



MOCVD Growth of Planar Non-Polar M-Plane Gallium Nitride

Tech ID: 21917 / UC Case 2005-566-0

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OTHER INFORMATION

KEYWORDS

Gallium Nitride, bulk growth,
MOCVD, indssl, indbulk,
cenIEE

CATEGORIZED AS

- ▶ **Engineering**
- ▶ **Optics and Photonics**
 - ▶ All Optics and
Photonics
- ▶ **Semiconductors**
 - ▶ Design and
Fabrication

RELATED CASES

[2005-566-0](#)

BRIEF DESCRIPTION

Methods for successfully growing planar non-polar m-plane gallium nitride (GaN) with metalorganic chemical vapor deposition (MOCVD).

BACKGROUND

It is relatively easy to grow c-plane GaN due to its large growth window (pressure, temperature and precursor flows) and its stability. However, as a result of c-plane growth, each material layer suffers from separation of electrons and holes to opposite faces of the layers. Furthermore, strain at the interfaces between adjacent layers gives rise to piezoelectric polarization, causing further charge separation. Such polarization effects decrease the likelihood of electrons and holes recombining, causing the device to perform poorly.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed methods for successfully growing planar non-polar m-plane gallium nitride (GaN) with metalorganic chemical vapor deposition (MOCVD). These methods take advantage of non-polar nature of m-plane GaN to eliminate polarization fields, and give rise to flexibility in growth variables, such as temperature, pressure and precursor flows, utilizing the advantage of m-GaN stability during growth.

ADVANTAGES

- ▶ Eliminates polarization fields
- ▶ More flexibility in growth variables

APPLICATIONS

Growth of non-polar GaN films

GaN-based devices

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

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,795,440	08/05/2014	2005-566
United States Of America	Issued Patent	8,097,481	01/17/2012	2005-566
United States Of America	Issued Patent	7,338,828	03/04/2008	2005-566

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
- ▶ Low Temperature Deposition of Magnesium Doped Nitride Films
- ▶ Transparent Mirrorless (TML) LEDs
- ▶ 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 AlGaIn 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 InGaIn 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
- ▶ Reduced Dislocation Density of Non-Polar GaN Grown by Hydride Vapor Phase Epitaxy
- ▶ 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
- ▶ Growth of Planar, Non-Polar, A-Plane GaN by Hydride Vapor Phase Epitaxy

- ▶ 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
- ▶ Nonpolar (Al, B, In, Ga)N Quantum Well Design
- ▶ 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

