GaN Newsletter

October 2022

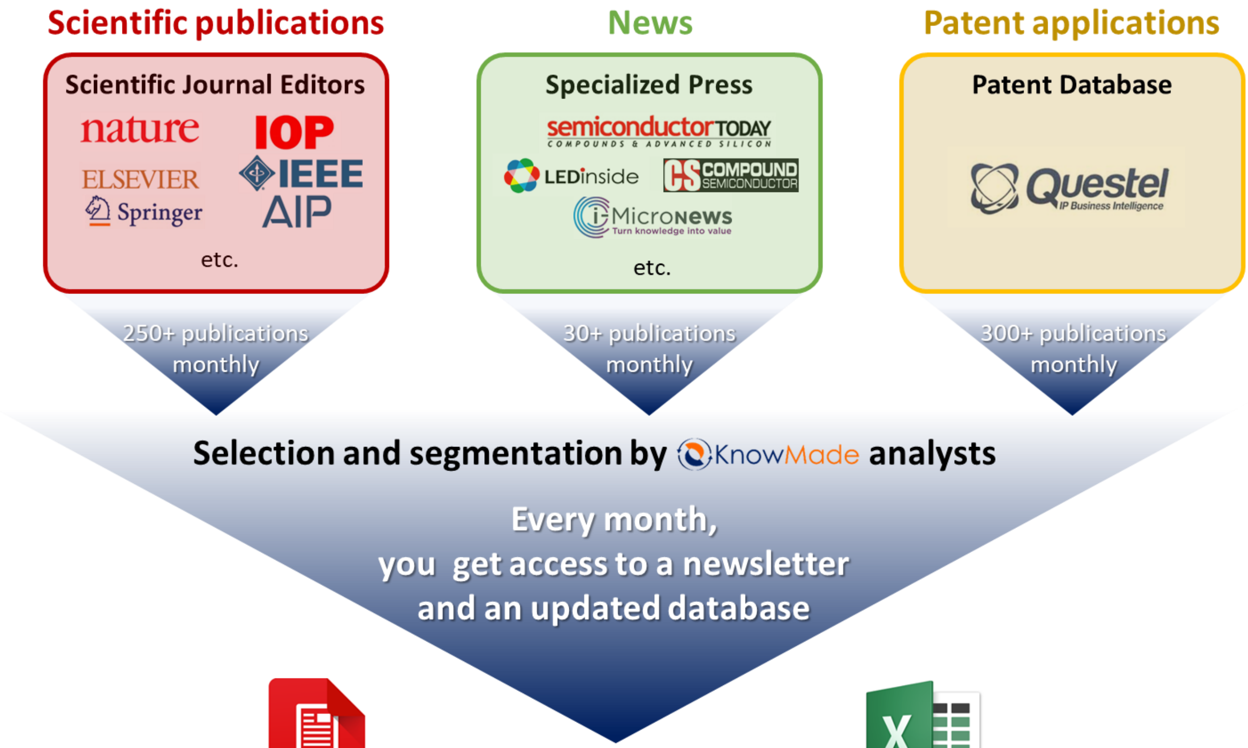
Powered by Knowmade every month, the **GaN newsletter** presents a selection of the latest **scientific publications**, **patent applications** and **news** related to **III-Nitride semiconductors** (GaN, AlN, InN and alloys) for **optoelectronic** and **electronic** applications (power, RF, LED, laser, photonics, etc.).

About Knowmade
Knowmade is a technology intelligence and IP strategy consulting company specialized in analyzing patents and scientific publications to help innovative companies, investors, and R&D organizations to understand competitive landscape, follow technological evolutions, reduce uncertainties, and identify opportunities and risks in terms of technology and intellectual property. Knowmade's analysts combine their strong technology expertise and in-depth knowledge of patents with powerful analytics tools and methodologies to turn patent information and scientific literature into actionable insights, providing high added value reports for decision makers working in R&D, innovation strategy, intellectual property, and marketing. With a strong focus on Semiconductors, Batteries, Biotech and Food industries, our experts provide prior art search, patent landscape analysis, freedom-to-operate analysis, IP due diligence, and monitoring services.
www.knowmade.com

TABLE OF CONTENTS

(clickable links to sections)

METHODOLOGY & CONTENT



Scientific publications

Scientific Journal Editors

etc.

250+ publications monthly

News

Specialized Press

etc.

30+ publications monthly

Patent applications

Patent Database

300+ publications monthly

Selection and segmentation by KnowMade analysts

Every month, you get access to a newsletter and an updated database

GaN newsletter

New scientific publications

- Optoelectronics
- Electronics

News

- Optoelectronics
- Electronics
- Others

New patent applications

- Statistical overview
- Notable patent applications

The newsletter focuses on the new publications of the month in optoelectronics (LED, µ-LED, laser, photonics, etc.) and electronics (power, RF and other advanced electronic devices).

GaN database

All scientific publications

- Optoelectronics
- Electronics
- MEMS & Sensors
- PV & Energy harvesting
- Nano-objects
- Non-polar & Semi-polar
- Fundamental & Materials

All news

All patent applications
(Premium version only)

The database is updated every month with new publications related to GaN with a segmentation of scientific publications in 7 categories.

