Technique for the Nitride Growth of Semipolar Thin Films, Heterostructures, and Semiconductor Devices
Tech ID: 25247 / UC Case 2005-668-0

BRIEF DESCRIPTION
A method to grow semipolar (Ga, Al, In, B)N thin films, heterostructures, and devices on suitable substrates or planar templates in which a large area of the semipolar film is parallel to the substrate surface.

BACKGROUND
The usefulness of gallium nitride (GaN) and its ternary and quaternary compounds incorporating aluminum and indium has been well established for fabrication of visible and ultraviolet optoelectronic devices. Current nitride technology for these devices uses nitride films grown along the polar c-direction; however, quantum-well active regions in devices suffer from the quantum-confined Stark effect (QCSE). One way to combat the issue is to grow films on semipolar planes of GaN in order to improve device performance by reduce polarization effects and increasing the efficiency of optical transitions.

DESCRIPTION
Researchers at UC Santa Barbara have developed a method to grow semipolar (Ga, Al, In, B)N thin films, heterostructures, and devices on suitable substrates or planar templates in which a large area of the semipolar film is parallel to the substrate surface. The method uses vapor phase epitaxy, such as metalorganic chemical vapor deposition (MOCVD), in order to grow the semipolar structures. Additionally, this technique alters the crystal growth orientation in order to reduce polarization effects in nitride thin films. This method is stable, energy efficient and cost-effective.

ADVANTAGES
▶ Reduces the negative impact of polarization
▶ Improved device efficiency
▶ Improved crystal growth orientation

APPLICATIONS
▶ LEDs and Laser Diodes (LDs)
▶ Semiconductors

PATENT STATUS

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OTHER INFORMATION
KEYWORDS
indssl, indled, MOCVD, thin films

CATEGORIZED AS
▶ Optics and Photonics
▶ All Optics and Photonics
▶ Energy
▶ Lighting
▶ Semiconductors
▶ Design and Fabrication

RELATED CASES
2005-668-0
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
- High-Quality N-Face GaN, InN, AlN by MOCVD
- 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
- Implantable Light Irradiation Device For Photodynamic Therapy
- 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
- A Structure For Increasing Mobility In A High-Electron-Mobility Transistor
- Method for Enhancing Growth of Semipolar Nitride Devices
- 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
- Methods for Locally Changing the Electric Field Distribution in Electron Devices
- 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
- Oxyfluoride Phosphors for Use in White Light LEDs
- (In,Ga)AlN Optoelectronic Devices with Thicker Active Layers for Improved Performance
- Group III-N Light Emitting Devices Enhanced By Stress From Post-Growth Deposited Films
- Thermally Stable, Laser-Driven White Lighting Device
- MOCVD Growth of Planar Non-Polar M-Plane Gallium Nitride
- GaN-based Vertical Metal Oxide Semiconductor and Junction Field Effect Transistors
- 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
Novel Current-Blocking Layer in High-Power Current Aperture Vertical Electron Transistors (CAVETs)
iii-N Transistor With Stepped Cap Layers
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
III-N Based Material Structures and Circuit Modules Based on Strain Management