Gallium arsenide infrared laser diode

Overview

The semiconductor laser is constructed from a single crystal of gallium-arsenide with a p-n junction. The n-section is heavily doped with tellurium and the p-section is heavily doped with zinc.

Key Takeaways

A GaAs infrared laser diode is a semiconductor device that emits coherent infrared light through stimulated emission in a forward-biased GaAs p-n junction.

Material and Structure

Gallium arsenide (GaAs) is a direct bandgap III-V semiconductor with a zinc blende crystal structure, making it highly efficient for light emission. A typical GaAs laser diode consists of a thin active layer (~0. 2 microns) of GaAs sandwiched between n-type and p-type GaAs layers.

The polished faces of the GaAs crystal form a resonant optical cavity, which allows photons to bounce back and forth, stimulating further emission and producing a coherent infrared beam.

Working Principle

When a forward voltage is applied across the p-n junction, electrons from the n-type region and holes from the p-type region are injected into the active layer. In this region, electron-hole recombination occurs, releasing energy as photons.

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Because Ga

As has a direct bandgap, this energy is efficiently converted into infrared light, typically in the near-infrared range (700–3000 nm). As the current increases, population inversion is achieved, and stimulated emission dominates, generating a coherent laser output.

Enhancements and Variants

To improve performance, GaAs laser diodes often incorporate heterostructures such as AlGaAs or InGaAs layers, which enhance carrier confinement and increase internal quantum efficiency. A common variant is the GaAlAs laser, which emits in the near-infrared region (650–900 nm) and is widely used in telecommunications, medical devices, and industrial applications. ApplicationsGaAs infrared laser diodes are used in: Optical communications for fiber-optic data transmission Medical devices such as laser therapy and surgical instruments Industrial processes including material processing and sensing Consumer electronics like CD/DVD players and infrared remote controls SummaryA GaAs infrared laser diode leverages the direct bandgap of GaAs to efficiently produce coherent infrared light.

Its performance can be tailored through heterostructure engineering, and it finds broad applications in telecommunications, medicine, and industry, making it a versatile and essential semiconductor laser technology.

Article Content

GaAs Semiconductor Laser Construction

The semiconductor laser is constructed from a single crystal of gallium-arsenide with a p-n junction. The n-section is heavily doped with tellurium and the p-section is heavily doped with zinc. When a

Semiconductor Laser (Laser Diode): Construction, Working, Diagram ...

A semiconductor laser, also called a laser diode, consists of a forward-biased p–n junction in gallium arsenide (GaAs). Electrons and holes recombine, releasing photons.

GaAs nano-ridge laser diodes fully fabricated in a 300

A new integration approach, nano-ridge engineering, enables electrically driven GaAs-based laser diodes to be fabricated on Si wafers in a

Application Notes and Protocols for Gallium Arsenide (GaAs) Based ...

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This document provides detailed application notes and experimental protocols for the design, fabrication, and characterization of GaAs-based IR LEDs. It is intended for researchers and professionals

InGaAs Photodiodes 500

Modern InGaAs PIN photodiodes are panchromatic and convert broadband light to photocurrents in the Visible-NIR range. Concretely speaking, this means a

GaAs nano-ridge laser diodes fully fabricated in a 300-mm CMOS

Here we report the electrically driven gallium arsenide (GaAs)-based laser diodes fully fabricated on 300-mm Si wafers in a CMOS pilot manufacturing line based on a new integration approach, nano

RCA Gallium Arsenide Laser And Emitters OPT 100 3-70

This brochure contains a concise description of the RCA line of solid-state emitters, including infrared emitters, single- and multiple-diode lasers utilizing either gallium arsenide or gallium aluminum

ST2025(20)02(March)Cover

Researchers working in Belgium claim record-low crystal defectivity in epitaxially grown gallium arsenide (GaAs) on silicon (Si) used as the base for nano-ridge (NR) quantum well laser diodes (LDs)

Gallium Arsenide GaAs

Dopted Gallium arsenide GaAs used for in LEDs, photocatodes, laser diodes, etc. Non-doped semi-insulating gallium arsenide is primarily used in microelectronics, and exclusively for infrared optics.

LED (Light Emitting Diode): Symbol, Diagram, Working Principle ...

Summary A Light Emitting Diode (LED) is a semiconductor device that emits light when forward biased. It works on the principle of electroluminescence, where electron–hole recombination releases

Near-Infrared (NIR) LED Guide: 850 nm vs 940 nm

Near-infrared LED guide across 700 to 1000 nm: 850nm vs 940nm performance, eye safety, and uses in night vision, sensing, and biometrics, with

LASERS IN PROSTHODONTICS | PPTX

41 Infrared systems • Diode lasers— 800-1064 nm • Aluminium Gallium Arsenide —810 nm • Gallium Aluminium Arsenide—940 nm • Indium Gallium Arsenide—980 nm • Indium Gallium Arsenide

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Solid state wideband fourier transform infrared spectrometer

For example, a pumping laser and a frequency mixer such as an oriented patterned gallium arsenide (“OPGaAs”) or oriented patterned gallium phosphide (“OPGaP”) mixer can be used to perform the up

VCSEL Market Size, Share, Analysis Forecast 2026-2034

Gallium arsenide dominates the vertical cavity surface emitting laser market share A detailed breakup and analysis of the market based on the material have also been provided in the report.

Light-emitting diode

In a light-emitting diode, the recombination of electrons and electron holes in a semiconductor produces light (infrared, visible or UV), a process called

Europe Opto Semiconductors Size, Share by 2033

Europe Opto Semiconductors CAGR: 13.45% European Opto Semiconductors Segments: By Product (LEDs, Laser Diodes, Infrared components, Image Sensors, Others); By Material (Gallium Nitride,

Optoelectronics Market by Product Type, Material Type, Application ...

Optoelectronics Market by Product Type, Material Type, Application - Global Forecast 2026-2032 - The Optoelectronics Market is projected to grow by USD 104.29 billion at a CAGR of 5.56%

Lasers in Conservative dentistry

This document provides an overview of the use of lasers in conservative dentistry. It discusses the history and development of lasers, classifications of lasers based on power output and wavelength,

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