



Tunnel Junction Devices with Optically-Pumped III-Nitride Layers

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BRIEF DESCRIPTION

A method of replacing standard electrical injection of the quantum wells in semiconductor devices with optically-pumping, by coupling a short-wavelength electrically pumped active region to a long-wavelength optically pumped region via a tunnel junction.

BACKGROUND

Despite the inherent advantages of growing III-N semiconductor devices on nonpolar and semipolar planes, challenges still remain for the emission of green, yellow, orange, and red light. High-indium content layers are necessary for long emission wavelengths, but are difficult to achieve because the current growth process involves high temperature steps that can degrade high-indium-content layers.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a method of replacing standard electrical injection of the quantum wells in semiconductor devices with optically-pumping, by coupling a short-wavelength electrically pumped active region to a long-wavelength optically pumped region via a tunnel junction. Optically pumping allows for the creation of multiple quantum wells, thereby reducing the relaxation of high-indium content layers. Epi stacks optimized for optical pumping may be grown at lower temperatures. Additionally, with optically pumping long wavelength quantum wells, the doping profile can be engineering to optimize the emission wavelength.

ADVANTAGES

- ▶ Easier than electrical injection for producing long wavelength emission
- ▶ Reduced relaxation of high-indium content layers
- ▶ Doping profile can be engineered to optimize the emission wavelength
- ▶ Easy incorporation of 2-D light-emitting structures

APPLICATIONS

- ▶ LEDs
- ▶ Laser diodes

PATENT STATUS

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

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OTHER INFORMATION

KEYWORDS

Tunnel Junction, indled, III-Nitride, Optically-pumped, LEDs, Laser Diodes, Light Emitting Diodes, Quantum Wells, indfeat

CATEGORIZED AS

- ▶ **Optics and Photonics**
 - ▶ All Optics and Photonics
- ▶ **Semiconductors**
 - ▶ Other

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