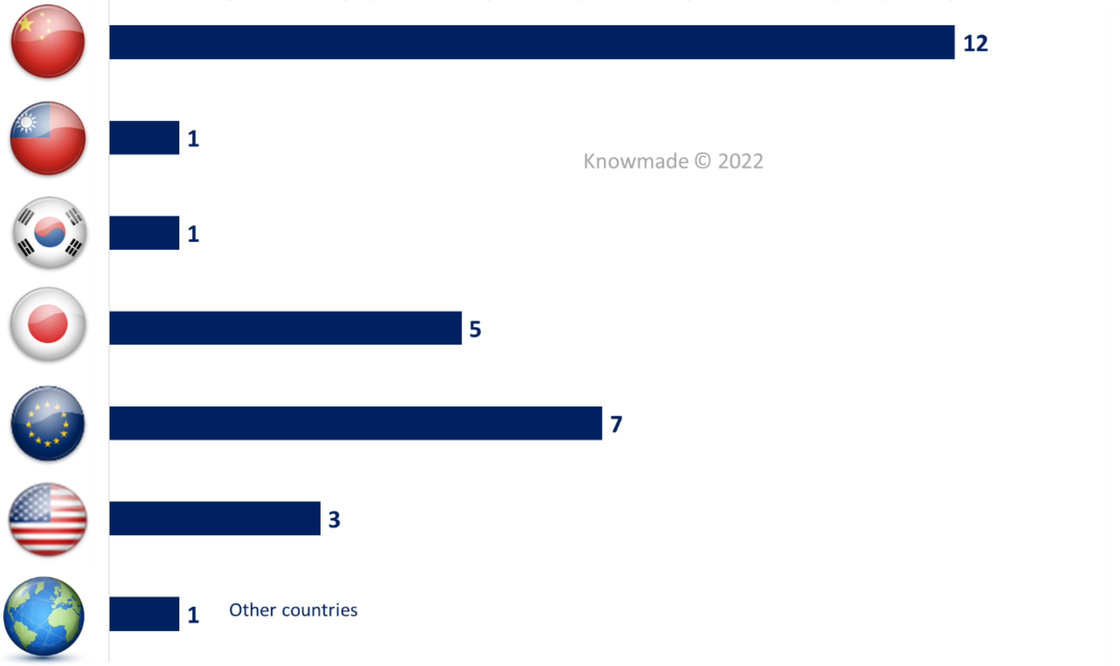
SCIENTIFIC PUBLICATIONS

More than **220 new scientific publications** related to GaN technology were selected in September 2022, of which **50+ publications related to GaN optoelectronics** (LED, laser, photonics, photodetectors) and **80+ publications related to GaN electronics** (Power, RF and advanced electronics):

Technology breakdown of the activity in the global GaN scientific landscape

Number of new scientific publications in September 2022 split by applications
Main companies active in the GaN scientific landscape in September 2022

As shown in the previous graph, many companies have been involved in the publications of scientific papers related to GaN technology this month, from different countries:



Geographical breakdown of the scientific activity of companies in the global GaN scientific landscape

Number of new scientific publications from companies in September 2022 split by headquarter locations

Review of a direct epitaxial approach developed for microLEDs by the Sheffield team

Department of Electronic and Electrical Engineering, Southern University of Science and Technology, Shenzhen, 518055, CHINA
Department of Electronic and Electrical Engineering, The University of Sheffield, Sheffield, S1 3JD, United Kingdom

Chinese Physics B
https://doi.org/10.1088/1674-1056/ac90b5

In this paper, a brief introduction of various studies on selective overgrowth for microLEDs is given first. Then a direct epitaxial approach to achieve microLEDs developed by our Sheffield team will be introduced. Advantages over conventional top-down method, namely dry etching method to form microLEDs are also discussed in details. At the end, limitations of such approach are briefly mentioned.

Low-power high-bandwidth non-polar InGaN micro-LEDs at low current densities for energy-efficient visible light communication

Institute for Electric Light Sources, School of Information Science and Technology, Academy of Engineering and Technology, Yiwu Research Institute, Fudan University, Shanghai, China

IEEE Photonics Journal
https://doi.org/10.1109/JPHOT.2022.3204711

Recently, the rapidly developing Internet of Things (IoT) needs to support massive connectivity with high transmission data rate, which requires IoT transmitters with high speed and low power consumption. In this work, non-polar micro-LED operating at low current density of 10 A/cm 2 can still maintain a high bandwidth of 508 MHz and near-peak external quantum efficiency (EQE), making it promising for low-power, energy-efficient visible light communication (VLC) to address the challenge. At 10 A/cm 2 , non-polar micro-LEDs can achieve a low power consumption and high energy efficiency, still maintaining the data rate of 0.25 Gbps. In addition, data rates of 2 Gbps and 1.1 Gbps were also successfully achieved for non-polar micro-LED operating at 320 and 50 A/cm 2 , respectively, to evaluate the relationship between power consumption and achievable data rate. The capability of non-polar micro-LED that can realize low-power consumption and high bandwidth at low current density is expected to play a great role in the field of energy-efficient VLC, multi-function display and IoT in the future.

