High-Intensity Solid State White Laser Diode

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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
- Enhanced Light Extraction LED with a Tunnel Junction Contact Wafer Bonded to a Conductive Oxide
- Improved Reliability & Enhanced Performance of III-Nitride Tunnel Junction Optoelectronic Devices

- (In,Ga,Al)N Optoelectronic Devices with Thicker Active Layers for Improved Performance
- Thermally Stable, Laser-Driven White Lighting Device
- III-Nitride Tunnel Junction LED with High Wall Plug Efficiency
- 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
- High-Efficiency and High-Power III-Nitride Devices Grown on or Above a Strain Relaxed Template
- III-Nitride Based VCSEL with Curved Mirror on P-Side of the Aperture

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