UV Optoelectronic Devices Based on Nonpolar and Semi-polar AlInN and AlInGaN Alloys

Tech ID: 24987 / UC Case 2009-258-0

BRIEF DESCRIPTION

A device structure that can be used to create high-power and high-efficiency LEDs and LDs in the UV range of the spectrum.

BACKGROUND

Nitride-based optoelectronics have been studied extensively in order to fabricate visible and UV light-emitting devices. While high-power and high-efficiency LEDs and LDs that emit in the visible spectrum have been achieved, devices that emit in the deep UV region of the spectrum (less than roughly 360 nm) with similar desirable qualities have not due to growth difficulties resulting in poor material quality.

DESCRIPTION

Researchers at UC Santa Barbara have developed a device structure that can be used to create high-power and high-efficiency LEDs and LDs in the UV range of the spectrum. The devices emit in the wavelength range from 280 nm to 360 nm using a nonpolar or semi-polar AlInN and AlInGaN layer grown on a nonpolar or semi-polar bulk GaN substrate. In this device configuration, the piezoelectric field is reduced as the AlInN and AlInGaN layers are lattice-matched to GaN. Polarization is minimized by growing along nonpolar or semi-polar orientations, thus creating a relatively wide bandgap and minimizing the reduction of the radiative recombination efficiency and the effects of the quantum-confined Stark effect.

ADVANTAGES

· Higher efficiency UV light emitting devices

· Reduced spontaneous polarization effects

· Reduction in the quantum confined Stark effect (QCSE)

APPLICATIONS

· UV LEDs and LDs

· Water- and air-purification systems

CONTACT

Pasquale S. Ferrari
ferrari@tia.ucsb.edu
tel: .

INVENTORS

- Chen, Zhen
- Chung, Roy B.
- DenBaars, Steven P.
- Nakamura, Shuji

OTHER INFORMATION

KEYWORDS

indssl, indled, UV

CATEGORIZED AS

- **Engineering**
- **Energy**
  - Lighting
  - Other
- **Semiconductors**
  - Design and Fabrication

RELATED CASES

2009-258-0

- Germicidal and biomedical instrumentation systems

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,653,503	02/18/2014	2009-258
United States Of America	Issued Patent	8,357,925	01/22/2013	2009-258
United States Of America	Issued Patent	8,084,763	12/27/2011	2009-258

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- 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
- Growth of Planar Semi-Polar Gallium Nitride
- High-Efficiency and High-Power III-Nitride Devices Grown on or Above a Strain Relaxed Template
- 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

University of California, Santa Barbara
Office of Technology & Industry Alliances
342 Lagoon Road, ,Santa Barbara,CA 93106-2055 |
www.tia.ucsb.edu
Tel: 805-893-2073 | Fax: 805.893.5236 | padilla@tia.ucsb.edu

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