Superior optoelectronic performance of N-polar GaN LED to Ga-polar counterpart in the “green gap” range

College of Semiconductors (College of Integrated Circuits), Hunan University, Changsha, China
Beijing National Laboratory for Condensed Matter Physics, Institute of Physics, Key Laboratory for Renewable Energy
Beijing Key Laboratory for New Energy Materials and Devices, Chinese Academy of Sciences, Beijing, China
Songshan Lake Materials Laboratory, Dongguan, Guangdong, China

IEEE Access
https://doi.org/10.1109/ACCESS.2022.3204668

The low luminous efficiency of indium gallium nitride (InGaN) light-emitting diodes (LED) in the “green gap” range has been a long unsettled issue confounding the researchers. One of the main obstacles comes from the intrinsic polarization field in the incumbent Ga-polar LEDs (Ga-LEDs), where the polarization field will bend the energy band thus reducing the radiative recombination efficiency. The scenario will become different when we reverse the polarization field with the adoption of N-polar GaN, which should be a promising candidate to obtain LEDs with high luminous efficiency in the “green gap” range. In this study, the optical and electronic performances of InGaN LEDs in the “green gap” range with N- and Ga-polar have been numerically investigated. The results demonstrate that the light-output power of N-polar LED (N-LED) is ~1.69-fold higher than that of Ga-LED at a current density of 1250 A/cm 2 , thus leading to a significantly improved internal quantum efficiency. Meanwhile, the turn-on voltage of N-LED is lowered by ~17.3% compared to that of Ga-LED. As revealed by the energy band diagram, the superior optoelectronic performance of N-LED is mainly attributed to the stronger carrier confinement in the active region and the lower carrier injection barriers. This study suggests the prospective realization of high luminous efficiency

InGaN LEDs in the "green gap" range by the implementation of N-LEDs.

Optical characterisation of InGaN-based microdisk arrays with nanoporous GaN/GaN DBRs

Department of Electronic and Electrical Engineering, The University of Sheffield, North Campus, UK, Sheffield, South Yorkshire, S3 7HQ, UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND

Journal of Physics D: Applied Physics
https://doi.org/10.1088/1361-6463/ac8fa0

Optically pumped whispering gallery mode (WGM) lasing has been observed in many freestanding microdisk structures. Dry etching is normally used to fabricate the microdisks, which causes severe sidewall damage, resulting in degradation of lasing performance, especially for ultra-small electrically-injected devices. In this paper, we demonstrate high quality microdisk cavities with 3.5 µm diameter, by combining a selective overgrowth approach and an epitaxial lattice-matched distributed Bragg reflectors (DBR), topped with a highly reflective (>99%) dielectric DBR. InGaN polaritons are foundto occur inthe high-quality microcavities. WGM modes are measured, with the positions in good agreement with finite difference time domain (FDTD) simulations. Furthermore, lasing behaviour is observed with a threshold at 410 µW and a dominate mode at 488 nm.

Real-time observation of delayed excited-state dynamics in InGaN/GaN quantum-wells by femtosecond transient absorption spectroscopy

Applied Quantum Mechanics Laboratory, Indian Institute of Technology; Bombay, Powai, Mumbai–400076, India
Solid-State Electronics Laboratory, Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, 48109-2122, United States of America

Nanotechnology
https://doi.org/10.1088/1361-6528/ac8a50

This work employs femtosecond transient absorption spectroscopy to investigate the ultrafast carrier dynamics of bound states in In0.14Ga0.86N/GaN quantum wells. The ground state (GS) dynamics usually dominate these characteristics, appearing as a prominent peak in the absorption spectra. It is observed that the excited state also contributes to the overall dynamics, with its signature showing up later. The contributions of both the ground and excited states in the absorption spectra and time-resolved dynamics are decoupled in this work. The carrier density in the GS first increases and then decays with time. The carriers populate the excited state only at a delayed time. The dynamics are studied considering the Quantum-Confined Stark Effect-induced wavelength shift in the absorption. The relevant microscopic optoelectronic processes are understood phenomenologically, and their time constants are extracted. An accurate study of these dynamics provides fundamentally essential insights into the time-resolved dynamics in quantum-confined heterostructures and can facilitate the development of efficient light sources using GaN heterostructures.

… and more than 50 other publications

ELECTRONICS

Information selected by Knowmade

Breakdown Mechanism of AlGaN/GaN HEMT on 200-mm Si Substrate with Si-Implant-Assisted Contacts

Univ. Grenoble Alpes, CEA, Leti, France
IEMN, Université de Lille, Villeneuve-d'Asq, France

IEEE Transactions on Electron Devices
https://doi.org/10.1109/TED.2022.3201837

We present an access technology suitable for scaled gallium nitride (GaN) high electron mobility transistor (HEMT) in Ka -band. The comparison between OFF-state characteristics of a silicon implant-assisted contact and a conventional recessed Ti/Al-based Ohmic contact is presented. The transistor with source/drain extension by Si implantation has a low contact resistance with RC down to 0.4 Ω·mm and a sheet resistance of the implanted layer of 67 Ω /sq. In addition to promising contact performance, transistors with source and drain extension sustain high breakdown voltage (BV) with short dimensions for high-frequency applications. The systematic study of gate–source, gate–drain, and gate length variations shows a new breakdown mechanism for implanted access technology with current flowing beneath the channel leading to an unusual correlation between source–drain spacing and BV. With a conventional titanium-alloyed contact, a punchthrough effect is responsible for the BV. Cross-sectional transmission electron microscopy and secondary ion mass spectroscopy (SIMS) characterizations on both wafers highlight a degradation of the AlGaN-based back-barrier and a high silicon concentration deep into the epitaxial stack on the implanted wafers indicating a way to improve BV with an adapted process flow.

