



## High-Intensity Solid State White Laser Diode

Tech ID: 25085 / UC Case 2015-204-0

### CONTACT

Pasquale S. Ferrari  
[ferrari@tia.ucsb.edu](mailto:ferrari@tia.ucsb.edu)  
tel: .

### INVENTORS

- ▶ Cantore, Michael S.
- ▶ DenBaars, Steven P.
- ▶ Nakamura, Shuji

### OTHER INFORMATION

#### KEYWORDS

indssl, indled, phosphor, indfeat

#### CATEGORIZED AS

- ▶ **Energy**
- ▶ Lighting

#### RELATED CASES

2015-204-0

## BRIEF DESCRIPTION

A solid state white lighting device consisting of a blue laser diode that emits light onto a single crystal phosphor, resulting in the emission of high-intensity white light.

## BACKGROUND

Conventional LED white light emitters typically suffer from efficiency droop as electrical current increases; this results in less efficient devices when run at high power. A large number of LEDs are usually required to preserve the efficiency of an illuminator constructed with LEDs. Laser diodes, in contrast, do not suffer from this efficiency droop and thus can be run at much higher power without increasing loss of efficiency. However, conventional powdered phosphor wavelength converters must be held in matrix of a polymer material, which is susceptible to damage at the high power density that is achievable at high efficiency when using a laser diode as the excitation source.

## DESCRIPTION

UC Santa Barbara researchers have devised a solid state white lighting device consisting of a blue laser diode that emits light onto a single crystal phosphor, resulting in the emission of high-intensity white light. The single crystal phosphor absorbs some of the laser diode emission and emits a band of longer wavelength light. The combination of the remaining blue laser emission with the longer wavelength phosphor emission results in white light. Use of a single crystal phosphor allows for the emission of greater than 1100 lumens of white light without damage or degradation to the materials. This enables the replacement of a traditional incandescent light bulb with a single laser diode requiring much less epitaxial wafer area than common LED-based white light sources, which usually consist of 10-20 LEDs.

## ADVANTAGES

- No damage, degradation, or loss of efficiency with increasing power
- Minimizes number of diodes needed for very high power emission
- Much less epitaxial wafer area

## APPLICATIONS

- Laser diodes (LDs)

## PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,495,268	12/03/2019	2015-204

## 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 AlGaIn template
- ▶ Improved Reliability & Enhanced Performance of III-Nitride Tunnel Junction Optoelectronic Devices
- ▶ Nonpolar III-Nitride LEDs With Long Wavelength Emission
- ▶ Improved Fabrication of Nonpolar InGaIn 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
- ▶ Nitride Based Ultraviolet LED with an Ultraviolet Transparent Contact
- ▶ GaN-Based Thermoelectric Device for Micro-Power Generation
- ▶ 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 AlInGaIn Alloys
- ▶ III-Nitride Based VCSEL with Curved Mirror on P-Side of the Aperture

