Growth of Planar Semi-Polar Gallium Nitride

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OTHER INFORMATION

KEYWORDS

GaN, Gallium Nitride, indssl, indbulk, cenIEE

CATEGORIZED AS

- **Engineering**
- **Semiconductors**
  - Design and Fabrication

RELATED CASES

2005-471-0

BRIEF DESCRIPTION

A technique for the growth of planar films of semi-polar nitrides, in which a large area of (Al, In, Ga)N is grown parallel to the substrate surface.

BACKGROUND

Current nitride technology for electronic and optoelectronic devices employs nitride films grown along the polar c-direction. However, conventional c-plane quantum well structures in III-nitride based optoelectronic and electronic devices suffer from the undesirable quantum-confined Stark effect (QCSE), due to the existence of strong piezoelectric effects and spontaneous polarizations. The strong built-in electric fields along the c-direction cause spatial separation of electrons and holes that in turn give rise to restricted carrier recombination efficiency, reduced oscillator strength, and red-shifted emission. The growth of non-polar GaN remains challenging and has not yet been widely adopted in the III-nitride industry.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a technique for the growth of planar films of semi-polar nitrides, in which a large area of (Al, In, Ga)N is grown parallel to the substrate surface. For example, samples can be grown on 10 mm x 10 mm or 2 inch diameter substrates. The advantage of semi-polar over c-plane nitride films is the reduction in polarization and the associated increase in internal quantum efficiency for certain devices.

ADVANTAGES

- Reduction in polarization and the associated increase in internal quantum efficiency for certain devices
- Easier to grow compared to non-polar nitride films

APPLICATIONS

- Production of planar semi-polar gallium nitride

This technology is available for a non-exclusive license.See below for a selection of the patents and patent applications related to this invention. Please inquire for full patent portfolio status.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,524,012	09/03/2013	2005-471
United States Of America	Issued Patent	8,128,756	03/06/2012	2005-471
United States Of America	Issued Patent	7,704,331	04/27/2010	2005-471
United States Of America	Issued Patent	7,220,324	05/22/2007	2005-471

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
- 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
- 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
- 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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