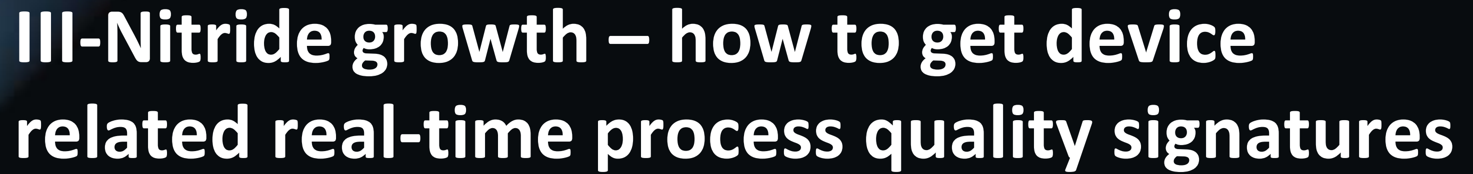

Talk at ISGN-5 (Atlanta, May 2014) – here: selected slides on AlInN-DBRs

Stephanie Fritze[1], Christoph Berger[2] and Marcello Binetti[1]

1) LayTec AG, Berlin, Germany

2) Otto-von-Guericke University, Magdeburg, Germany

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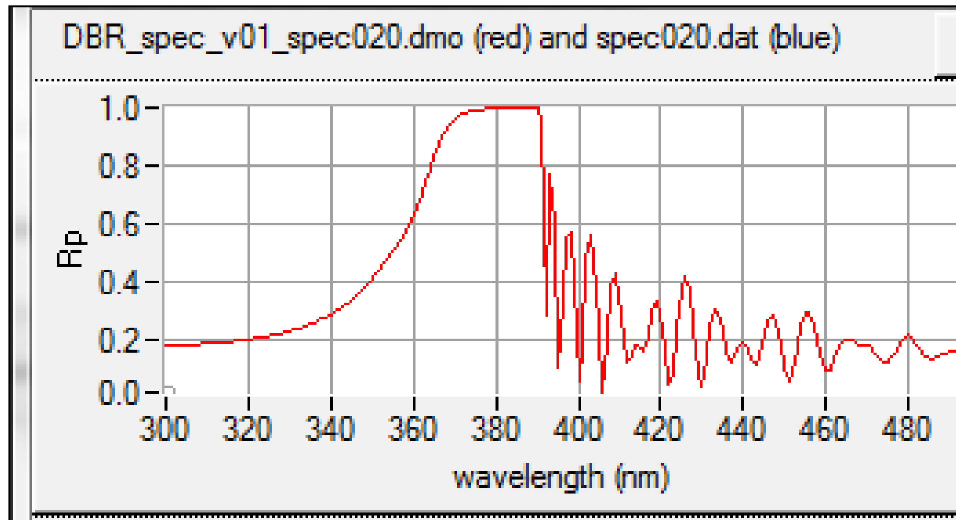
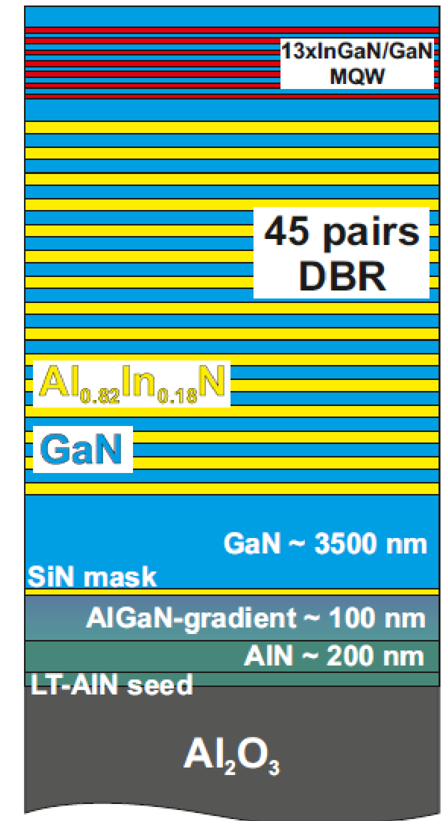
AlInN/GaN DBR: tight control needed → in-situ metrology





