

Supplementary material

References

- (1) *Optoelectronic Devices: III Nitrides*; Elsevier, 2005. <https://doi.org/10.1016/B978-0-08-044426-0.X5000-7>.
- (2) Nguyen, T.; Fleming, Y.; Bender, P.; Grysan, P.; Valle, N.; El Adib, B.; Adjeroud, N.; Arl, D.; Emo, M.; Ghanbaja, J.; Michels, A.; Polesel-Maris, J. Low-Temperature Growth of AlN Films on Magnetostrictive Foils for High-Magnetolectric-Response Thin-Film Composites. *ACS Appl. Mater. Interfaces* **2021**, *13* (26), 30874–30884. <https://doi.org/10.1021/acsami.1c08399>.
- (3) Fei, C.; Liu, X.; Zhu, B.; Li, D.; Yang, X.; Yang, Y.; Zhou, Q. AlN Piezoelectric Thin Films for Energy Harvesting and Acoustic Devices. *Nano Energy* **2018**, *51*, 146–161. <https://doi.org/10.1016/j.nanoen.2018.06.062>.
- (4) Algieri, L.; Todaro, M. T.; Guido, F.; Mastronardi, V.; Desmaële, D.; Qualtieri, A.; Giannini, C.; Sibillano, T.; De Vittorio, M. Flexible Piezoelectric Energy-Harvesting Exploiting Biocompatible AlN Thin Films Grown onto Spin-Coated Polyimide Layers. *ACS Appl. Energy Mater.* **2018**, *acsam.8b00820*. <https://doi.org/10.1021/acsaem.8b00820>.
- (5) Khan, A.; Abas, Z.; Soo Kim, H.; Oh, I.-K. Piezoelectric Thin Films: An Integrated Review of Transducers and Energy Harvesting. *Smart Mater. Struct.* **2016**, *25* (5), 053002. <https://doi.org/10.1088/0964-1726/25/5/053002>.
- (6) Fu, Y. Q.; Luo, J. K.; Nguyen, N. T.; Walton, A. J.; Flewitt, A. J.; Zu, X. T.; Li, Y.; McHale, G.; Matthews, A.; Iborra, E.; Du, H.; Milne, W. I. Advances in Piezoelectric Thin Films for Acoustic Biosensors, Acoustofluidics and Lab-on-Chip Applications. *Progress in Materials Science* **2017**, *89*, 31–91. <https://doi.org/10.1016/j.pmatsci.2017.04.006>.
- (7) Strnad, N. A.; Sarney, W. L.; Rayner, G. B.; Benoit, R. R.; Fox, G. R.; Rudy, R. Q.; Larrabee, T. J.; Shallenberger, J.; Pulskamp, J. S. Plasma Enhanced Atomic Layer Deposition of Textured Aluminum Nitride on Platinized Substrates for MEMS. *Journal of Vacuum Science & Technology A* **2022**, *40* (4), 042403. <https://doi.org/10.1116/6.0001633>.
- (8) Strnad, N. A.; Potrepka, D. M.; Hanrahan, B. M.; Fox, G. R.; Polcawich, R. G.; Pulskamp, J. S.; Knight, R. R.; Rudy, R. Q. Extending Atomic Layer Deposition for Use in Next-Generation piezoMEMS: Review and Perspective. *Journal of Vacuum Science & Technology A* **2023**, *41* (5), 050801. <https://doi.org/10.1116/6.0002431>.
- (9) Jeon, W. Recent Advances in the Understanding of High- k Dielectric Materials Deposited by Atomic Layer Deposition for Dynamic Random-Access Memory Capacitor Applications. *J. Mater. Res.* **2020**, *35* (7), 775–794. <https://doi.org/10.1557/jmr.2019.335>.
- (10) Knaut, M.; Junige, M.; Neumann, V.; Wojcik, H.; Henke, T.; Hossbach, C.; Hiess, A.; Albert, M.; Bartha, J. W. Atomic Layer Deposition for High Aspect Ratio through Silicon Vias. *Microelectronic Engineering* **2013**, *107*, 80–83. <https://doi.org/10.1016/j.mee.2013.01.031>.
- (11) Österlund, E.; Seppänen, H.; Bepalova, K.; Miikkulainen, V.; Paulasto-Kröckel, M. Atomic Layer Deposition of AlN Using Atomic Layer Annealing—Towards High-Quality AlN on Vertical Sidewalls. *Journal of Vacuum Science & Technology A: Vacuum, Surfaces, and Films* **2021**, *39* (3), 032403. <https://doi.org/10.1116/6.0000724>.
- (12) Ueda, S. T.; McLeod, A.; Jo, Y.; Zhang, Z.; Spiegelman, J.; Spiegelman, J.; Alvarez, D.; Moser, D.; Kanjolia, R.; Moinpour, M.; Woodruff, J.; Cho, K.; Kummel, A. C. Experimental and Theoretical Determination of the Role of Ions in Atomic Layer Annealing. *J. Mater. Chem. C* **2022**, *10* (14), 5707–5715. <https://doi.org/10.1039/D1TC05194F>.
- (13) Goswami, R.; Qadri, S.; Nepal, N.; Eddy, C. Microstructure and Interfaces of Ultra-Thin Epitaxial AlN Films Grown by Plasma-Enhanced Atomic Layer Deposition at Relatively Low Temperatures. *Coatings* **2021**, *11* (4), 482. <https://doi.org/10.3390/coatings11040482>.
- (14) Broas, M.; Jiang, H.; Graff, A.; Sajavaara, T.; Vuorinen, V.; Paulasto-Kröckel, M. Blistering Mechanisms of Atomic-Layer-Deposited AlN and Al₂O₃ Films. *Applied Physics Letters* **2017**, *111* (14), 141606. <https://doi.org/10.1063/1.4994974>.
- (15) Lei, W.; Chen, Q. Crystal AlN Deposited at Low Temperature by Magnetic Field Enhanced Plasma Assisted Atomic Layer Deposition. *Journal of Vacuum Science & Technology A: Vacuum, Surfaces, and Films* **2013**, *31* (1), 01A114. <https://doi.org/10.1116/1.4764112>.

