High-Intensity Solid State White Laser Diode
Tech ID: 25085 / UC Case 2015-204-0

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OTHER INFORMATION
KEYWORDS
indssl, indled, phosphor, indfeat

CATEGORIZED AS
- Energy
  - Lighting

RELATED CASES
2015-204-0
BRIEF DESCRIPTION
A solid state white lighting device consisting of a blue laser diode that emits light onto a single crystal phosphor, resulting in the emission of high-intensity white light.

BACKGROUND
Conventional LED white light emitters typically suffer from efficiency droop as electrical current increases; this results in less efficient devices when run at high power. A large number of LEDs are usually required to preserve the efficiency of an illuminator constructed with LEDs. Laser diodes, in contrast, do not suffer from this efficiency droop and thus can be run at much higher power without increasing loss of efficiency. However, conventional powdered phosphor wavelength converters must be held in matrix of a polymer material, which is susceptible to damage at the high power density that is achievable at high efficiency when using a laser diode as the excitation source.

DESCRIPTION
UC Santa Barbara researchers have devised a solid state white lighting device consisting of a blue laser diode that emits light onto a single crystal phosphor, resulting in the emission of high-intensity white light. The single crystal phosphor absorbs some of the laser diode emission and emits a band of longer wavelength light. The combination of the remaining blue laser emission with the longer wavelength phosphor emission results in white light. Use of a single crystal phosphor allows for the emission of greater than 1100 lumens of white light without damage or degradation to the materials. This enables the replacement of a traditional incandescent light bulb with a single laser diode requiring much less epitaxial wafer area than common LED-based white light sources, which usually consist of 10-20 LEDs.

ADVANTAGES
- No damage, degradation, or loss of efficiency with increasing power
- Minimizes number of diodes needed for very high power emission
- Much less epitaxial wafer area

APPLICATIONS
- Laser diodes (LDs)

PATENT STATUS

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<th>Type</th>
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<td>United States Of America</td>
<td>Issued Patent</td>
<td>10,495,268</td>
<td>12/03/2019</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
Reduced Dislocation Density of Non-Polar GaN Grown by Hydride Vapor Phase Epitaxy
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
Nitride Based Ultraviolet LED with an Ultraviolet Transparent Contact
Growth of Planar, Non-Polar, A-Plane GaN by Hydride Vapor Phase Epitaxy
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
Nonpolar (Al, B, In, Ga)N Quantum Well Design

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