



# Enhanced Light Extraction LED with a Tunnel Junction Contact Wafer Bonded to a Conductive Oxide

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## BACKGROUND

The development of light emitting devices (LEDs) with optimized materials is essential to increase the overall efficiency of the myriad commercial applications of the LED. Wafer bonding permits extension of the design parameters of these devices by allowing the formation of heterojunctions that are not possible through conventional deposition schemes. Bonding to transparent conductive materials leads to higher efficiency due to enhanced light extraction.

## DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a method for bonding transparent conductive oxides on III-nitride materials using wafer bonding techniques. Light emitting devices (LEDs) can be processed using this technique which yields higher efficiency devices than traditional methods and allows for greater design options for fabricating devices such as fully transparent tunnel junction-based III-nitride-based LEDs.

## ADVANTAGES

- ▶ Increased light extraction efficiency
- ▶ Greater design options for fabricating devices

## APPLICATIONS

- ▶ Fully transparent tunnel junction-based LEDs
- ▶ LEDs

## PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,411,137	08/09/2022	2016-324

## RELATED TECHNOLOGIES

- ▶ [Contact Architectures for Tunnel Junction Devices](#)
- ▶ [III-Nitride Tunnel Junction LED with High Wall Plug Efficiency](#)
- ▶ [Methods for Fabricating III-Nitride Tunnel Junction Devices](#)

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## OTHER INFORMATION

### KEYWORDS

LED, tunnel junction, wafer bonded, conductive oxide, III-nitride, indfeat, indenergy

### CATEGORIZED AS

- ▶ [Energy](#)
  - ▶ [Lighting](#)
  - ▶ [Other](#)
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  - ▶ [Design and Fabrication](#)

### RELATED CASES

2016-324-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ Vertical Cavity Surface-Emitting Lasers with Continuous Wave Operation
- ▶ Eliminating Misfit Dislocations with In-Situ Compliant Substrate Formation
- ▶ Ultraviolet Laser Diode on Nano-Porous AlGaIn template
- ▶ 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
- ▶ Methods for Fabricating III-Nitride Tunnel Junction Devices
- ▶ Contact Architectures for Tunnel Junction Devices
- ▶ III-Nitride Tunnel Junction LED with High Wall Plug Efficiency
- ▶ 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