HEMT Average Temperature Determination Utilizing Low-Power Device Operation

Institute of Electronics and Photonics, Faculty of Electrical Engineering and Information Technology, Slovak University of Technology, Bratislava, Slovakia
III-V. Lab, Marcoussis, France

IEEE Transactions on Electron Devices
https://doi.org/10.1109/TED.2022.3200630

The modified thermal device model was adapted to determine the channel temperature of the AlGaN/GaN HEMT operating under pulsed and quasi-static conditions. The differential analysis of the isothermal and thermal part of the resulting current, as well as ambient temperature variation, is utilized to determine the average channel temperature. Ambient temperature increases in the device operating range is required under low-power operation only, while under high-power operation the thermal stress of the device is significantly reduced due to small ambient temperature variation. In addition, trapping phenomena incorporation is demonstrated to obtain more accurate results utilizing the HEMT threshold voltage shift and transconductance. For experimental verification of the thermal model, Al 0.25 Ga 0.75 N/GaN HEMT electrical properties are investigated. Experimentally verified results are in a good agreement with numerical simulations.

GaN Ring Oscillators Operational at 500 °C Based on a GaN-on-Si Platform

Microsystems Technology Laboratories, Massachusetts Institute of Technology, Cambridge, MA, U.S.A
Department of Electrical and Computer Engineering, Rice University, Houston, TX, U.S.A
Department of Electrical and Electronic Engineering, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh

IEEE Electron Device Letters
https://doi.org/10.1109/LED.2022.3204566

A study of GaN for high temperature (HT, up to 500 °C) digital circuits was conducted. A HT-robust GaN-on-Si technology based on enhancement-mode p-GaN-gate AlGaN/GaN high electron mobility transistors (HEMTs) and depletion-mode AlGaN/GaN HEMTs was proposed and used to implement different digital circuit configurations, namely E/D-mode and E/E-mode (E: enhancement, D: depletion). The E/D-mode inverter was found to offer significantly better performance in terms of voltage swing, noise margin, and gain, across temperature and V DD scaling. As calculated from E/D-mode ring oscillators (ROs) with L G = 2 µm, a RO exhibited a propagation delay (t p) of < 1.48 ns/stage at 500 °C. The best RO achieved t p < 0.18 ns/stage at 25 °C. To the best of the authors' knowledge, the proposed technology sets a new boundary of t p vs. L G in wide band gap digital logic, and is operational at the highest reported temperature (500 °C) of a GaN digital circuit. The results reflect the promising potential of the proposed technology for emerging HT applications at 500 °C and beyond.

25–31 GHz GaN-Based LNA MMIC Employing Hybrid-Matching Topology for 5G Base Station Applications

Department of Radio and Information Communication Engineering, Chungnam National University, Daejeon, South Korea
ICT Creative Research Laboratory, Electronics and Telecommunication Research Institute, Daejeon, South Korea
Wavepia Incorporated, Hwaseong-si, South Korea

IEEE Microwave and Wireless Components Letters
https://doi.org/10.1109/LMWC.2022.3201075

This letter presents a gallium nitride (GaN) high electron mobility transistor (HEMT)-based three-stage low noise amplifier (LNA) monolithic microwave integrated circuit (MMIC) that can apply to the fifth-generation (5G) new radio base station applications. The designed GaN-based LNA MMIC utilizes a hybrid-matching topology with double-shunt capacitors at input and output (I/O) matching networks to achieve broad return loss (RL) and bandwidth characteristics across 5G frequency range two bands. The design is fabricated in a 0.15 μ m GaN on silicon carbide technology and attains small signal gains greater than 21 dB, noise figures of 2.4–2.9 dB, 1-dB compression points greater than 19.1 dBm, output third-order intercept points greater than 28.5 dBm, and I/O RLs greater than 10 dB at 25–31 GHz band. The implemented design consumes a power approximately 300 mW.

Statistical investigation of dislocation induced leakage current paths in AlGaN/GaN HEMT structures on Si and the impact of growth conditions

Fraunhofer Institute for Integrated Systems and Device Technology IISB, Schottkystr. 10, D-91058 Erlangen, Germany
Chair of Electron Devices, Friedrich-Alexander-Universität Erlangen-Nürnberg, Cauerstr. 6, D-91058 Erlangen, Germany

Applied Physics Express
https://doi.org/10.35848/1882-0786/ac8639

Threading dislocations in the AlGaN-barrier of four pairwise differently grown AlGaN/GaN high electron mobility transistor structures on Si were investigated with respect to their structural and electrical properties in direct comparison simultaneously ensuring statistical significance of the results. Portions of pure screw and mixed type dislocations were observed to serve as leakage current paths and to be clearly dependent on growth conditions like the AlN nucleation layer growth temperature. The role of impurity segregation at dislocation cores due to growth-dependent locally characteristic strain fields as for example induced by specific dislocation reactions at the AlGaN/GaN interface is discussed as the origin.

… and more than 50 other publications

PRESS RELEASE

Technical and economic information selected by Knowmade

ELECTRONICS

Navitas and JP showcase GaN and SiC at electronica India

SemiconductorToday

Navitas Semiconductor of El Segundo, CA, USA and Dublin, Ireland is participating alongside official distributor JP Electronic Devices in booth EB-21 (Hall 10) at electronica India 2022 at the India Expo Mart in Greater Noida (21-23 September).

Navitas is showcasing its portfolio of wide-bandgap (WBG) semiconductors, which includes the latest family of gallium nitride (GaN) GaNSense half-bridge power ICs, which are said to enable a new level of MHz switching frequencies while dramatically reducing system cost and complexity compared with existing discrete solutions.

