Size-Independent Forward Voltage Micro-LED with an Epitaxial Junction
Tech ID: 32268 / UC Case 2020-714-0

BACKGROUND

Conventional tunnel junction micro-LEDs currently face challenges of higher voltage penalties and varied voltage with different device sizes. Unfortunately, size-dependent voltage characteristics limit the applications of micro-LEDs and result in a lack of device reliability. Thus, overcoming the size dependence of the forward voltage in tunnel junction micro-LEDs would increase their potential to meet the demands of next-generation display applications.

DESCRIPTION

Researchers at the University of California, Santa Barbara have fabricated size-independent low forward voltage micro-LEDs with an epitaxial tunnel junction (TJ) comprised of p+GaN and n+GaN layers. Utilizing selective area growth (SAG) for regular and micro-size InGaN LEDs, the optimized devices exhibit a very small voltage penalty of 0.2-0.3 V compared to conventional indium tin oxide contact LEDs. Therefore, this composition solves the issue of forward voltage variation in different size tunnel junction micro-LEDs by realizing a size-independent low forward voltage device.

ADVANTAGES

▶ Size-independent forward voltage
▶ Increases reliability of micro-LEDs in expanded applications

APPLICATIONS

▶ Micro-LEDs

PATENT STATUS

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<td>Patent Cooperation Treaty</td>
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RELATED MATERIALS

▶ Metalorganic chemical vapor deposition-grown tunnel junctions for low forward voltage InGaN light-emitting diodes: epitaxy optimization and light extraction simulation - 02/17/2021

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

▶ Method for Improved Surface of (Ga,Al,In,B)N Films on Nonpolar or Semipolar Substrates
▶ 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
▶ Eliminating Misfit Dislocations with In-Situ Compliant Substrate Formation
▶ III-Nitride-Based Devices Grown With Relaxed Active Region
▶ 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