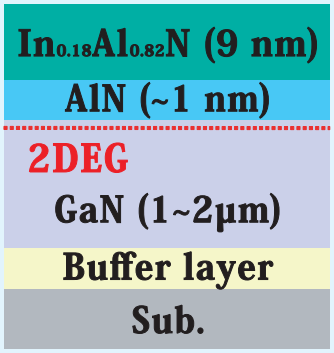

HEMT on Si sub.

| | |
|---|---|
| Sheet resistance | ~ 300 ohm/sq. [1], ~ 400 ohm/sq. [2] |
| Sheet carrier density | ~$10^{13}$($cm^{-2}$) |
| Electron mobility | > ~2000 $cm^2$/Vs |
| Breakdown voltage [3] | >200 V (for RF), ~1000 V (for power) |

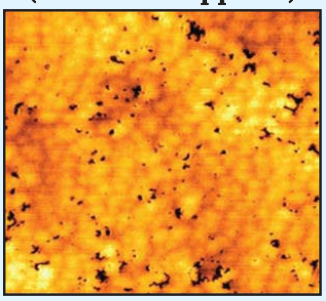
1) with AlN spacer
2) without AlN spacer
3) influenced by device structure

## Now, InAlN/GaN HEMT is deliverable

Typical Structure




InAlN/GaN surface (on 3 inch Sapphire)



2μm×2μm RMS:0.53nm

(on 3 inch Sapphire)

- Sheet resistance
  - Average : 239ohm/sq.
  - Variation : 6.4%
- Mobility
  - Average : 1,489$cm^2$/Vs
- Sheet carrier density
  - 1.8x$10^{13}$$cm^{-2}$

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