

# Supplemental information

## References

- [1] La Spina, L., Iborra, E., Schellevis, H., Clement, M., Olivares, J., & Nanver, L. K. (2008). Aluminum nitride for heatspreading in RF IC's. *Solid-state electronics*, 52(9), 1359-1363.
- [2] Haider, S. T., Shah, M. A., Lee, D. G., & Hur, S. (2023). A review of the recent applications of aluminum nitride-based piezoelectric devices. *Ieee Access*, 11, 58779-58795.
- [3] Strnad, N. A., Sarney, W. L., Rayner, G. B., Benoit, R. R., Fox, G. R., Rudy, R. Q., ... & Pulskamp, J. S. (2022). Plasma enhanced atomic layer deposition of textured aluminum nitride on platinized substrates for MEMS. *Journal of Vacuum Science & Technology A*, 40(4).
- [4] Demir, I., Li, H., Robin, Y., McClintock, R., Elagoz, S., & Razeghi, M. (2018). Sandwich method to grow high quality AlN by MOCVD. *Journal of Physics D: Applied Physics*, 51(8), 085104.
- [5] Dadgar, A., Hörich, F., Borgmann, R., Bläsing, J., Schmidt, G., Veit, P., ... & Strittmatter, A. (2023). Sputter epitaxy of AlN and GaN on Si (111). *physica status solidi (a)*, 220(8), 2200609.
- [6] Österlund, E., Seppänen, H., Bespalova, K., Miikkulainen, V., & Paulasto-Kröckel, M. (2021). Atomic layer deposition of AlN using atomic layer annealing—Towards high-quality AlN on vertical sidewalls. *Journal of Vacuum Science & Technology A*, 39(3).
- [7] Ueda, S. T., McLeod, A., Jo, Y., Zhang, Z., Spiegelman, J., Spiegelman, J., ... & Kummel, A. C. (2022). Experimental and theoretical determination of the role of ions in atomic layer annealing. *Journal of Materials Chemistry C*, 10(14), 5707-5715.
- [8] Goswami, R., Qadri, S., Nepal, N., & Eddy Jr, C. (2021). Microstructure and Interfaces of Ultra-Thin Epitaxial AlN Films Grown by Plasma-Enhanced Atomic Layer Deposition at Relatively Low Temperatures. *Coatings*, 11(4), 482.
- [9] Zhang, X. Y., Peng, D. C., Yan, J. H., Zhang, Z. X., Ruan, Y. J., Zuo, J., ... & Zhu, W. Z. (2023). Plasma power effect on crystallinity and density of AlN films deposited by plasma enhanced atomic layer deposition. *Journal of Materials Research and Technology*, 27, 4213-4223.
- [10] Gungor, N., & Alevli, M. (2022). Oxygen incorporation in AlN films grown by plasma-enhanced atomic layer deposition. *Journal of Vacuum Science & Technology A*, 40(2).

Plots

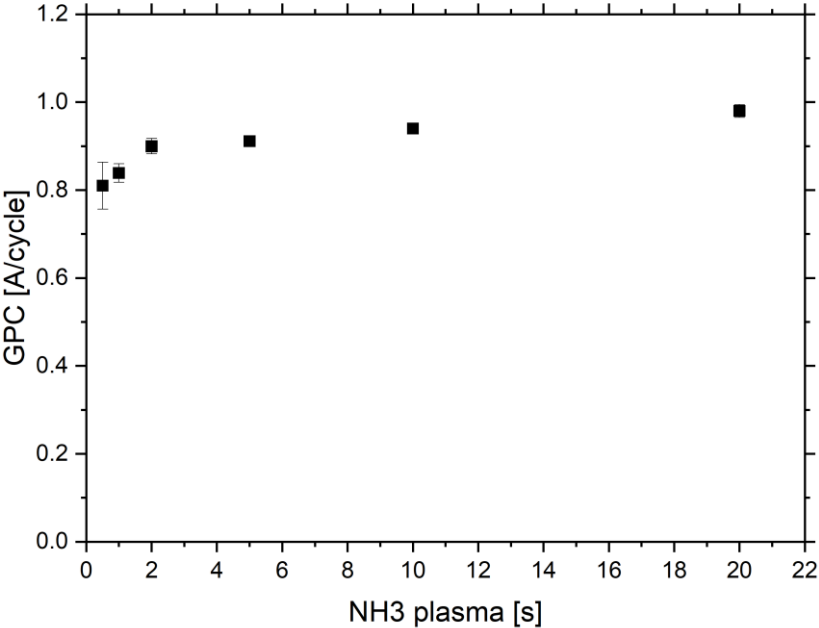


Figure 1: Growth per cycle as a function of NH3 plasma duration for AlN films grown at 200 °C. GPC values represent average and 1σ standard deviations of 49 points on 200 mm wafers with 10 mm edge exclusion.

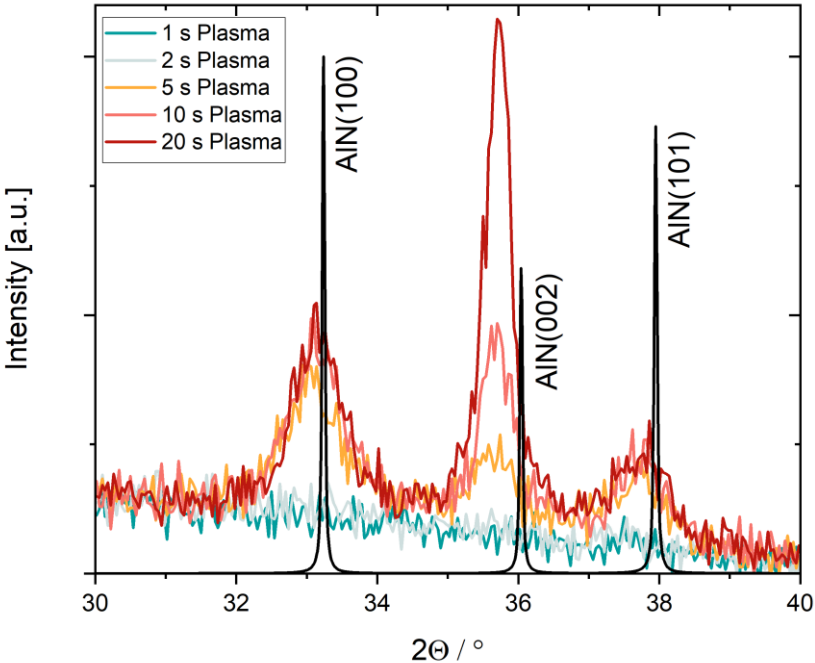


Figure 2: Grazing-incidence X-ray diffraction patterns of ~55 nm AlN thin films grown at 200 °C with varying NH3 plasma durations. Black patterns show reference data (COD ID 9011657).