

Title	Large-Sized Nanocrystalline Ultrathin β-Ga₂O₃ Membranes Fabricated by Surface Charge Lithography.
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Description EN	Large-sized 2D semiconductor materials have gained significant attention for their fascinating properties in various applications. In this work, we demonstrate the fabrication of nanoperforated ultrathin β -Ga ₂ O ₃ membranes of a nanoscale thickness. The technological route includes the fabrication of GaN membranes using the Surface Charge Lithography (SCL) approach and subsequent thermal treatment in air at 900 °C in order to obtain β -Ga ₂ O ₃ membranes. The as-grown GaN membranes were discovered to be completely transformed into β -Ga ₂ O ₃ , with the morphology evolving from a smooth topography to a

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nanoperforated surface consisting of nanograin structures. At intermediate temperatures, the formation of α and γ phases of Ga_2O_3 were disclosed by TEM analysis. The oxidation mechanism of the membrane was investigated under different annealing conditions followed by XPS, AFM, Raman and TEM analyses.

Thus, the combination of the SCL and thermal treatment under ambient conditions presents a cost-efficient approach for obtaining large-sized ultrathin membranes of $\beta\text{-Ga}_2\text{O}_3$ – a promising material for nano-electronics and photonics.

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