Cleaved Facet Edge-Emitting Laser Diodes Grown on Semipolar GaN
Tech ID: 21809 / UC Case 2007-423-0

BRIEF DESCRIPTION

Highly-efficient cleaved facet edge-emitting laser diodes grown on semipolar gallium nitride substrates.

BACKGROUND

Current group-III nitride lasers are grown on polar c-plane substrates and usually employ dry-etched facets, which are inherently rough. Since these devices suffer from reduced efficiency due to high polarization-induced electric fields and scattering loss, there is a need for a high-efficiency laser diode that avoids these shortcomings.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed cleaved facet edge-emitting laser diodes grown on semipolar gallium nitride substrates. Because the devices are grown on a semipolar orientation, they have lower thresholds and higher efficiencies. The efficiency is further increased due to smooth, low loss cavities achieved by cleaved mirror facets. These devices are applicable to high brightness lighting displays, high resolution printers, projection displays, next generation DVD players, medical imaging, and efficient solid-state lighting.

ADVANTAGES

▶ Lower thresholds and higher efficiencies than standard polar c-plane laser diodes
▶ May offer higher wall-plug efficiencies than can be achieved with LEDs
▶ Smooth low loss mirror facets with high reflectivity

APPLICATIONS

▶ High Brightness Lighting Displays
▶ High Resolution Printers
▶ Projection Displays
▶ Next Generation DVD Players
▶ Medical Imaging
▶ Efficient Solid-State Lighting

This technology is available for licensing. See below for a selection of the patents and patent applications related to this invention.

Please inquire for full patent portfolio status.

PATENT STATUS

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<td>8,541,869</td>
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CONTACT

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OTHER INFORMATION

KEYWORDS

LED, laser diode, indssl, indled, cenIEE, indfeat

CATEGORIZED AS

▶ Engineering
▶ Energy
▶ Lighting
▶ Other
▶ Optics and Photonics
▶ All Optics and Photonics
▶ Semiconductors
▶ Design and Fabrication

