Blue Solid-State Laser Diode



Overview

Blue, direct diode semiconductor lasers can be built using inorganic gallium nitride (GaN) or InGaN gain medium, upon which many (dozens or more) layers of atoms are placed to form the active part of the laser that generates photons from quantum wells. Infrared lasers built on gallium arsenide (GaAs) semiconductors use similar manufacturing techniques. To contain the photons in the gain medium, AlGaN cladding is constructed.

Key Takeaways

Blue solid-state laser diodes are semiconductor lasers emitting in the 400–480 nm range, offering high output power, long lifetimes, and applications in scientific, industrial, and biomedical fields.

Technology and Materials

Blue laser diodes are primarily based on gallium nitride (GaN) or indium gallium nitride (InGaN) materials, which allow emission in the 400–480 nm wavelength range. These diodes can be fabricated on sapphire substrates or high-quality GaN mono-crystals, with the latter providing fewer defects and longer lifetimes. The development of GaN-based diodes overcame early challenges of lattice mismatch and high defect densities, enabling practical, high-power blue lasers.

Output Power and Configurations

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Modern blue diode lasers can achieve continuous-wave (CW) output powers up to 200 mW for single diodes, while broad-area diodes and diode bars can reach tens to hundreds of watts. By combining multiple diodes, fiber-coupled systems can deliver hundreds of watts from a single multimode fiber. Blue diode-pumped solid-state (DPSS) lasers also exist, where an infrared diode pumps a crystal (e.g., Nd: YAG or Nd: YVO4) and frequency doubling produces blue light, typically at 457 nm or 473 nm.

Performance Characteristics

Blue solid-state laser diodes offer: High beam quality and stabilityLong operational lifetimes compared to early GaN lasersLow noise and precise temperature control in commercial systemsCompact and efficient designs, often plug-and-play with no external cooling required Q-switched DPSS blue lasers provide high peak power, short pulse durations, and repetition rates suitable for marking, measurement, and scientific research.

Applications

Blue solid-state laser diodes are widely used in: Industrial processing: metal marking, cutting, welding, and microfabricationScientific research: spectroscopy, flow cytometry, fluorescence imaging, and LIBSBiomedical applications: bio-imaging, holography, and interferometryConsumer electronics: Blu-ray disc reading and high-density optical storage Their short wavelength allows small spot sizes, high absorption in metals like copper, and precise energy delivery, making them ideal for high-resolution and spatter-free processing.

Commercial Availability

Companies such as RPMC Lasers, CNI, CrystaLaser, HT Laser, and FLC offer a range of blue diode and DPSS lasers, from low-power CW modules to high-power fiber-coupled systems, with options for single-mode or multimode operation, free-space or fiber-coupled outputs, and customizable configurations. These systems often include integrated temperature control, overcurrent protection, and stabilized output power for reliable operation in demanding environments. In summary, blue solid-state laser diodes combine advanced GaN-based semiconductor technology with DPSS configurations to provide versatile, high-performance lasers suitable for a wide range of industrial, scientific, and biomedical applications.

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Article Content

Blue Diode Pumped Solid State Laser

FLC - Frankfurt Laser Company GmbH is a world leading supplier of FP, DFB and DBR laser diodes, SM individually addressable and broad area laser diode

Blue laser

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Blue Lasers – Buyer''s Guide & Supplier List | RP

This buyer''s guide for blue lasers provides technical background, comparison of major types, selection criteria, and an overview of suppliers.

Narrow-linewidth blue diode laser array Assisted ~10 W continuous

The blue laser diode array consists of 8 single TO-packaged blue laser diodes from OSRAM, which are spatially combined along the fast axis and water-cooled at 20℃.

Blue Laser, blue laser system, violet blue laser diode

CrystaLaser designs and manufactures state of the art ultra-compact diode-pumped blue laser systems. Our blue laser features with high stability, high efficiency,

440 nm blue CW diode laser, q-switched solid state laser

All solid state Q-switched blue laser at 440nm has the features of high peak power, high repetition rate, and short pulse duration, which is widely used in marking, carving, measure, scientific research, and

Blue Laser Diode-Based Visible Light Communication and Solid-State ...

Laser diode-based solid-state lighting Blue GaN LD is an emerging candidate in the future high-luminance SSL because of its advantages over the LED and traditional lighting sources.

Blue Laser Diodes – Mouser

Blue Laser Diodes are available at Mouser Electronics. Mouser offers inventory, pricing, & datasheets for Blue Laser Diodes.

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How do lasers work? | Who invented the laser?

Photo: A classic solid-state ruby laser: Photo courtesy of US Department of Energy. Solid-state lasers produce high-powered beams, typically

Laser Diode Market Size, Share and Opportunities, 2026-2033

Indium Gallium Nitride (InGaN) produces blue and green laser diodes for high-density data storage and solid-state lighting. Gallium Nitride (GaN) is suitable for ultraviolet and blue laser diodes

Pulsed blue laser at 491nm by Nonlinear Cavity Dumping

The blue-emitting lasers are available in many forms such as laser diodes, diode pumped solid-state (DPSS) lasers, optically pumped semiconductors, vertical-cavity surface-emitting lasers

High Power 100W 200W 450nm Blue Fiber Coupled Laser Diode

Find verified High Power 100W 200W 450nm Blue Fiber Coupled Laser Diode suppliers and wholesalers with AI-powered sourcing. Access real-time supply chain data and learn how to import from China

OBIS LS/LX

OBIS LS/LX are the original compact smart lasers, offering plug-and-play simplicity with over 30 wavelengths from the UV to near-IR plus optional fiber delivery.

Recycle Renesas Optical Sensors:Ambient Light Sensors,Laser Diode ...

Renesas laser diode drivers are specifically designed for projectors, optical storage and LiDAR transmitters, covering three major categories: multi-channel high-speed modulation,

Invention, development, and status of the blue light-emitting diode ...

The realization of the first high-brightness blue-light-emitting diodes (LEDs) in 1993 sparked a more than twenty-year period of intensive research to improve their efficiency. Solutions to

Blue Laser Diode-Based Visible Light Communication and Solid-State Lighting

Abstract and Figures In this chapter, we review our recent work on blue laser diode-based visible light communication and solid-state lighting.

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Blue Laser Diode-Based Visible Light Communication and Solid-State ...

In this chapter, we review our recent work on blue laser diode-based visible light communication and solid-state lighting. Gallium nitride (GaN) phosphor-converted white light-emitting

Related Video Reference

This video was associated with the source search result. Verify technical details against current product documentation and project requirements.

Additional source notes

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EU project coordination: Parque das Nações, Lisbon, Portugal

This document is for preliminary research. Verify specifications against current standards, product documentation and project requirements.

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