Also on show is technology from silicon carbide (SiC) firm GeneSiC (acquired in August), whose MOSFETs and diodes are optimized to meet the power, voltage and ruggedness demands of applications such as uninterruptible power supplies (UPS), solar inverters, wind turbines, industrial motors, smart grids, and electric vehicles (EVs).

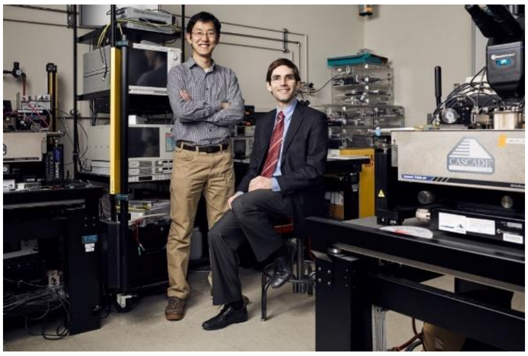
“India and the southern Asian region are key markets for Navitas and electronica India provides an ideal platform to showcase our technologies to designers and engineers developing new generations of applications focused on efficiency and sustainability,” says David Carroll, senior VP of worldwide sales.

Finwave: Getting GaN Ready For 5G

Compound Semiconductor

Come 2025, 5G networks are likely to cover one third of the world population accounting for some 1.2 billion connections, predicts the GSMA, UK's Global System for Mobile Communications. The impact on the mobile industry will be profound, a fact that hasn't been lost on many a semiconductor start-up vying to provide the tech the telecoms industry needs to chase ever-higher speeds and efficiencies.

One clear example is US-based Finwave Semiconductor, the MIT spin-off that started life as Cambridge Electronics and following a decade of quiet development, has emerged and rebranded to commercialise its high efficiency, high linearity GaN devices. Announcing its intention to 'revolutionise the future of 5G communications' in June this year, Finwave has also just won $12.2 million in Series A funding to expand its team, ramp up product development and get its FinFET-based GaN transistors swiftly to market.



As lead financier, Jennifer Uhrig, from Fine Structure Ventures, said at the time: “Finwave's technology unlocks the promise of 5G... The company combines best-in-class power amplification efficiency with high-volume manufacturing to overcome the performance and cost limitations that have together stymied widespread adoption of mmWave.”

Firm foundation

The fin field-effect transistor (FinFET) - with its multiple-gate architecture and nanometre-sized fin-shaped channels - isn't new. Thanks to superior gate control and reduced short-channel effects, silicon FinFETs have been widely used in digital and memory applications as CMOS technology nodes have shrunk over the last decade.

However, at the same time, researchers worldwide have also developed GaN FinFETs for high voltage, high frequency RF and power applications, with GaN-on-silicon FinFETs emerging more recently. And this is where, at least for 5G, the technology holds huge appeal.

As Bin Lu, Finwave's chief executive and co-founder, points out, the 3D fin structure was exactly what GaN transistors needed to raise efficiency and linearity, to meet 5G requirements. “We started to work on GaN-on-Si devices at MIT back in 2007, and then decided to borrow the silicon FinFET architecture and bring this to GaN so we could really shrink the gate length of the transistor,” he says. “On doing this, we discovered some unique things about GaN FinFETs, including the reduced short channel effect and improvements in transistor linearity.”

During this time, Lu and colleagues also devoted much time and effort to manufacturability, initially fabricating structures on 1 cm2 coupons and pioneering their so-called etch-stop barrier structure to progressively scale up the technology to 6 inch and 8 inch Si CMOS fabrication. Since Autumn 2021, with the support of the ARPA-E SCALEUP (Seeding Critical Advances for Leading Energy technologies with Untapped Potential) program, they are working with industry's key epitaxial wafer vendors and partners in an industry first, to transfer their FinFET process to a US-based 8 inch silicon wafer manufacturing plant.

Industry experience

From word go, Lu has worked closely with fellow company co-founder Prof. Tomas Palacios but in the last year or so, they have been joined by key industry veterans. Jim Cable, past chief executive of RF SOI pioneer, Peregrine Semiconductor, is chief strategy officer, while Ian Warbrick, also from Peregrine and International Rectifier, holds the position of chief operating officer. Thom Degnan, past Soitec, US, president and chief operating officer as well as Intel, Infineon and Qualcomm vice president, also stands as executive vice president of sales and marketing.

Each is excited to be a part of Finwave, has a wealth of experience in manufacturing expansions and in taking new products to market. As Cable puts it: “This journey is similar to past journeys - we're bringing a new material into high volume markets.” And according to Degnan: “We've taken a very organised, ready-aim-fire approach - we've established the value proposition, built the plan and executed that plan - this is a very good team.”

… and more than 10 other publications

OPTOELECTRONICS

PlayNitride sampling car-use microLED panels

DIGITIMES Asia

PlayNitride has begun to ship sample microLED panels to 5-6 potential clients for trial use, according to company chairman and CEO Charles Li.

Flexible and transparent microLED panels are especially suitable for automotive displays, Li said. Shipments for trial use have brought revenues on a NRE (non-recurring engineering) basis, Li noted.

Based on potential clients' progress, concept car models equipped with microLED displays will be debuted by early 2024, Li indicated.