Plot

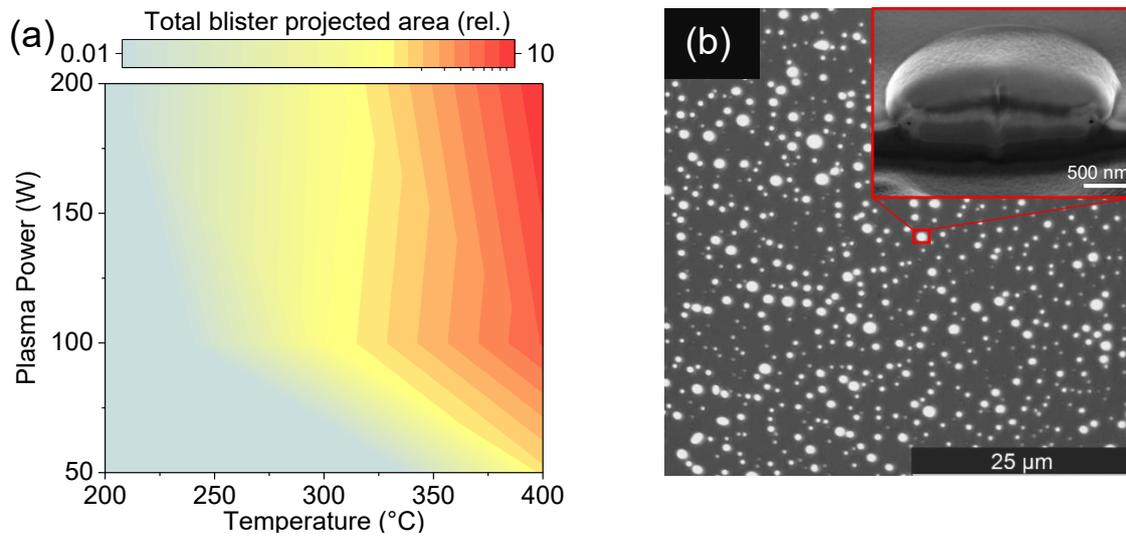


Figure 1: **(a)** Contour map of the relative total blister projected area (%) as a function of chuck temperature and NH_3 plasma power. The relative total blister projected area is defined as the sum of the projected (top-view) areas of all blisters, normalized by the AFM scan area ($2 \times 2 \mu\text{m}^2$) and represents the fraction of the surface covered by blisters. **(b)** Optical microscope image of the AlN film deposited at 400 °C and 200 W, showing blister formation. An inset shows a magnified SEM-FIB cross-section of a representative blister.