Supplementary Materials for

8-inch Free-Standing GaN Substrates Grown by Hydride Vapor Phase Epitaxy

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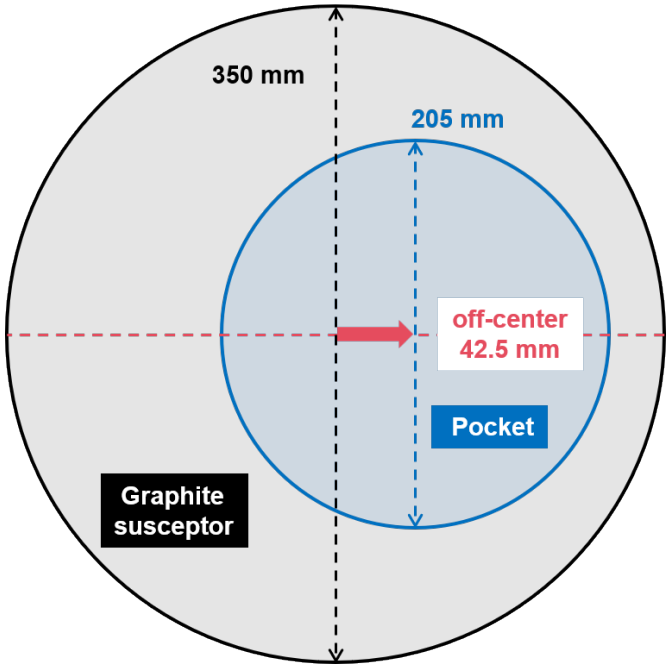

Fig. S1 Schematic diagram of the off-center 8-inch GaN template placement. The graphite susceptor has a diameter of 350 mm, with a 205 mm pocket machined into it. The pocket is offset from the center of the susceptor by 42.5 mm, in which the 8-inch GaN template is placed.

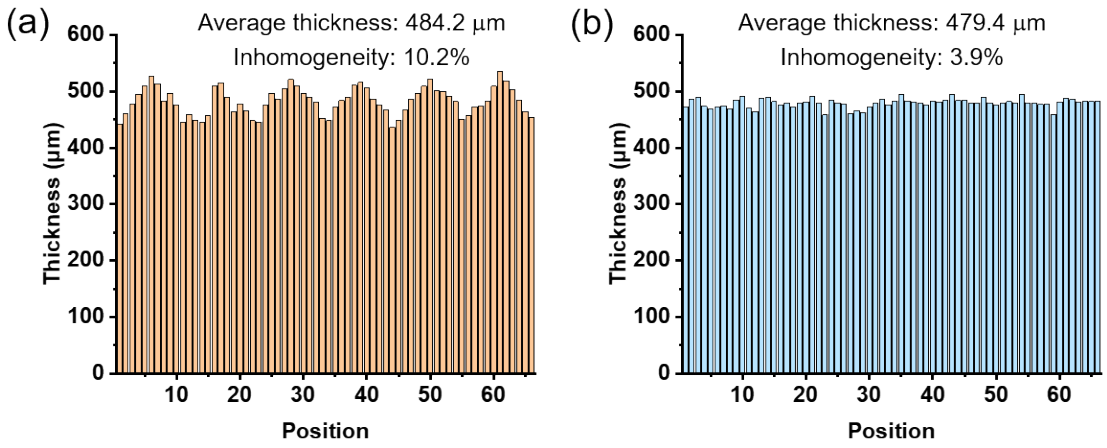

Fig. S2 Thickness uniformity of HVPE-grown GaN thick films. (a) Results from the sample grown with the conventional nozzle, which cracked severely. The average thickness was 484.2 μm with an inhomogeneity of 10.2%. (b) Results from the sample grown with the optimized nozzle. This sample remained crack-free. The average thickness was 479.4 μm with an inhomogeneity of 3.9%. Here, thickness was measured using a micrometer caliper at 11 equally spaced points along a diameter. This measurement pattern was repeated across 6 different angular orientations (0°, 30°, 60°, 90°, 120°, and 150°).

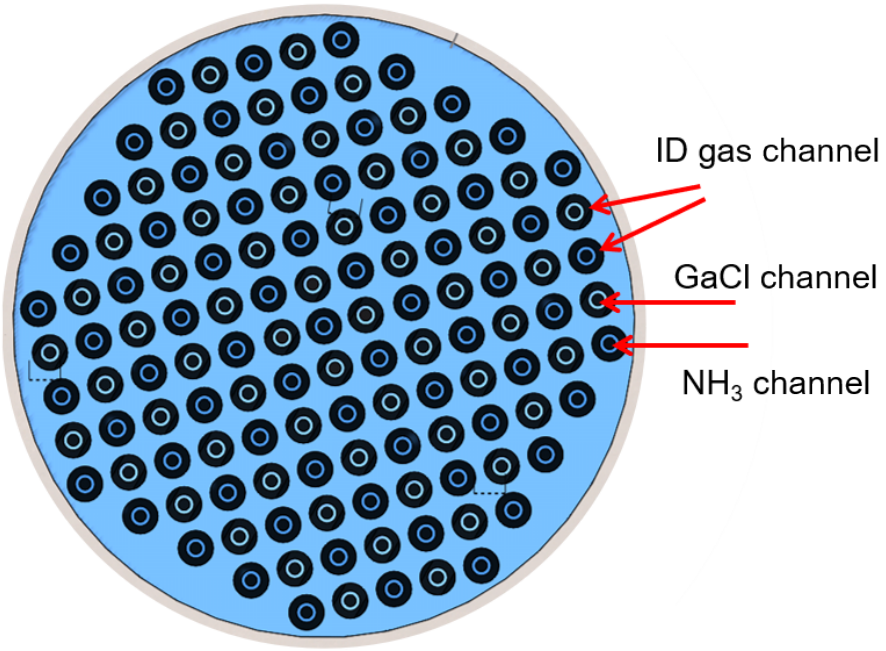

Fig. S3 Structural details of the optimized nozzle design. The central GaCl and NH_3 gas pipes have an outer diameter of 10 mm and an inner diameter of 8 mm. These are concentrically surrounded by an annular ID (N_2) gas channel with an outer diameter of 18 mm and an inner diameter of 10 mm. The spacing between adjacent ID gas channels is 4 mm.