RELATED CASES

2007-423-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

▶ Reduced Dislocation Density of Non-Polar GaN Grown by Hydride Vapor Phase Epitaxy
Growth of Planar, Non-Polar, A-Plane GaN by Hydride Vapor Phase Epitaxy
Nonpolar (Al, B, In, Ga)N Quantum Well Design
Improved Manufacturing of Semiconductor Lasers
Etching Technique for the Fabrication of Thin (Al, In, Ga)N Layers
Enhancing Growth of Semipolar (Al,In,Ga,B)N Films via MOCVD
GaN-Based Thermoelectric Device for Micro-Power Generation
Growth of High-Quality, Thick, Non-Polar M-Plane GaN Films
Method for Growing High-Quality Group III-Nitride Crystals
Growth of Planar Semi-Polar Gallium Nitride
Defect Reduction of Non-Polar and Semi-Polar III-Nitrides
MOCVD Growth of Planar Non-Polar M-Plane Gallium Nitride
Lateral Growth Method for Defect Reduction of Semipolar Nitride Films
Low Temperature Deposition of Magnesium Doped Nitride Films
Growth of Polyhedron-Shaped Gallium Nitride Bulk Crystals
Improved Manufacturing of Solid State Lasers via Patternning of Photonic Crystals
Control of Photoelectrochemical (PEC) Etching by Modification of the Local Electrochemical Potential of the Semiconductor Structure
Phosphor-Free White Light Source
Single or Multi-Color High Efficiency LED by Growth Over a Patterned Substrate
High Efficiency LED with Optimized Photonic Crystal Extractor
Packaging Technique for the Fabrication of Polarized Light Emitting Diodes
LED Device Structures with Minimized Light Re-Absorption
(In,Ga,A)N Optoelectronic Devices with Thicker Active Layers for Improved Performance
Oxyfluoride Phosphors for Use in White Light LEDs
III-V Nitride Device Structures on Patterned Substrates
Growth of Semipolar III-V Nitride Films with Lower Defect Density
Improved GaN Substrates Prepared with Ammonothermald Growth
Enhanced Optical Polarization of Nitride LEDs by Increased Indium Incorporation
Semipolar-Based Yellow, Green, Blue LEDs with Improved Performance
Hexagonal Wurtzite Type Epitaxial Layer with a Low Alkali-Metal Concentration
Photoelectrochemical Etching Of P-Type Semiconductor Heterostructures
Photoelectrochemical Etching for Chip Shaping Of LEDs
Highly Efficient Blue-Violet III-Nitride Semipolar Laser Diodes
Method for Manufacturing Improved III-Nitride LEDs and Laser Diodes: Monolithic Integration of Optically Pumped and Electrically Injected III-Nitride LEDs
Defect Reduction in GaN films using in-situ SiNx Nanomask
Semi-polar LED/LD Devices on Relaxed Template with Misfit Dislocation at Hetero-interface
Limiting Strain-Relaxation in III-Nitride Heterostructures by Substrate Patterning
Suppression of Defect Formation and Increase in Critical Thickness by Silicon Doping
High Efficiency Semipolar AlGaNa-Cladding-Free Laser Diodes
Low-Cost Zinc Oxide for High-Power-Output, GaN-Based LEDs (UC Case 2010-150)
Nonpolar III-Nitride LEDs With Long Wavelength Emission
Method for Growing Self-Assembled Quantum Dot Lattices
Method for Increasing GaN Substrate Area in Nitride Devices
Flexible Arrays of MicroLEDs using the Photoelectrochemical (PEC) Liftoff Technique
Optimization of Laser Bar Orientation for Nonpolar Laser Diodes
UV Optoelectronic Devices Based on Nonpolar and Semi-polar AlInN and AlInGaAlloys
Low-Droop LED Structure on GaN Semi-polar Substrates
Improved Fabrication of Nonpolar InGaN Thin Films, Heterostructures, and Devices
Growth of High-Performance M-plane GaN Optical Devices
Method for Enhancing Growth of Semipolar Nitride Devices
Transparent Mirrorless (TML) LEDs
Solid Solution Phosphors for Use in Solid State White Lighting Applications
Technique for the Nitride Growth of Semipolar Thin Films, Heterostructures, and Semiconductor Devices
Planar, Nonpolar M-Plane III-Nitride Films Grown on Miscut Substrates
High-Efficiency, Mirrorless Non-Polar and Semi-Polar Light Emitting Devices
High Light Extraction Efficiency III-Nitride LED
Tunable White Light Based on Polarization-Sensitive LEDs
Method for Improved Surface of (Ga,Al,In,B)N Films on Nonpolar or Semipolar Substrates

Improved Anisotropic Strain Control in Semipolar Nitride Devices

III-Nitride Tunnel Junction with Modified Interface

Enhanced Light Extraction LED with a Tunnel Junction Contact Wafer Bonded to a Conductive Oxide

Increased Light Extraction with Multistep Deposition of ZnO on GaN

Hybrid Growth Method for Improved III-Nitride Tunnel Junction Devices

Contact Architectures for Tunnel Junction Devices

Internal Heating for Ammonothermal Growth of Group-III Nitride Crystals

Methods for Fabricating III-Nitride Tunnel Junction Devices

Multfaceted III-Nitride Surface-Emitting Laser

Reduction in Leakage Current and Increase in Efficiency of III-Nitride MicroLEDs

Vertical Cavity Surface-Emitting Lasers with Continuous Wave Operation

Continuous Fluidic Printing Of MicroLEDs

Creating and Releasing Nanoscale Light Emitting Devices from Their Growth Substrates

Colloidal Lithography-Enabled Creation of Metasurface-Integrated MicroLEDs and Devices

Efficient Implementation of a Tunnel Junction Contact on a Nitride-Based Edge-Emitting Laser Diode

Wafer Bonding for Embedding Active Regions with Relaxed Nanostructures

Heterogeneously Integrated GaN on Si Photonic Integrated Circuits

Enhancement of Semi-Polar Gallium Nitride Surface Morphology in Photo-Electrochemical Undercut Etching

Transparent Vertical Cavity Surface Emitting Laser for Augmented and Mixed Reality Displays

Control Of Photoelectrochemical Etch Parameters For Minimization of Interfacial Roughness of Light Emitting Device Structures

High Speed Indium Gallium Nitride Multi-Quantum Well (InGaN MQW) Photodetector

Distributed Feedback Laser with Transparent Conducting Oxide Grating