While leading automakers and their tier-1 supply chain makers have been actively introducing next-generation automotive displays, PlayNitride has been developing car-use microLED panels since 2019, Li said.

PlayNitride has cooperated with LCD panel maker AU Optronics to produce 9.38-inch microLED panels with transparency of 70% for automotive dashboards and central information displays and began small-volume NRE shipments at the end of 2021, Li noted.

According to Lee Byiing-jye, chairman for Ennostar, a main shareholder of PlayNitride, car-use microLED panels are expected to enter volume production in 2028-2029 based on automakers' roadmaps and until then miniLED-backlit LCD panels will play an important role in the automotive display market.

Production costs for microLED chips and panels may still be too high, but they can be reduced by 90% in the future when yield rates rise through technological improvements for mass transfer, chip size reductions and increased usage area of epitaxial wafers.

Epistar, Ennostar's wholly-owned subsidiary that makes LED and miniLED chips, has invested NT$610 million (US$19.8 million) to acquire a factory building in northern Taiwan for dedicated production of microLED epitaxial wafers and chips. Before the production starts, Epistar and Unikorn Semiconductor, Ennostar's wholly-owned subsidiary that makes compound semiconductor wafers, will both be setting up production capacities for 6-inch microLED epitaxial wafers to reach a monthly level of over 10,000 wafers in 2025.

BluGlass’ Silicon Valley GaN laser fab now contributing to tech roadmaps

SemiconductorToday

BluGlass Ltd of Silverwater, Australia – which has developed proprietary low-temperature, low-hydrogen remote-plasma chemical vapor deposition (RPCVD) technology for manufacturing devices such as laser diodes, next-generation LEDs and micro-LEDs for industrial, defence, display and scientific markets – says that its Silicon Valley production fab in Fremont, CA, USA now has several operational manufacturing processes for GaN laser diode development and is contributing to the firm’s technical roadmaps.

GaN wafers shipped from BluGlass’ Silverwater (NSW) facility have commenced front- and back-end processing steps in the Silicon Valley fab, complementing and accelerating its contract manufacturing development.

The fab is also being utilized for short-loop development cycles, enabling BluGlass to test iterations of the key components of laser diodes – metals, facets and bonds – without requiring a full product. These in-house short-loops can be completed many times faster than processing cycles through contract manufacturers.

BluGlass' Silicon Valley production fab has now been awarded all requisite regulatory approvals, including US Environment Protection Authority (EPA), air quality and waste management permits.

Picture: BluGlass' Silicon Valley GaN laser production fab in Fremont, CA, USA.

"Successfully bringing a semiconductor manufacturing fab online and up-to-speed in a new material class is an important milestone," says president Jim Haden. "Our captive fab is now contributing to our technical roadmaps, enabling us to speed product development while also reducing our cost base," he adds.

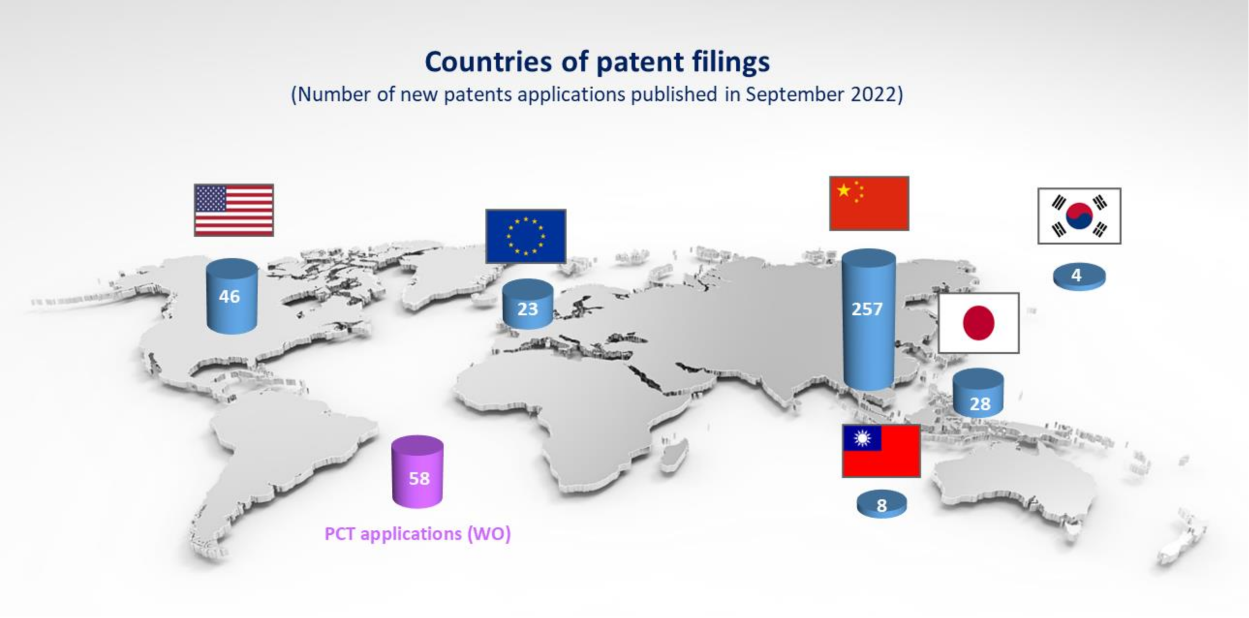
"By bringing core fabrication processes in-house, we reduce supply chain complexity and improve the quality and consistency of our laser diodes," continues Haden. "Each process we bring in-house is the equivalent of a specialist supplier being integrated into the business – reducing the complexity of co-ordinating efforts and problem-solving at multiple locations."

