Nonpolar III-Nitride LEDs With Long Wavelength Emission

Tech ID: 24536 / UC Case 2008-063-0

BRIEF DESCRIPTION

A method of growing III-nitride films on nonpolar planes where the MQW barrier thickness can be manipulated.

BACKGROUND

Current nitride-based electronic and optoelectronic devices, including light-emitting diodes (LEDs), use nitride films that are grown on polar surfaces. These surfaces cause polarization, which in turn separates electrons from holes. This separation limits carrier recombination efficiency, and causes the devices to emit mostly in the red region of the spectrum. This polarization severely limits the flexibility of emission wavelength, and thus the colors, that devices can exhibit.

However, polarization can be limited by growing devices on nonpolar planes. By using nonpolar planes, total polarization can be greatly reduced, possibly to zero for certain combinations of alloys on specific planes. There have been successful optoelectronic devices grown on nonpolar planes, but they have had trouble producing longer wavelength emission. The limitation has been due to the barrier thickness of MQWs (multiple quantum wells), which has only allowed for light emission in the violet region of the spectrum.

DESCRIPTION

UC Santa Barbara researchers have developed a method of growing III-nitride films on nonpolar planes where the MQW barrier thickness can be manipulated. This results in the ability to vary the wavelength (color) of light emitted by the devices. Small barrier thickness results in short wavelength visible light, while increasing the barrier thickness results in subsequently longer wavelength emission. The reduced polarization in these devices, coupled with the ability to change the wavelength of emission, would improve the overall performance of optoelectronic devices.

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OTHER INFORMATION

KEYWORDS

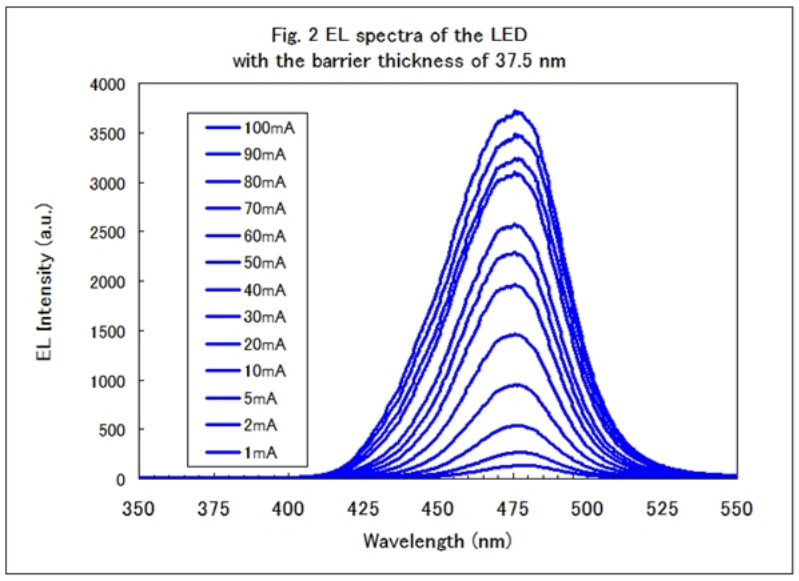
indssl, indled, LED, cenIEE, III-nitride, wavelength

CATEGORIZED AS

- **Engineering**
- **Energy**
  - Lighting
  - Other
- **Materials & Chemicals**
  - Other
- **Semiconductors**
  - Design and Fabrication

RELATED CASES

2008-063-0



ADVANTAGES

- Ability to control wavelength/color of light emitted
- Total polarization is reduced
- Increased overall performance

APPLICATIONS

- LEDs
- Other optoelectronic devices

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,642,993	02/04/2014	2008-063
United States Of America	Issued Patent	7,847,280	12/07/2010	2008-063

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)
- 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
- Growth of Polyhedron-Shaped Gallium Nitride Bulk Crystals
- 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
- Technique for the Nitride Growth of Semipolar Thin Films, Heterostructures, and Semiconductor Devices
- 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
- 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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