Highly Efficient Blue-Violet III-Nitride Semipolar Laser Diodes
Tech ID: 23858 / UC Case 2013-490-0

BRIEF DESCRIPTION
A method for making a high power blue-violet III-nitride semipolar laser diode.

BACKGROUND
Conventional solid-state lighting systems use a III-nitride light emitting diode (LED) that emits blue light to excite a phosphor that emits yellow light. Although LEDs show promise for solid state lighting applications, they nevertheless suffer from efficiency droop at high injection levels. Laser diodes are a suitable replacement for generating blue light in solid state lighting systems, since they do not experience the same droop effects.

DESCRIPTION
Researchers at the University of California, Santa Barbara have developed a method for making a high power blue-violet III-nitride semipolar laser diode. These laser diodes have output powers in excess of 1W, slope efficiencies of more than 1 W/A, external quantum efficiencies (EQEs) in excess of 35%, and show great potential for use in solid state lighting systems.

ADVANTAGES
▶ Precise control of directionality and efficiency of light extraction
▶ Higher efficiency at high operating power

APPLICATIONS
▶ Solid state lighting

PATENT STATUS
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<th>Type</th>
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<td>United States Of America</td>
<td>Issued Patent</td>
<td>9,356,431</td>
<td>05/31/2016</td>
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CATEGORIZED AS
▶ Energy
▶ Lighting
▶ Semiconductors
▶ Design and Fabrication
▶ Other

RELATED CASES
2013-490-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS
▶ Method for Improved Surface of (Ga,Al,In,B)N Films on Nonpolar or Semipolar Substrates
▶ High Efficiency LED with Optimized Photonic Crystal Extractor
▶ Enhanced Optical Polarization of Nitride LEDs by Increased Indium Incorporation
▶ Etching Technique for the Fabrication of Thin (Al, In, Ga)N Layers
▶ Lateral Growth Method for Defect Reduction of Semipolar Nitride Films
▶ Vertical Cavity Surface-Emitting Lasers with Continuous Wave Operation
▶ Low-Cost Zinc Oxide for High-Power-Output, GaN-Based LEDs (UC Case 2010-183)
▶ Internal Heating for Ammonothermal Growth of Group-III Nitride Crystals
▶ 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
Improved Manufacturing of Semiconductor Lasers

LED Device Structures with Minimized Light Re-Absorption

Growth of Planar Semi-Polar Gallium Nitride

Nonpolar (Al, B, In, Ga)N Quantum Well Design

UV Optoelectronic Devices Based on Nonpolar and Semi-polar AllnN and AllnGaN Alloys

Integration And Mass Transfer Of Microleds

Defect Reduction of Non-Polar and Semi-Polar III-Nitrides

III-Nitride Based VCSEL with Curved Mirror on P-Side of the Aperture

Low-Cost Zinc Oxide for High-Power-Output, GaN-Based LEDs (UC Case 2010-150)

Suppression of Defect Formation and Increase in Critical Thickness by Silicon Doping

Wafer Bonding for Embedding Active Regions with Relaxed Nanofeatures

Enhancing Growth of Semipolar (Al,In,Ga,B)N Films via MOCVD