- stop band of 45 pair AlInGaN/GaN DBR at RT

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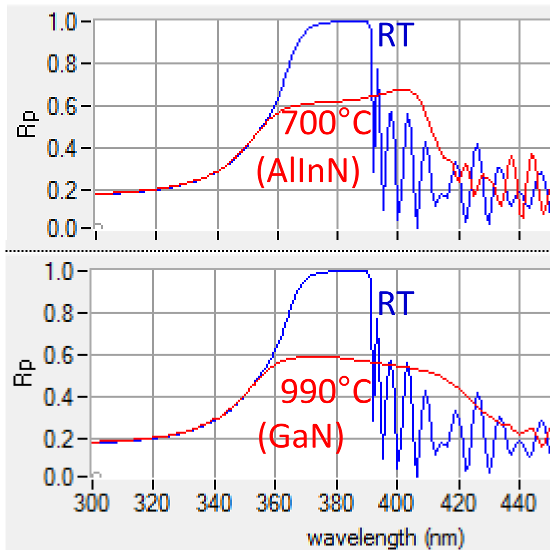
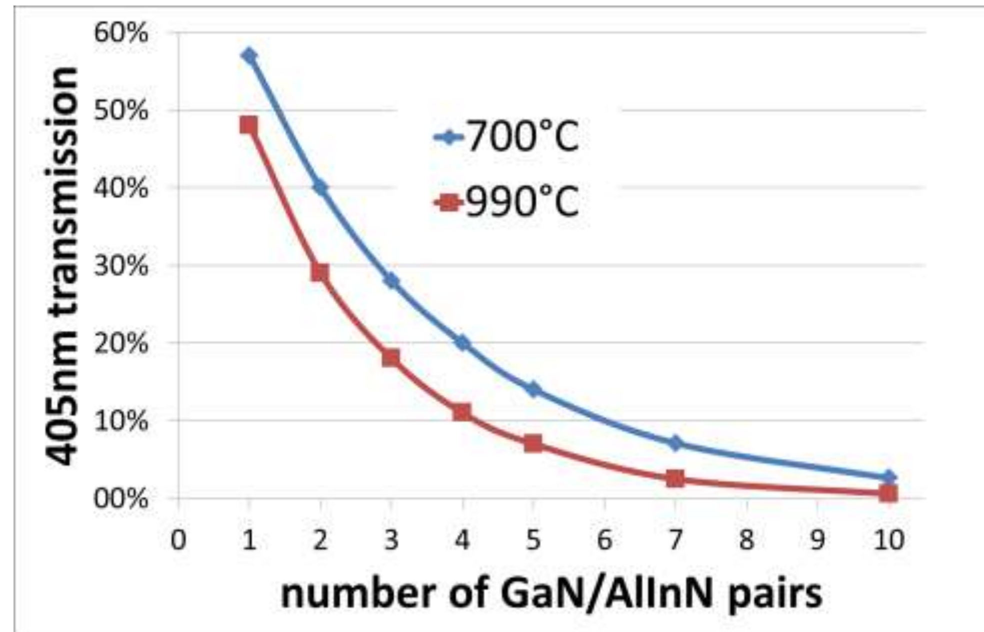
The in-situ optical response of an ideal GaN/AlInN DBR



Simulation: height and shape of stop band change (n&k change at high T)



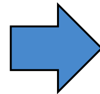
At growth temperature the 405nm reflectance pattern should stabilize after ~10 pairs (GaN HT absorption)

During growth: only the upper-most 8-10 layer pairs of the DBR are sensed by 405nm reflectance due to absorption.

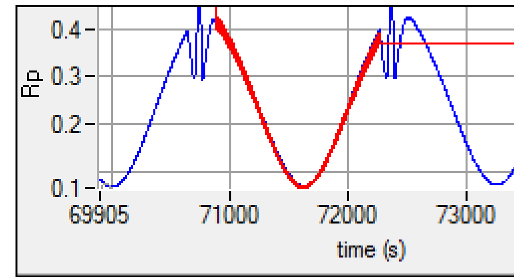
The n,k data for simulation have been derived from *E Sakalauskas1 et al., J. Phys. D, Appl. Phys. 43 (2010) 365102*

405nm reflectance indicates: small drift in DBR properties

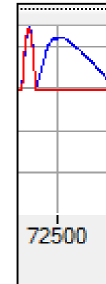
Layer thickness of every single layer can be determined with „virtual interface" based algorithms [*D. E. Aspnes, J. Opt. Soc. Am.* ***10****, 974 (1993).]*)



fit to R_{405nm} : 43.3nm AlInN



36.8nm GaN



--- Reflectivity @405nm

--- Reflectivity @950nm

Ideal DBR would give zero drift R(405nm) signatures, but ...

