III-V Nitride Device Structures on Patterned Substrates

Tech ID: 23498 / UC Case 2007-773-0

BRIEF DESCRIPTION

Novel device structures for use in LEDs grown on patterned substrates.

BACKGROUND

The usefulness of III-V nitride materials has been well established for fabrication of visible and ultraviolet optoelectronic devices and high-power electronic devices. One important method for increasing the light extraction efficiency in these devices is to use a patterned substrate on which the device is subsequently grown. Using a standard LED structure (normally used with non-patterned substrates) on patterned substrates, however, has exhibited detrimental performance in output power. There is a need for LED device structures that allow for the realization of high output power LEDs grown on patterned substrates.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed novel device structures for use in LEDs grown on patterned substrates. By incorporating nitride interlayers, these devices minimize the deleterious effect present in the conventional device structures of LEDs deposited on patterned substrates. In doing so, they enhance the output power of LEDs and increase the light extraction efficiency.

ADVANTAGES

▶ Enhanced power output
▶ Increased extraction efficiency

APPLICATIONS

▶ LEDs grown on patterned substrates
PATENT STATUS

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<tr>
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<th>Type</th>
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<td>United States Of America</td>
<td>Issued Patent</td>
<td>8,592,802</td>
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<td>8,183,557</td>
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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
▶ 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
▶ 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
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