Growth of Semipolar III-V Nitride Films with Lower Defect Density
Tech ID: 23649 / UC Case 2006-422-0

BRIEF DESCRIPTION
A novel method for growing high quality semipolar III-V nitride based optoelectronic devices.

BACKGROUND
Current nitride technology for electronic and optoelectronic devices employs nitride films grown in the polar c-direction. Unfortunately, the structure of III-nitride based devices suffers from the undesirable quantum-confined Stark effect (QCSE), due to the strong electric fields and polarization effects along the c-direction. While growing devices on nonpolar planes of the crystal seems advantageous, growth of nonpolar nitrides remains challenging and has not yet been widely adopted in the industry.

DESCRIPTION
Researchers at the University of California, Santa Barbara have developed a novel method for growing high quality semipolar III-V nitride based optoelectronic devices. This includes growing an active layer on suitable material with facetted surfaces, which are typically semipolar planes, and a method for fabricating the facetted surfaces. The use of these growth techniques results in semipolar light emitting layers with a low defect density through reduction of the polarization effects in GaN devices. Furthermore, these layers may be grown using commonly used techniques including, MOCVD, MBE, or HPVE.

ADVANTAGES
- Lower defect density
- Higher quality devices
- Uses widely adopted growth techniques

APPLICATIONS
- Optoelectronic devices
- High power electronic devices

PATENT STATUS

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OTHER INFORMATION
KEYWORDS
nitride films, indssl, indbulk

CATEGORIZED AS
- Engineering
- Optics and Photonics
  - All Optics and Photonics
  - Semiconductors
    - Design and Fabrication

RELATED CASES
2006-422-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS
- Method for Improved Surface of (Ga,Al,In,B)N Films on Nonpolar or Semipolar Substrates
High Efficiency LED with Optimized Photonic Crystal Extractor
Enhanced Optical Polarization of Nitride LEDs by Increased Indium Incorporation
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
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
Highly Efficient Blue-Violet III-Nitride Semipolar Laser Diodes
Hybrid Growth Method for Improved III-Nitride Tunnel Junction Devices
Volumetric Hole Injection with Intentional V-Defects
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
High Efficiency Semipolar AlGaN-Cladding-Free Laser Diodes
Method for Growing Self-Assembled Quantum Dot Lattices
Size-Independent Forward Voltage Micro-LED with an Epitaxial Junction
Method for Enhancing Growth of Semipolar Nitride Devices
III-Nitride Tunnel Junction with Modified Interface
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
Increased Light Extraction with Multistep Deposition of ZnO on GaN
Method for Manufacturing Improved III-Nitride LEDs and Laser Diodes: Monolithic Integration of Optically Pumped and Electrically Injected III-Nitride LEDs
Selective-Area Mesoporous Semiconductors And Devices For Optoelectronic And Photonic Applications
High-Efficiency, Mirrorless Non-Polar and Semi-Polar Light Emitting Devices
Method for Growing High-Quality Group III-Nitride Crystals
Controlled Photoelectrochemical (PEC) Etching by Modification of Local Electrochemical Potential of Semiconductor Structure
Incorporating Temperature-Sensitive Layers in III-N Devices
Oxyfluoride Phosphors for Use in White Light LEDs
Technique for the Nitride Growth of Semipolar Thin Films, Heterostructures, and Semiconductor Devices
(In,Ga,Ai)N Optoelectronic Devices with Thicker Active Layers for Improved Performance
MOCVD Growth of Planar Non-Polar M-Plane Gallium Nitride
Reduced Dislocation Density of Non-Polar GaN Grown by Hydride Vapor Phase Epitaxy
Heterogeneously Integrated GaN on Si Photonic Integrated Circuits
Reduction in Leakage Current and Increase in Efficiency of III-Nitride MicroLEDs
Methods for Fabricating III-Nitride Tunnel Junction Devices
Low-Droop LED Structure on GaN Semi-polar Substrates
Contact Architectures for Tunnel Junction Devices
Semipolar LED/LD Devices on Relaxed Template with Misfit Dislocation at Hetero-interface
Photoelectrochemical Etching Of P-Type Semiconductor Heterostructures
Semipolar-Based Yellow, Green, Blue LEDs with Improved Performance
III-Nitride Tunnel Junction LED with High Wall Plug Efficiency
Improved Manufacturing of Solid State Lasers via Patternimg of Photonic Crystals
Solid Solution Phosphors for Use in Solid State White Lighting Applications
Multifaceted III-Nitride Surface-Emitting Laser
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
High Light Extraction Efficiency III-Nitride LED
III-V Nitride Device Structures on Patterned Substrates
Activation of P-Type Layers of Tunnel Junctions in Micro-LEDs
Method for Increasing GaN Substrate Area in Nitride Devices
Nitride Based Ultraviolet LED with an Ultraviolet Transparent Contact
▶ Growth of Planar, Non-Polar, A-Plane GaN by Hydride Vapor Phase Epitaxy
▶ Single or Multi-Color High Efficiency LED by Growth Over a Patterned Substrate
▶ GaN-Based Thermoelectric Device for Micro-Power Generation
▶ Limiting Strain-Relaxation in III-Nitride Heterostructures by Substrate Patterning
▶ Improved Manufacturing of Semiconductor Lasers
▶ LED Device Structures with Minimized Light Re-Absorption
▶ Growth of Planar Semi-Polar Gallium Nitride
▶ Nonpolar (Al, B, In, Ga)N Quantum Well Design
▶ UV Optoelectronic Devices Based on Nonpolar and Semi-polar AlInN and AlInGaN Alloys
▶ Integration And Mass Transfer Of Microleds
▶ Defect Reduction of Non-Polar and Semi-Polar III-Nitrides
▶ III-Nitride Based VCSEL with Curved Mirror on P-Side of the Aperture
▶ Low-Cost Zinc Oxide for High-Power-Output, GaN-Based LEDs (UC Case 2010-150)
▶ Suppression of Defect Formation and Increase in Critical Thickness by Silicon Doping
▶ Wafer Bonding for Embedding Active Regions with Relaxed Nanofeatures
▶ Enhancing Growth of Semipolar (Al,In,Ga,B)N Films via MOCVD