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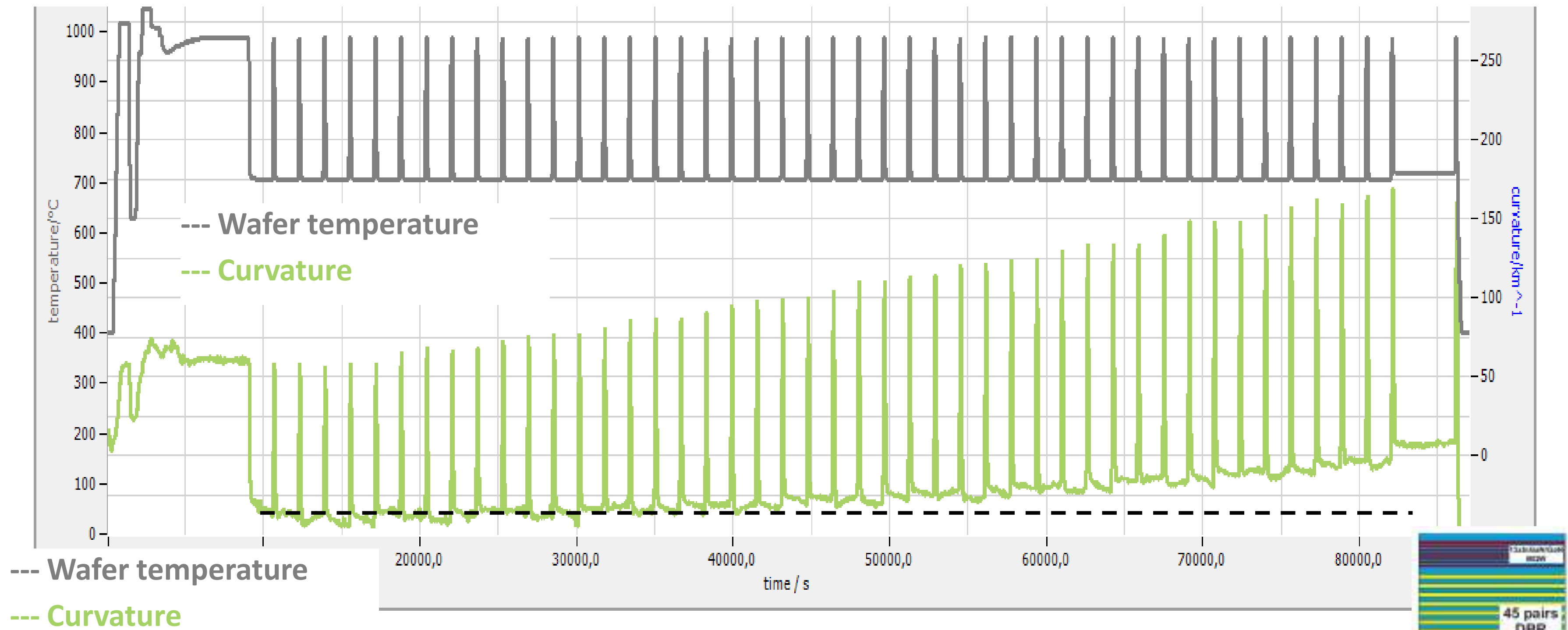
Wafer bow indicates: small GaN/AlInN mismatch



Very long process ➔ ceiling coating ➔ increasing GaN-surface temperature ➔ composition shift towards less In?

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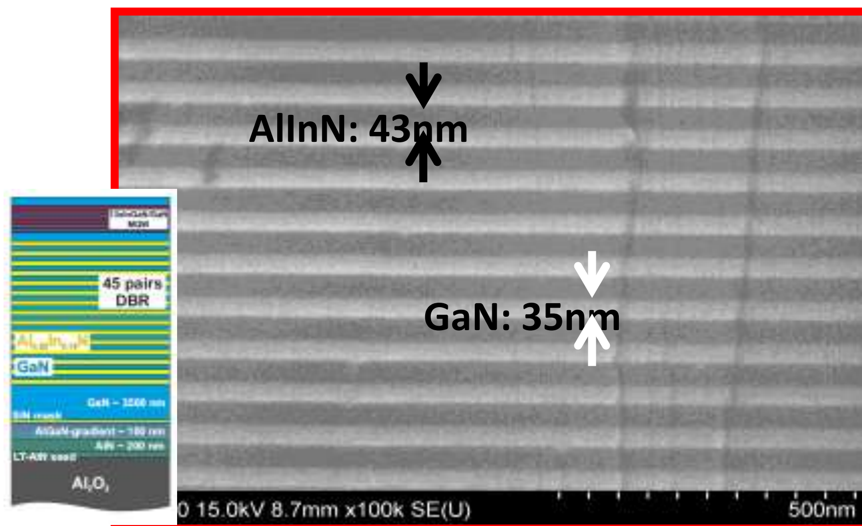
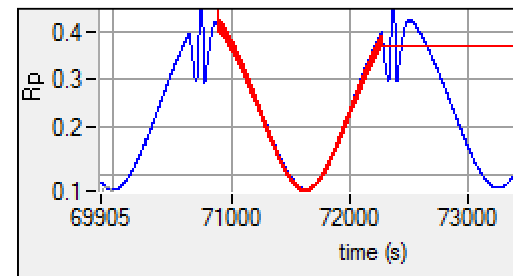
Conclusion

For high-yield MOCVD processes of III-Nitride based devices the contribution of industrial and academic research is:

- → **Investigate and understand physics of III-N in-situ signatures**
- → **Establish solid correlation of metrology data: in-situ vs. ex-situ**
- → **Establish clear correlation: in-situ signatures vs. device performance**



fit to R_{405nm} : 43.3nm AlInN



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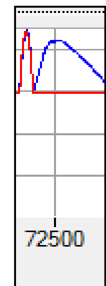

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