III-Nitride Tunnel Junction LED with High Wall Plug Efficiency
Tech ID: 31762 / UC Case 2017-131-0

BACKGROUND

Commercially-available III-nitride light-emitting diodes (LEDs) use an active region in a biased p-n junction to allow for electron and hole injection. The p-GaN is difficult to contact electrically and has low hole concentration and mobility. This means that p-GaN cannot be used as a current spreading layer and that traditional p-contacts will add significant voltage to devices. Despite these inherent problems, all commercial light emitting devices utilize a p-contact and a material other than p-GaN for current spreading, typically transparent conducting oxides (TCO).

DESCRIPTION

Researchers at the University of California, Santa Barbara have introduced an n-GaN layer that produces less loss than a traditional transparent conducting oxide. The favorable current spreading of the n-GaN layer also helps to reduce the droop observed in previous iterations of III-Nitride LEDs. The combined benefits of this novel current spreading layer materialize into a device with over 70% wall plug efficiency.

ADVANTAGES

- Improved light extraction
- Improved energy efficiency (over 70%)
- No requirement for TCOs or mirrors

APPLICATIONS

- III-Nitride LEDs

PATENT STATUS

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<td>United States Of America</td>
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RELATED TECHNOLOGIES

- Contact Architectures for Tunnel Junction Devices
- Methods for Fabricating III-Nitride Tunnel Junction Devices
- Enhanced Light Extraction LED with a Tunnel Junction Contact Wafer Bonded to a Conductive Oxide
- III-Nitride Tunnel Junction with Modified Interface
- Hybrid Growth Method for Improved III-Nitride Tunnel Junction Devices

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)
- Defect Reduction in GaN films using in-situ SiNx Nanomask
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 AlInN and AlInGaN 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 Nanostructures
Enhancing Growth of Semipolar (Al,In,Ga,B)N Films via MOCVD