BluGlass says that it is steadily progressing towards commercial reliability with its 405nm and 420nm single- and multi-mode devices.

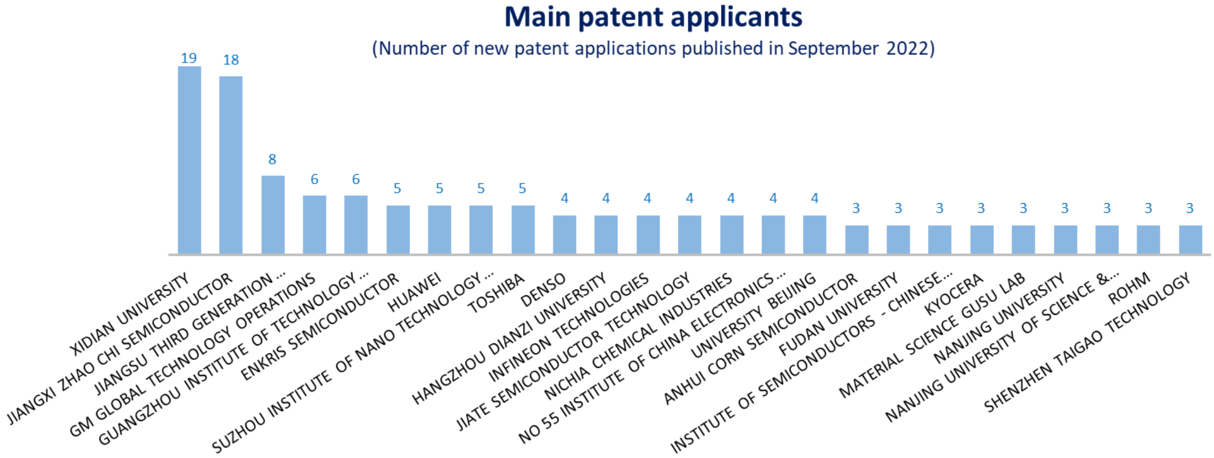
… and more than 10 other publications

PATENT APPLICATIONS

More than 340+ **new patent families (inventions)** were published in **September 2022**.


Countries of patent filings

(Number of new patents applications published in September 2022)


Main patent applicants

(Number of new patent applications published in September 2022)

<u>Other patent applicants</u> Shin Etsu Handotai, Southeast University, United Microelectronics, UESTC, University South Science & Technology China, Wuxi Wuyue Semiconductor, Xiamen Future Display Technology Research Institute, Yangtze Delta Region Institute Quzhou University of Electronic Science & Technology of China, AET Displays, Ams Osram, Applied Materials, Asahi Kasei, Cea, China Electronic Product Reliability & Environmental Testing Research Institute, Chongqing Konka Photoelectric Technology Research Institute, Dynax Semiconductor, Fuji Electric, Henan Xingqiaoyuan Electronic Technology, Huaian Aucksun Optoelectronics Technology, Innoscience, Jiangxi Qianzhao Photoelectric, Jiangxi Yuhongjin Material Technology, Kookmin University, Lumileds, Nanchang University, National University Corporation Tokai National Higher Education & Research System, NGK Insulators, Nuvoton, Panasonic, Shin Etsu Chemical, Suzhou Fengxin Technology, Suzhou Uvcantek, University of Illinois, Xian Saphlux Semiconductor Technology, Xidian Wuhu Research Institute, Xuzhou Jinshajiang Semiconductor, PLA, Airbus Defence & Space, AIST, Akash Systems, Akoustis, Anhui Dehui Chuangxin Technology, Anhui Sanan Optoelectronics, Au Optronics, BALDR Light, Beijing Chip Identification Technology, Beijing Huafeng Test & Control Technology, Beijing Qinghe Jingyuan Semiconductor Technology, Beijing Smartchip Microelectronics Technology, Beijing University of Technology, Beyond Shidai Smartor Technology Beijing, CETC, Changzhou Giantion Photoelectricity Industry Development, Changzhou University, Chengdu Radartone Technology, Chengdu Work Semiconductor, Chenmko, Chongqing Hanbo Display Technology R&D Center, Chongqing Institute of Green & Intelligent Technology Chinese Academy of Sciences, Continental Business Julicheng Semiconductor Shanghai, Delta Electronics, Dexerials, Diyowell Technology Qingyuan, Dongguan Zhongji Integrated Circuit, East China Normal University, Epileds Technologies, Exergan, Ezhou Industrial Technology Research Institute Huazhong University of Science & Technology, Foshan Powertech, Fujian Prima Optoelectronics, Fujitsu, Fuyang Electronic Information Research Institute, GLC Semi Conductor Group SH, Guangdong Huixin Semiconductor, Guangdong Keerda Electronics Technology.

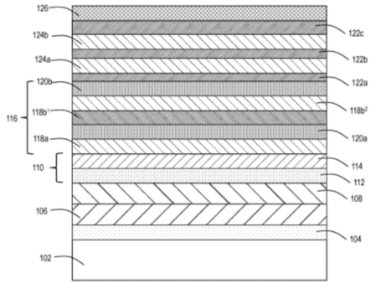
Notable new patent applications

Red LED with low forward voltage, high wall plug efficiency, and high operating current density

Publication number: WO2022/203914

Patent applicant: Lumileds

Described are light emitting diode (LED) devices including a quantum well comprising an indium gallium nitride (InGaN) well and a barrier layer. The indium gallium nitride (InGaN) well has an indium concentration greater than 18% mole fraction. The LED device has a dominant wavelength greater than 605 nm at a current density of greater than or equal to 2 A/cm2.

