Transparent Mirrorless (TML) LEDs
Tech ID: 25240 / UC Case 2007-273-0

BRIEF DESCRIPTION
Minimizes the re-absorption of LED light by using transparent conductive oxide electrodes (ITO or ZnO) instead of mirrors.

BACKGROUND
Conventional LEDs utilize mirrors in order to increase the front emissions of particular wavelengths of light by reflecting the LED light forward. In order to increase the output power for the front side of the LED, the emitting light is reflected by the mirror on the backside of the sapphire substrate. These reflected emissions are partly re-absorbed by the active layer of the LED, reducing the output power and efficient of the LED.

DESCRIPTION
An invention created by UC Santa Barbara researchers minimizes the re-absorption of LED light by using transparent conductive oxide electrodes (ITO or ZnO) instead of mirrors. This type of LED also employs a gallium nitride substrate instead of a sapphire substrate in order to create more efficient quantum wells and utilizes textured phosphor layers in order to increase luminous efficacy. The combination of transparent conductive oxide electrodes with a nitride LED and a shaped lens results in high levels of light extraction.

ADVANTAGES
▶ Reduces reflection
▶ Minimizes light re-absorption
▶ Increases efficiency

APPLICATIONS
▶ Light emitting diodes (LEDs)

PATENT STATUS

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CATEGORIZED AS
▶ Engineering
▶ Energy
▶ Lighting
▶ Other
▶ Optics and Photonics
▶ All Optics and Photonics
▶ Semiconductors
▶ Design and Fabrication

RELATED CASES
2007-273-0

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
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
Implantable Light Irradiation Device For Photodynamic Therapy
Low Temperature Deposition of Magnesium Doped Nitride Films
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
Group III-N Light Emitting Devices Enhanced By Stress From Post-Growth Deposited Films
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
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
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
High-Efficiency and High-Power III-Nitride Devices Grown on or Above a Strain Relaxed Template
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