Supplemental to:
Wurtzite AlP_yN_{1-y}: A New III-V Compound Semiconductor Lattice Matched to GaN (0001)

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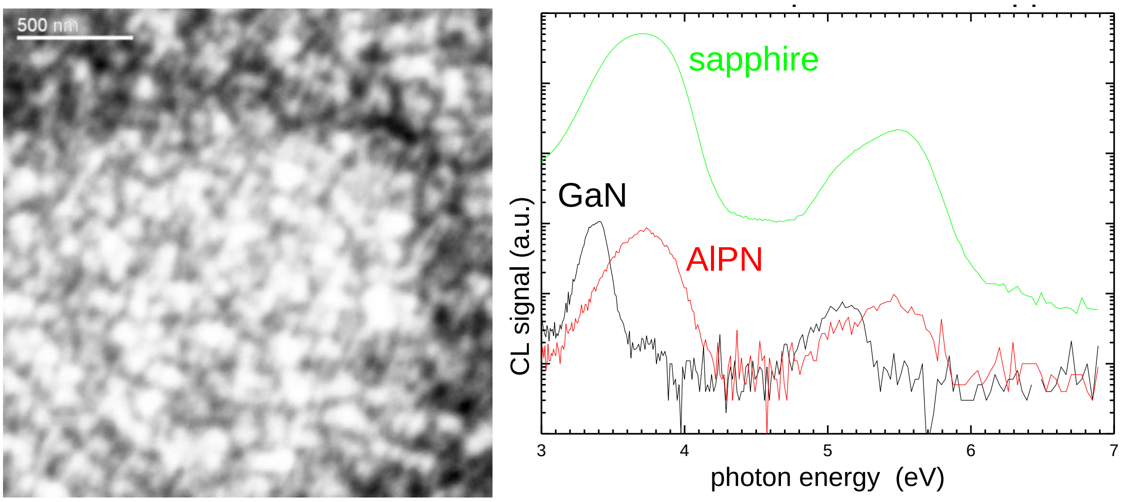

Fig. S1. Secondary electron microscopy image with 40,000x magnification of 60 nm lattice matched 10.3% AlPN on GaN/sapphire (left). Cross sectional room temperature cathodoluminescence (CL) spectra from a 655 nm thick AlPN layer on 22mu GaN on sapphire. The CL of the AlPN layer resembles the spectrum of the sapphire. Nearby the supposed band gap of AlPN around 5.6 eV both AlOx[1] and GaOx[2] signals dominate.

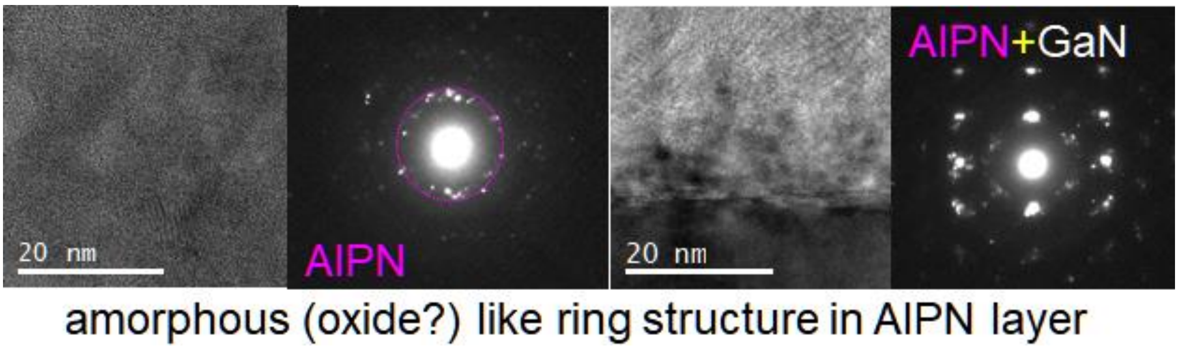

Fig. S2. Transmission electron microscopy of a 140 nm thick $AlP_{0.13}N_{0.87}$ layer after storage for two months and thinning. Dark field and diffraction pattern about 50 nm into the AlPN layer (left) and close to the GaN interface (right).