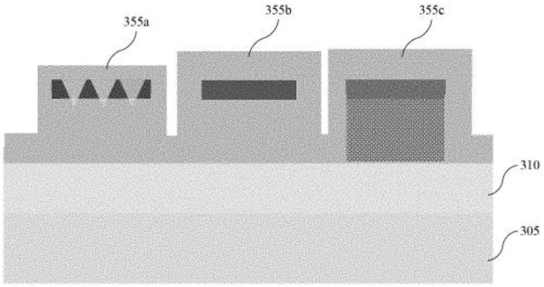


Indium-gallium-nitride light emitting diodes with increased red-light quantum efficiency

Publication number: US20220293821, WO2022/192009, TW202236698

Patent applicant: Applied Materials

Exemplary processing methods of forming a semiconductor structure may include forming a nucleation layer on a semiconductor substrate. The methods may further include forming first, second, and third, gallium-and-nitrogen-containing regions on the nucleation layer. The first gallium-and-nitrogen-containing region may be porosified, without porosifying the second and third gallium-and-nitrogen containing regions. The methods may still further include forming a first active region on the porosified first gallium-and-nitrogen-containing region, and a second active region on the unporosified second gallium-and-nitrogen-containing region. The methods may yet also include forming a third active region on the unporosified third gallium-andnitrogen-containing region.

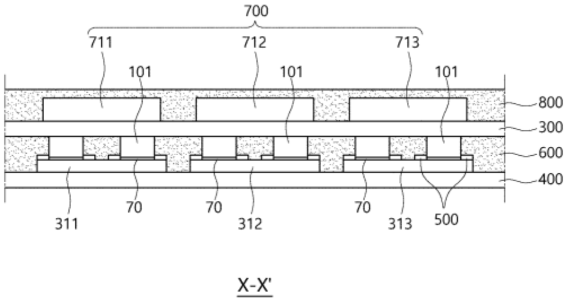


Full-color LED display using ultra-thin led element and method for manufacturing thereof

Publication number: US20220310884, CN115132900

Patent applicant: Kookmin University

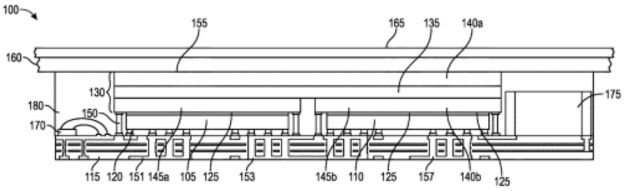
The present disclosure relates to a full-color light-emitting diode (LED) display, and more particularly, to a full-color LED display using an ultra-thin LED element and a manufacturing method thereof.



Electronic packages with integral heat spreaders

Publication number: US20220310475, WO2022/204710, US20220310476
Patent applicant: Navitas Semiconductor

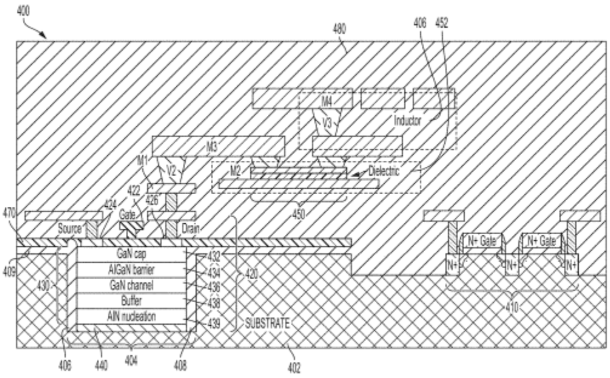
An electronic device includes a substrate and a first gallium nitride (GaN) transistor formed on a first semiconductor die that is electrically coupled to the substrate. A second GaN transistor is formed on a second semiconductor die and is also electrically coupled to the substrate. An integral heat spreader is thermally coupled to the first and the second gallium nitride semiconductor dies and is electrically coupled to the substrate. A first bias voltage is applied to the first GaN transistor via the integral heat spreader and a second bias voltage is applied to the second GaN transistor via the integral heat spreader.



Compound semiconductor and CMOS transistor integration

Publication number: US20220302107, WO2022/197390
Patent applicant: Qualcomm

A radio frequency integrated circuit (RFIC) includes a bulk semiconductor substrate (402). The RFIC also includes a compound semiconductor field effect transistor (FET, 420). The compound semiconductor FET is composed of a gallium nitride (GaN) epitaxial stack (430) in a trench (404) in the bulk semiconductor substrate having sidewall spacers (406, 408). The sidewall spacers are between the GaN epitaxial stack and sidewalls of the trench. A carbonized surface layer (440) is at a base of the trench and coupled to the GaN epitaxial stack. The RFIC further includes a complementary metal oxide semiconductor (CMOS, 410) transistor integrated with the compound semiconductor FET (420) on the bulk semiconductor substrate (402).



… and more than 10 other notable patents

2405 route des Dolines, Le Drakkar
06560 Valbonne Sophia Antipolis, France
contact@knowmade.fr
www.knowmade.com