GaN-Based Thermoelectric Device for Micro-Power Generation

Tech ID: 21830 / UC Case 2009-389-0

BRIEF DESCRIPTION

A novel, highly-customizable device architecture for GaN thermoelectric micro power generators.

BACKGROUND

Currently practical thermoelectric technology consists mainly of Bi2Te3 based materials. These materials however are not only toxic and scarce, but have a maximum operating temperature of roughly 150°C. The current material used for high temperature applications is SiGe, but low efficiencies and limited room for improvement necessitate the search for an improved high temperature thermoelectric material. Wide bandgap GaN and its family of alloys are promising candidates to fill this role because they are non-toxic and very stable at high temperatures.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a novel, highly-customizable device architecture for GaN thermoelectric micro power generators. The device structure consists of only n-type GaN with gold interconnections. Several measurements performed on this device proved the suitability of GaN at high operating temperatures for this application. For example, a maximum average temperature of 825K was achieved with no sign of device or contact degradation. This was the highest temperature tested due to limitations in the testing apparatus, not by device performance.

ADVANTAGES

- Very stable at high temperatures (>825K)
- Low thermal conductivity
- Electrical conductivity maintained at the same level as standard nitride films

APPLICATIONS

- Thermoelectric Devices

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OTHER INFORMATION

KEYWORDS

thermoelectric, energy efficiency, GaN, indaltenergy, indthermo, cenIEE, indfeat, indadvmat

CATEGORIZED AS

- **Energy**
  - Other
- **Semiconductors**
  - Design and Fabrication

RELATED CASES

2009-389-0

This technology is available for licensing. 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	8,692,105	04/08/2014	2009-389

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- 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
- Low-Cost Zinc Oxide for High-Power-Output, GaN-Based LEDs (UC Case 2010-183)
- Enhanced Light Extraction LED with a Tunnel Junction Contact Wafer Bonded to a Conductive Oxide
- Ultraviolet Laser Diode on Nano-Porous AlGaN template
- Improved Reliability & Enhanced Performance of III-Nitride Tunnel Junction Optoelectronic Devices
- Nonpolar III-Nitride LEDs With Long Wavelength Emission
- Improved Fabrication of Nonpolar InGaN Thin Films, Heterostructures, and Devices
- Oxyfluoride Phosphors for Use in White Light LEDs
- (In,Ga,Al)N Optoelectronic Devices with Thicker Active Layers for Improved Performance
- Thermally Stable, Laser-Driven White Lighting Device
- 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 Tunnel Junction LED with High Wall Plug Efficiency
- Tunable White Light Based on Polarization-Sensitive LEDs
- Improved Anisotropic Strain Control in Semipolar Nitride Devices
- Novel Multilayer Structure for High-Efficiency UV and Far-UV Light-Emitting Devices
- A Method To Lift-Off Nitride Materials With Electrochemical Etch
- High-Intensity Solid State White Laser Diode
- Nitride Based Ultraviolet LED with an Ultraviolet Transparent Contact
- Limiting Strain-Relaxation in III-Nitride Heterostructures by Substrate Patterning
- High-Efficiency and High-Power III-Nitride Devices Grown on or Above a Strain Relaxed Template
- 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

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