Wafer Bonding for Embedding Active Regions with Relaxed Nanofeatures
Tech ID: 30116 / UC Case 2019-395-0

BRIEF DESCRIPTION
An alternative method, using wafer bonding, to connect relaxed nanostructures in the active region with separately grown material.

BACKGROUND
Relaxed active areas are advantageous for semiconductor device systems that experience high lattice mismatch in epitaxial growth. Current approaches to using relaxed active areas in III-V materials for LEDs and laser diodes consist of material growth over relaxed material. However, this method reduces the device’s performance because it deteriorates the crystal quality of the device’s other components.

DESCRIPTION
Researchers at the University of California, Santa Barbara have developed an alternative method using wafer bonding to connect relaxed nanostructures in the active region with separately grown material. The nanostructures act as the contact points for the two wafers bonding and do not need to be planar, unlike conventional wafer bonding techniques. This unique process produces greater device performance and higher quality device materials by utilizing relaxed active areas.

ADVANTAGES
▶ Enhanced device performance
▶ Improved material quality
▶ Wafer bonding technique is already commercially viable

APPLICATIONS
▶ Semiconductor device systems
▶ III-V materials for LEDs
▶ Laser diodes for long wavelength emissions

PATENT STATUS
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CATEGORIZED AS
▶ Energy
  ▶ Lighting
▶ Semiconductors
  ▶ Design and Fabrication
  ▶ Materials

RELATED CASES
2019-395-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS
▶ Method for Improved Surface of (Ga,Al,In,B)N Films on Nonpolar or Semipolar Subtrates
▶ High Efficiency LED with Optimized Photonic Crystal Extractor
▶ Enhanced Optical Polarization of Nitride LEDs by Increased Indium Incorporation
▶ Vertical Cavity Surface-Emitting Lasers with Continuous Wave Operation
▶ Achieving “Active P-Type Layer/Layers” In III-Nitride Epitaxial Or Device Structures Having Buried P-Type Layers
▶ High-Quality N-Face GaN, InN, AIN by MOCVD
▶ 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
▶ 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
- Optimization of Laser Bar Orientation for Nonpolar Laser Diodes
- High Efficiency Semipolar AlGaN-Cladding-Free Laser Diodes
- Size-Independent Forward Voltage Micro-LED with an Epitaxial Junction
- A Structure For Increasing Mobility In A High-Electron-Mobility Transistor
- Method for Enhancing Growth of Semipolar Nitride Devices
- III-Nitride Tunnel Junction with Modified Interface
- Fabrication of Relaxed Semiconductor Films without Crystal Defects
- Improved Fabrication of Nonpolar InGaN Thin Films, Heterostructures, and Devices
- Growth of High-Quality, Thick, Non-Polar M-Plane GaN Films
- Methods for Locally Changing the Electric Field Distribution in Electron Devices
- Increased Light Extraction with Multistep Deposition of ZnO on GaN
- Selective-Area Mesoporous Semiconductors And Devices For Optoelectronic And Photonic Applications
- High-Efficiency, Mirrorless Non-Polar and Semi-Polar Light Emitting Devices
- Incorporating Temperature-Sensitive Layers in III-N Devices
- 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
- MOCVD Growth of Planar Non-Polar M-Plane Gallium Nitride
- Reduced Dislocation Density of Non-Polar GaN Grown by Hydride Vapor Phase Epitaxy
- Heterogeneously Integrated GaN on Si Photonic Integrated Circuits
- Reduction in Leakage Current and Increase in Efficiency of III-Nitride MicroLEDs
- GaN-based Vertical Metal Oxide Semiconductor and Junction Field Effect Transistors
- Methods for Fabricating III-Nitride Tunnel Junction Devices
- Low-Droop LED Structure on GaN Semi-polar Substrates
- Contact Architectures for Tunnel Junction Devices
- GaN Interlayer Design to Fully Eliminate V-Pits from InGaN Pseudo-Substrates
- Semi-polar LED/LD Devices on Relaxed Pits with Misfit Dislocation at Hetero-interface
- Photoelectrochemical Etching Of P-Type Semiconductor Heterostructures
- Semipolar-Based Yellow, Green, Blue LEDs with Improved Performance
- Growth of Semipolar III-V Nitride Films with Lower Defect Density
- III-Nitride Tunnel Junction LED with High Wall Plug Efficiency
- Novel Current-Blocking Layer in High-Power Current Aperture Vertical Electron Transistors (CAVEFs)
- Improved Manufacturing of Solid State Lasers via Patterning of Photonic Crystals
- III-N Transistor With Stepped Cap Layers
- Solid Solution Phosphors for Use in Solid State White Lighting Applications
- 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
- Hexagonal Wurtzite Type Epitaxial Layer with a Low Alkali-Metal Concentration
- 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 Gallium Nitride
- Growth of High-Performance M-plane GaN Optical Devices
- Single or Multi-Color High Efficiency LED by Growth Over a Patterned Substrate
- 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
- Nonpolar (Al, B, In, Ga)N Quantum Well Design
- UV Optoelectronic Devices Based on Nonpolar and Semi-polar AllInN and AllInGaN Alloys
Defect Reduction of Non-Polar and Semi-Polar III-Nitrides
- Low-Cost Zinc Oxide for High-Power-Output, GaN-Based LEDs (UC Case 2010-150)
- Suppression of Defect Formation and Increase in Critical Thickness by Silicon Doping
- Enhancing Growth of Semipolar (Al,In,Ga,B)N Films via MOCVD
- III-N Based Material Structures and Circuit Modules Based on Strain Management