Low Temperature Deposition of Magnesium Doped Nitride Films
Tech ID: 21919 / UC Case 2006-678-0

BRIEF DESCRIPTION

A method for growing an improved quality device by depositing a low temperature magnesium doped nitride semiconductor thin film.

BACKGROUND

Magnesium doped gallium nitride has been extensively used in nitride based LEDs, but requires high deposition temperatures. Indium nitride has a high volatility and readily evaporates out of the InGaN films when exposed to a high enough temperature or a low temperature for an extended period of time. This time and temperature value is commonly referred to as the material's thermal budget. As a result, there is a need for improved methods for the growth of low temperature magnesium doped nitride planar films, wherein the thermal budget of the previously deposited indium nitride containing multiple quantum wells is considerably reduced.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a method for growing an improved quality device by depositing a low temperature magnesium doped nitride semiconductor thin film. This process includes using deposition temperature for the magnesium doped GaN film that is lower than the one used for the deposition of the multi quantum well. This results in a significant increase in the output power of a nitride LED.

ADVANTAGES

▶ Reduced damages to the multi quantum well materials
▶ Increased output power of nitride LED and improved device performance

APPLICATIONS

▶ Nitride LEDs and Laser Diodes

This technology is available for a non-exclusive license. See below for a selection of the patents and patent applications related to this invention. Please inquire for full patent portfolio status.

PATENT STATUS

<table>
<thead>
<tr>
<th>Country</th>
<th>Type</th>
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<tr>
<td>United States Of America</td>
<td>Issued Patent</td>
<td>7,709,284</td>
<td>05/04/2010</td>
<td>2006-678</td>
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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
▶ 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
- Defect Reduction of Non-Polar and Semi-Polar III-Nitrides
- MOCVD Growth of Planar Non-Polar M-Plane Gallium Nitride
- Lateral Growth Method for Defect Reduction of Semipolar Nitride Films
- Growth of Polyhedron-Shaped Gallium Nitride Bulk Crystals
- Improved Manufacturing of Solid State Lasers via Patterned of Photonic Crystals
- Control of Photoelectrochemical (PEC) Etching by Modification of the Local Electrochemical Potential of the Semiconductor Structure
- Phosphor-Free White Light Source
- 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
- Oxysulfide Phosphors for Use in White Light LEDs
- III-V Nitride Device Structures on Patterned Substrates
- Growth of Semipolar III-Nitride Films with Lower Defect Density
- Improved GaN Substrates Prepared with Ammonothermal Growth
- 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
- Method for Manufacturing Improved III-Nitride LEDs and Laser Diodes: Monolithic Integration of Optically Pumped and Electrically Injected III-Nitride LEDs
- 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)
- Nonpolar III-Nitride LEDs With Long Wavelength Emission
- 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 Substrates
- 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
- Internal Heating for ammonothermal Growth of Group-III Nitride Crystals
Methods for Fabricating III-Nitride Tunnel Junction Devices

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

Distributed Feedback Laser with Transparent Conducting Oxide Grating

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