Enhanced Light Extraction LED with a Tunnel Junction Contact Wafer Bonded to a Conductive Oxide

Tech ID: 25741 / UC Case 2016-324-0

BACKGROUND

The development of light emitting devices (LEDs) with optimized materials is essential to increase the overall efficiency of the myriad commercial applications of the LED. Wafer bonding permits extension of the design parameters of these devices by allowing the formation of heterojunctions that are not possible through conventional deposition schemes. Bonding to transparent conductive materials leads to higher efficiency due to enhanced light extraction.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a method for bonding transparent conductive oxides on III-nitride materials using wafer bonding techniques. Light emitting devices (LEDs) can be processed using this technique which yields higher efficiency devices than traditional methods and allows for greater design options for fabricating devices such as fully transparent tunnel junction-based III-nitride-based LEDs.

ADVANTAGES

- Increased light extraction efficiency
- Greater design options for fabricating devices

APPLICATIONS

- Fully transparent tunnel junction-based LEDs
- LEDs

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,411,137	08/09/2022	2016-324

RELATED TECHNOLOGIES

- Contact Architectures for Tunnel Junction Devices
- III-Nitride Tunnel Junction LED with High Wall Plug Efficiency
- Methods for Fabricating III-Nitride Tunnel Junction Devices

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OTHER INFORMATION

KEYWORDS

LED, tunnel junction, wafer bonded, conductive oxide, III-nitride, indfeat, indenergy

CATEGORIZED AS

- **Energy**
  - Lighting
  - Other
- **Engineering**
  - Engineering
- **Semiconductors**
  - Design and Fabrication

RELATED CASES

2016-324-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- 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
- Eliminating Misfit Dislocations with In-Situ Compliant Substrate Formation
- 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
- Low Temperature Deposition of Magnesium Doped Nitride Films
- Transparent Mirrorless (TML) LEDs
- 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
- Improved Fabrication of Nonpolar InGaN Thin Films, Heterostructures, and Devices
- Growth of High-Quality, Thick, Non-Polar M-Plane GaN Films
- 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
- III-V Nitride Device Structures on Patterned Substrates
- 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
- UV Optoelectronic Devices Based on Nonpolar and Semi-polar AlInN and AlInGaN Alloys
- Defect Reduction of Non-Polar and Semi-Polar III-Nitrides
- Enhancing Growth of Semipolar (Al,In,Ga,B)N Films via MOCVD

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