



Method for Enhancing Growth of Semipolar Nitride Devices

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OTHER INFORMATION

KEYWORDS

indssl, indled, GaN, nitride films

CATEGORIZED AS

- ▶ **Optics and Photonics**
 - ▶ All Optics and Photonics
- ▶ **Energy**
 - ▶ Lighting
- ▶ **Semiconductors**
 - ▶ Design and Fabrication

RELATED CASES

2005-722-0

BRIEF DESCRIPTION

A method for enhancing the growth of semipolar nitride films using either a buffer layer or a nucleation layer.

BACKGROUND

GaN and its alloys (AlGa_N, InGa_N, AlInGa_N) have been established as effective for fabrication of visible and ultraviolet optoelectronic devices and high-power electronic devices. These devices are most often grown along the polar c-direction, using a variety of growth techniques, including molecular beam epitaxy (MBE), metalorganic chemical vapor deposition (MOCVD), or hydride vapor phase epitaxy (HVPE). However, growing devices along the polar c-direction results in charge separation, spontaneous polarization, and degraded device performance. Growth of such devices along a semipolar axis could significantly improve their performance by eliminating the spontaneous and piezoelectric polarization that occurs.

DESCRIPTION

UC Santa Barbara researchers have invented a method for enhancing the growth of semipolar nitride films using either a buffer layer or a nucleation layer. Samples can be grown onto substrates measuring two inches in diameter, whereas previous semipolar nitrides could only be grown on substrates a few micrometers wide. Films are grown using a commercially available MOCVD system, with a pressure range between 10 and 1000 torr, and a temperature range of 400-1400°C. These variable growth conditions demonstrate the stability of the growth of GaN using a suitable substrate. Growing these films on a semipolar surface reduces the polarization effects and built-in electric fields of III-nitride devices.

ADVANTAGES

- Large variability in pressure and temperature growth parameters
- Ease of manufacturing and processing
- Greater growth area of devices

APPLICATIONS

- LEDs
- Laser diodes (LDs)

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	7,575,947	08/18/2009	2005-722

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Etching Technique for the Fabrication of Thin \(Al, In, Ga\)N Layers](#)
- ▶ [Lateral Growth Method for Defect Reduction of Semipolar Nitride Films](#)
- ▶ [Vertical Cavity Surface-Emitting Lasers with Continuous Wave Operation](#)

- ▶ Eliminating Misfit Dislocations with In-Situ Compliant Substrate Formation
- ▶ III-Nitride-Based Vertical Cavity Surface Emitting Laser (VCSEL) with a Dielectric P-Side Lens
- ▶ Aluminum-cladding-free Nonpolar III-Nitride LEDs and LDs
- ▶ Low-Cost Zinc Oxide for High-Power-Output, GaN-Based LEDs (UC Case 2010-183)
- ▶ Defect Reduction in GaN films using in-situ SiNx Nanomask
- ▶ Enhanced Light Extraction LED with a Tunnel Junction Contact Wafer Bonded to a Conductive Oxide
- ▶ Low Temperature Deposition of Magnesium Doped Nitride Films
- ▶ Transparent Mirrorless (TML) LEDs
- ▶ Improved GaN Substrates Prepared with Ammonothermal Growth
- ▶ Optimization of Laser Bar Orientation for Nonpolar Laser Diodes
- ▶ Ultraviolet Laser Diode on Nano-Porous AlGaN template
- ▶ Improved Reliability & Enhanced Performance of III-Nitride Tunnel Junction Optoelectronic Devices
- ▶ Growth of Polyhedron-Shaped Gallium Nitride Bulk Crystals
- ▶ Nonpolar III-Nitride LEDs With Long Wavelength Emission
- ▶ Improved Fabrication of Nonpolar InGaN Thin Films, Heterostructures, and Devices
- ▶ Growth of High-Quality, Thick, Non-Polar M-Plane GaN Films
- ▶ Method for Growing High-Quality Group III-Nitride Crystals
- ▶ Controlled Photoelectrochemical (PEC) Etching by Modification of Local Electrochemical Potential of Semiconductor Structure
- ▶ Oxyfluoride Phosphors for Use in White Light LEDs
- ▶ Technique for the Nitride Growth of Semipolar Thin Films, Heterostructures, and Semiconductor Devices
- ▶ (In,Ga,Al)N Optoelectronic Devices with Thicker Active Layers for Improved Performance
- ▶ Thermally Stable, Laser-Driven White Lighting Device
- ▶ MOCVD Growth of Planar Non-Polar M-Plane Gallium Nitride
- ▶ Methods for Fabricating III-Nitride Tunnel Junction Devices
- ▶ Low-Droop LED Structure on GaN Semi-polar Substrates
- ▶ Contact Architectures for Tunnel Junction Devices
- ▶ Semi-polar LED/LD Devices on Relaxed Template with Misfit Dislocation at Hetero-interface
- ▶ Semipolar-Based Yellow, Green, Blue LEDs with Improved Performance
- ▶ III-Nitride-Based Devices Grown On Thin Template On Thermally Decomposed Material
- ▶ Growth of Semipolar III-V Nitride Films with Lower Defect Density
- ▶ III-Nitride Tunnel Junction LED with High Wall Plug Efficiency
- ▶ Tunable White Light Based on Polarization-Sensitive LEDs
- ▶ Cleaved Facet Edge-Emitting Laser Diodes Grown on Semipolar GaN
- ▶ Growth of High-Performance M-plane GaN Optical Devices
- ▶ Packaging Technique for the Fabrication of Polarized Light Emitting Diodes
- ▶ Improved Anisotropic Strain Control in Semipolar Nitride Devices
- ▶ Novel Multilayer Structure for High-Efficiency UV and Far-UV Light-Emitting Devices
- ▶ III-V Nitride Device Structures on Patterned Substrates
- ▶ Method for Increasing GaN Substrate Area in Nitride Devices
- ▶ High-Intensity Solid State White Laser Diode
- ▶ Nitride Based Ultraviolet LED with an Ultraviolet Transparent Contact
- ▶ GaN-Based Thermoelectric Device for Micro-Power Generation
- ▶ Limiting Strain-Relaxation in III-Nitride Heterostructures by Substrate Patterning
- ▶ LED Device Structures with Minimized Light Re-Absorption
- ▶ Growth of Planar Semi-Polar Gallium Nitride
- ▶ High-Efficiency and High-Power III-Nitride Devices Grown on or Above a Strain Relaxed Template

- ▶ UV Optoelectronic Devices Based on Nonpolar and Semi-polar AlInN and AlInGaN Alloys
- ▶ Defect Reduction of Non-Polar and Semi-Polar III-Nitrides
- ▶ III-Nitride Based VCSEL with Curved Mirror on P-Side of the Aperture
- ▶ Enhancing Growth of Semipolar (Al,In,Ga,B)N Films via MOCVD

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