High Light Extraction Efficiency III-Nitride LED

Tech ID: 25553 / UC Case 2008-277-0

BRIEF DESCRIPTION
A III-nitride light emitting diode (LED) with increased light extraction from having at least one textured surface of a semipolar or nonpolar plane of a III-nitride layer of the LED.

BACKGROUND
While the advent of high-quality freestanding GaN substrates has led to the development of high-performance nonpolar and semipolar LEDs, there is plenty of room for improving the light extraction efficiency. The lack of means for surface roughening has become a major hurdle for nonpolar and semipolar LEDs to achieve higher extraction efficiency and hence higher overall efficiency, and therefore improved roughening techniques are needed to address this issue.

DESCRIPTION
Researchers at the University of California, Santa Barbara have developed a III-nitride light emitting diode (LED) with increased light extraction from having at least one textured surface of a semipolar or nonpolar plane of a III-nitride layer of the LED. The texturing may be performed by plasma-assisted chemical etching, photolithography followed by etching, or nano-imprinting followed by etching.

ADVANTAGES
▶ Increased light extraction efficiency and output power
▶ More straightforward than other light extraction enhancement techniques (such as using a photonic crystal)
▶ Applicable to all nitride semiconductor surfaces regardless of crystal structure

APPLICATIONS
▶ LEDs

PATENT STATUS

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<td>Issued Patent</td>
<td>9,040,326</td>
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OTHER INFORMATION
KEYWORDS
indssl, indled, LED, III-nitride

CATEGORIZED AS
▶ Engineering
▶ Energy
▶ Lighting
▶ Other
▶ Semiconductors
▶ Design and Fabrication

RELATED CASES
2008-277-0

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
▶ Cleaved Facet Edge-Emitting Laser Diodes Grown on Semipolar GaN
▶ 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
Multifaceted 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
- Heterogeneously Integrated GaN on Si Photonic Integrated Circuits
- High Speed Indium Gallium Nitride Multi-Quantum Well (InGaN MQW) Photodetector
- Distributed Feedback Laser with Transparent Conducting Oxide Grating
- Eliminating Plasma Damage for Beta-Phase Gallium Oxide Transistors
- Retaining Injection Efficiency and Optical Properties of Laser Diodes with Built-in Polarization Fields
- Laser Diode With Tunnel Junction Contact Surface Grating
- III-Nitride Tunnel Junction LED with High Wall Plug Efficiency