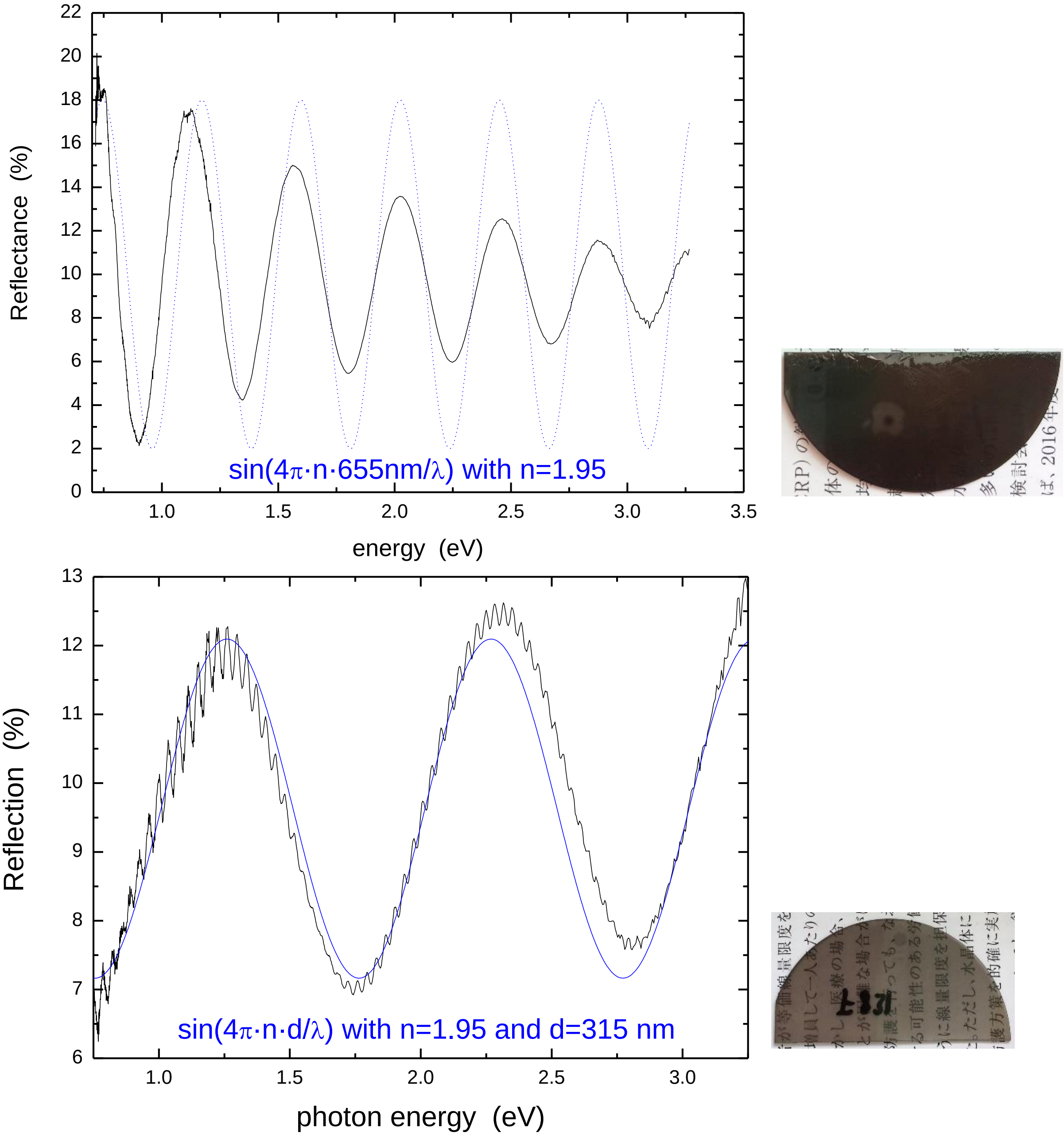

Fig. S3. Two reflection spectra of thicker, near lattice matched $AlP_{0.13}N_{0.87}$ on 22 μm (top) and 7.5 μm (bottom) thick C:GaN on sapphire templates (to reduce GaN Fabry Pérot oscillations). The top figure shows a sample with lower NH_3 flow and the bottom with about 1.5x higher NH_3 flow at otherwise similar growth conditions. The small picture shows a photo of each half-wafer. The bottom sample is much more transparent since the writing of the sample number (F831) on the backside can be clearly seen. Hence $AlP_{0.13}N_{0.87}$ can be transparent with the right growth conditions, and the FP oscillation show very little damping.

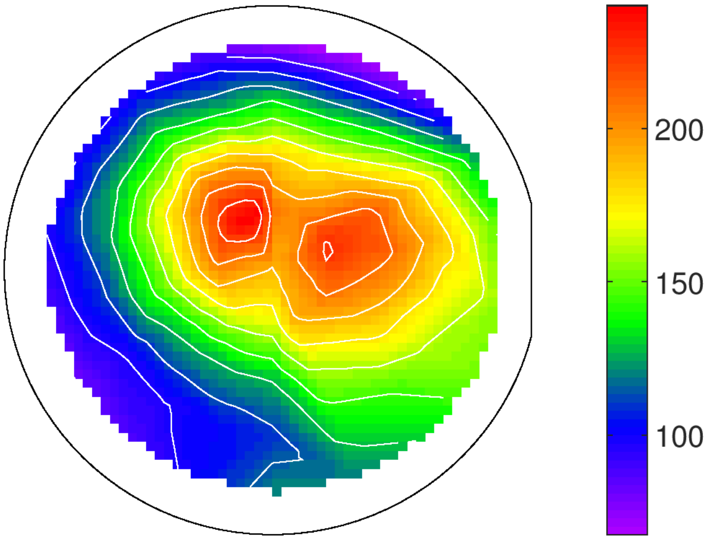

Fig. S4. Eddy current sheet resistance mapping of a 45 nm layer of $AlP_{0.13}N_{0.87}$ grown at 1200°C on a 4 μm GaN/sapphire template without an AlN interlayer or a GaN cap layer. The mean value was (154±46) Ω/□. The strong inhomogeneity is likely due to the strong bow of the GaN/sapphire template at this temperature that leads to a strong temperature gradient.

References

1) M. Kirm, G. Zimmerer, E. Feldbach, A. Lushchik, Ch. Lushchik, and F. Savikhin, Phys. Rev. B **60**, p. 502 (1999). DOI:

2) E.M. Goldys, T. Paskova, J. Sheely, W. Schaff', and L.F. Eastman, COMMAD 2000 Proceedings. Conference on Optoelectronic and Microelectronic Materials and Devices, p. 113, (2000). DOI: 10.1109/commad.2000.1022909