



High-Quality N-Face GaN, InN, AlN by MOCVD

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BRIEF DESCRIPTION

BACKGROUND

The use of group III nitride materials in optoelectronic devices is widespread. However, one of the major challenges of III-nitride based light emitters is the growth of high quality InGaN with high Indium composition. Devices using c-plane limit the temperature at which InGaN can be grown; this limits the types of devices that can be made. Traditional c-plane GaN suffers from inversion, while m-plane does not. Conversely, most m-plane GaN films grown by MOCVD, the most common growth method for large scale fabrication of GaN-based devices, are characterized by large hexagonal features that make the material unacceptable for device applications.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a novel method that allows for the growth of smooth, high quality m-plane films. The invention enables heteroepitaxial growth of smooth m-plane films by MOCVD onto any off-cut substrate, e.g., sapphire or silicon carbide. The different physical properties provided by m-plane allow for the design of new LEDs and laser diodes. M-plane also allows for the growth of InGaN at higher temperatures than traditional Ga-face. M-plane materials enable the growth of better quality, high Indium composition InGaN alloys which are currently needed to create high power devices in the green, yellow, and red parts of the color spectrum. Additionally, m-plane provides an electric field in the opposite direction of c-plane, which results in increased efficiency in light-emitting devices.

ADVANTAGES

- ▶ Growth of InGaN at higher temperatures
- ▶ Capable of using any off-cut substrate
- ▶ Lower turn-on voltage and increased efficiency

APPLICATIONS

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OTHER INFORMATION

KEYWORDS

indssl, indbulk, MOCVD, cenIEEE

CATEGORIZED AS

- ▶ **Engineering**
- ▶ **Energy**
 - ▶ Lighting
 - ▶ Other
- ▶ **Optics and Photonics**
 - ▶ All Optics and Photonics
- ▶ **Semiconductors**
 - ▶ Design and Fabrication

RELATED CASES

2007-121-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,455,885	06/04/2013	2007-121
United States Of America	Issued Patent	8,193,020	06/05/2012	2007-121
United States Of America	Issued Patent	7,566,580	07/28/2009	2007-121

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Defect Reduction in GaN films using in-situ SiNx Nanomask
- A Structure For Increasing Mobility In A High-Electron-Mobility Transistor
- Improved Fabrication of Nonpolar InGaN Thin Films, Heterostructures, and Devices
- Methods for Locally Changing the Electric Field Distribution in Electron Devices
- Technique for the Nitride Growth of Semipolar Thin Films, Heterostructures, and Semiconductor Devices
- (In,Ga,Al)N Optoelectronic Devices with Thicker Active Layers for Improved Performance
- GaN-based Vertical Metal Oxide Semiconductor and Junction Field Effect Transistors
- Novel Current-Blocking Layer in High-Power Current Aperture Vertical Electron Transistors (CAVETs)
- Iii-N Transistor With Stepped Cap Layers
- III-N Based Material Structures and Circuit Modules Based on Strain Management