Growth of Polyhedron-Shaped Gallium Nitride Bulk Crystals
Tech ID: 21921 / UC Case 2007-809-0

BRIEF DESCRIPTION

A method to grow polyhedron-shaped GaN bulk crystals, which are not possible using existing growth methods.

BACKGROUND

In order to eliminate the problems arising from heteroepitaxial growth, gallium nitride wafers sliced from bulk GaN crystals must be used. A new technique for growing bulk GaN crystals is based on using supercritical ammonia, which has high solubility of source materials, and which has high transport speed of dissolved precursors. This ammonothermal method has a potential for growing large GaN crystals. However, existing technology is limited by the crystal size, because the growth rate is not fast enough to obtain large crystals.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a method to grow polyhedron-shaped GaN bulk crystals, which are not possible using existing growth methods. This shape of GaN crystals has an advantage over the existing platelet-shaped GaN since GaN wafers of any orientation can be obtained simply by slicing the polyhedron.

ADVANTAGES

▶ Allows simple production of GaN wafers of any orientations
▶ Less impurities on the crystals compared to previous grow methods
▶ Faster than previous methods and easily scalable
▶ Cost effective

APPLICATIONS

▶ Gallium nitride wafers

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

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<td>United States Of America</td>
<td>Issued Patent</td>
<td>9,243,344</td>
<td>01/26/2016</td>
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<td>United States Of America</td>
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<td>8,253,221</td>
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ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

▶ Enhanced Optical Polarization of Nitride LEDs by Increased Indium Incorporation
▶ Lateral Growth Method for Defect Reduction of Semipolar Nitride Films
▶ Vertical Cavity Surface-Emitting Lasers with Continuous Wave Operation
▶ III-Nitride-Based Devices Grown With Relaxed Active Region
▶ Low-Cost Zinc Oxide for High-Power-Output, GaN-Based LEDs (UC Case 2010-183)
▶ Highly Efficient Blue-Violet III-Nitride Semipolar Laser Diodes
Hybrid Growth Method for Improved III-Nitride Tunnel Junction Devices

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

Size-Independent Forward Voltage Micro-LED with an Epitaxial Junction

Method for Enhancing Growth of Semipolar Nitride Devices

III-Nitride Tunnel Junction with Modified Interface

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

Method for Manufacturing Improved III-Nitride LEDs and Laser Diodes: Monolithic Integration of Optically Pumped and Electrically Injected III-Nitride LEDs

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

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

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

Reduced Dislocation Density of Non-Polar GaN Grown by Hydride Vapor Phase Epitaxy

Highly Compact, High-Index Dielectric Nanostructures for Deep-Ultraviolet Devices

Growth of Group III-Nitride Crystals using Supercritical Ammonia and Nitrogen

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

Photoelectrochemical Etching Of P-Type Semiconductor Heterostructures

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

High Efficiency III-Nitride Devices with Smooth Relaxed InGaN Buffer and Strain Compliant Template

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

High Light Extraction Efficiency III-Nitride LED

III-V Nitride Device Structures on Patterned Substrates

Activation of P-Type Layers of Tunnel Junctions in Micro-LEDs

Method for Increasing GaN Substrate Area in Nitride Devices

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

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

III-Nitride Based VCSEL with Curved Mirror on P-Side of the Aperture

Enhancing Growth of Semipolar (Al,Ga,B)N Films via MOCVD