Creating and Releasing Nanoscale Light Emitting Devices from Their Growth Substrates
Tech ID: 30111 / UC Case 2019-391-0

BRIEF DESCRIPTION
A way to reproduce micron and submicron scale III-nitride LEDs and/or devices and remove them from growth substrates.

BACKGROUND
In order for current near eye display technologies to improve, efficient micro and nanoscale pixels for light-emitting diodes (LEDs) and/or devices are required. This is possible with more efficient III-nitride materials. However, the industry still struggles with manufacturing and handling sub-micron scale InGaN/GaN structures that emit at different wavelengths. Additionally, flexible and curved display applications need substrate thinning along with techniques to detach individual LED devices from their growth substrates or use of pick-and-place to position LEDs or devices onto alternate substrates.

DESCRIPTION
Researchers at the University of California, Santa Barbara have designed a way to reproduce micron and sub-micron scale III-nitride LEDs and/or devices and remove them from growth substrates. This is done through selective photoelectrochemical etching of a sacrificial layer that is fixed between the active emitting layer and the growth substrate. This is a cost-effective and scalable method of fabricating next generation small LED and device displays.

ADVANTAGES
▶ Cost-effective
▶ Scalable
▶ Ability to reproduce micron and sub-micron scale III-nitride LEDs
▶ Ability to detach individual LED devices from their growth substrates

APPLICATIONS
▶ Near eye and flexible display technologies
▶ LED/nanoLED devices
▶ Lighting and display systems

PATENT STATUS
Patent Pending

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
▶ Cleaved Facet Edge-Emitting Laser Diodes Grown on Semipolar GaN
▶ 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
▶ Growth of Planar Semi-Polar Gallium Nitride
▶ Defect Reduction of Non-Polar and Semi-Polar III-Nitrides
▶ MOCVD Growth of Planar Non-Polar M-Plane Gallium Nitride

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OTHER INFORMATION
KEYWORDS
indfeat, indled, LED, Laser Diodes, nanoLED, Etching, Lighting, Display

CATEGORIZED AS
▶ Energy
▶ Lighting
▶ Nanotechnology
▶ Electronics

RELATED CASES
2019-391-0
Low Temperature Deposition of Magnesium Doped Nitride Films

Improved Manufacturing of Solid State Lasers via Patterned of Photonic Crystals

Single or Multi-Color High Efficiency LED by Growth Over a Patterned Substrate

High Efficiency LED with Optimized Photonic Crystal Extractor

Packaging Technique for the Fabrication of Polarized Light Emitting Diodes

LED Device Structures with Minimized Light Re-Absorption

(In,Ga,Al)N Optoelectronic Devices with Thicker Active Layers for Improved Performance

Oxyfluoride Phosphors for Use in White Light LEDs

III-Nitride Device Structures on Patterned Substrates

Growth of Semipolar III-V Nitride Films with Lower Defect Density

Enhanced Optical Polarization of Nitride LEDs by Increased Indium Incorporation

Semipolar-Based Yellow, Green, Blue LEDs with Improved Performance

Hexagonal Wurtzite Type Epitaxial Layer with a Low Alkali-Metal Concentration

Photoelectrochemical Etching Of P-Type Semiconductor Heterostructures

Highly Efficient Blue-Violet III-Nitride Semipolar Laser Diodes

Defect Reduction in GaN films using in-situ SiNx Nanomask

Semi-polar LED/LD Devices on Relaxed Template with Misfit Dislocation at Hetero-interface

Limiting Strain-Relaxation in III-Nitride Heterostructures by Substrate Patternning

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

High Efficiency Semipolar AlGaN-Cladding-Free Laser Diodes

Low-Cost Zinc Oxide for High-Power-Output, GaN-Based LEDs (UC Case 2010-183)

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

Method for Increasing GaN Substrate Area in Nitride Devices

Flexible Arrays of MicroLEDs using the Photoelectrochemical (PEC) Liftoff Technique

Optimization of Laser Bar Orientation for Nonpolar Laser Diodes

UV Optoelectronic Devices Based on Nonpolar and Semi-polar AlInN and AlInGaN Alloys

Low-Droop LED Structure on GaN semi-polar Substrates

Improved Fabrication of Nonpolar InGaN Thin Films, Heterostructures, and Devices

Growth of High-Performance M-plane GaN Optical Devices

Method for Enhancing Growth of Semipolar Nitride Devices

Transparent Mirrorless (TML) LEDs

Solid Solution Phosphors for Use in Solid State White Lighting Applications

Technique for the Nitride Growth of Semipolar Thin Films, Heterostructures, and Semiconductor Devices

Planar, Nonpolar M-Plane III-Nitride Films Grown on Miscut Substrates

High-Efficiency, Mirrorless Non-Polar and Semi-Polar Light Emitting Devices

High Light Extraction Efficiency III-Nitride LED

Tunable White Light Based on Polarization-Sensitive LEDs

Method for Improved Surface of (Ga,Al,In,B)N Films on Nonpolar or Semipolar Subtrates

Improved Anisotropic Strain Control in Semipolar Nitride Devices

III-Nitride Tunnel Junction with Modified Interface

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

Increased Light Extraction with Multistep Deposition of ZnO on GaN

Hybrid Growth Method for Improved III-Nitride Tunnel Junction Devices

Contact Architectures for Tunnel Junction Devices

Methods for Fabricating III-Nitride Tunnel Junction Devices

Colorimetric Sensing Of Amines

Reduction in Leakage Current and Increase in Efficiency of III-Nitride MicroLEDS

Vertical Cavity Surface-Emitting Lasers with Continuous Wave Operation

Continuous Fluidic Printing Of MicroLEDs

Colloidal Lithography-Enabled Creation of Metasurface-Integrated MicroLEDs and Devices

Wafer Bonding for Embedding Active Regions with Relaxed Nanofeatures

Heterogeneously Integrated GaN on Si Photonic Integrated Circuits

Enhancement of Semi-Polar Gallium Nitride Surface Morphology in Photo-Electrochemical Undercut Etching

Transparent Vertical Cavity Surface Emitting Laser for Augmented and Mixed Reality Displays

Control Of Photoelectrochemical Etch Parameters For Minimization of Interfacial Roughness of Light Emitting Device Structures