

Selective-area growth of Ga-polar GaN nanowires by continuous flow MOVPE: polarity and dislocation filtering

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As compared to conventional GaN planar structures, GaN nanowires offer the possibility of obtaining strain and dislocation-free material and, thus, appear as very promising nanostructures for novel electronic and photonic devices. However, the selective area growth of GaN nanowires increases the probability of forming defects and/or inversion domain boundaries on top of the mask. In this study we show that our GaN nanowires grown on GaN-on-sapphire templates with a patterned dielectric mask can be defect free and pure Ga-polar. The early growth stages have been characterized by transmission electron microscopy. The aperture size in the mask (from 200 nm to about 800 nm) determines the presence or absence of threading dislocations coming from the underlying template, which results in dislocation-free nanowires for the smallest aperture diameters. Besides, dislocation bending can be achieved on larger aperture diameters thanks to a 3D growth mode. The Ga-polarity of the underlying GaN-on-sapphire template is conserved in all nanowires irrespective of the aperture size, even in the nanowire regions grown laterally above the mask. The pure Ga-polarity assures spatially homogeneous optical properties as evidenced by cathodoluminescence. This opens new perspectives for the growth of nitrides on highly-dislocated templates.