GaN Interlayer Design to Fully Eliminate V-Pits from InGaN Pseudo-Substrates
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BACKGROUND

Current GaN-based LEDs suffer from a lattice mismatch between the GaN buffer layer and the InGaN quantum wells (QWs), causing them to experience a low efficiency. In addition, low miscibility of Indium in InGaN, alloy fluctuations, and phase separation demands require a lower growth temperature of InGaN QWs which results in defects and material deterioration. Although c-plane InGaN pseudo-substrates afford the opportunity to provide an alternative platform for long-wavelength-emitting optical devices, the main challenge in growing such InGaN pseudo-substrates is the formation of V-pits as they are detrimental for subsequent material growth and device fabrication.

DESCRIPTION

Researchers at the University of California, Santa Barbara have designed a GaN interlayer that completely eliminates V-pits from InGaN pseudo-substrates. In this technology, buffer layers comprised of InGaN layers and GaN interlayers are grown on the InGaN pseudo-substrate. Growth parameters for the InGaN layers and GaN interlayers work to enhance Ga atom diffusion to the V-pits on sidewalls of the InGaN pseudo-substrate.

ADVANTAGES

▶ Elimination of V-pits
▶ Enhanced Ga atom diffusion

APPLICATIONS

▶ LEDs
▶ Blue Laser Diodes

PATENT STATUS

Patent Pending

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

▶ Method for Improved Surface of (Ga,Al,In,B)N Films on Nonpolar or Semipolar Substrates
▶ 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
▶ 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
▶ Laser Diode With Tunnel Junction Contact Surface Grating
▶ Optimization of Laser Bar Orientation for Nonpolar Laser Diodes
▶ High Efficiency Semipolar AlGaN-Cladding-Free Laser Diodes