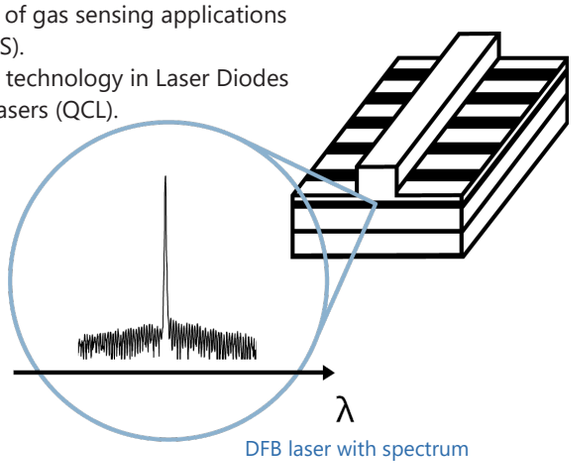
Nanosystems and Technologies GmbH
nanoplus

DFB Laser Concept
LD, ICL, QCL

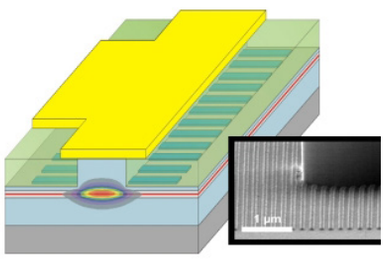
Distributed feedback lasers (DFB) provide longitudinal and transverse single-mode emission at a precise wavelength with a narrow linewidth. In comparison to distributed Bragg reflectors or VCSELs, they guarantee high output power and large mode-hop-free tunability. Thus, DFB lasers perfectly meet the high standards of gas sensing applications based on tunable diode laser absorption spectroscopy (TDLAS).
This technical note introduces the unique nanoplus DFB laser technology in Laser Diodes (LD), Interband Cascade Lasers (ICL) and Quantum Cascade Lasers (QCL).



DFB laser with spectrum

Key features:

- MONOMODE
- CONTINUOUS WAVE
- ROOM TEMPERATURE
- MODE HOP FREE TUNING


Schematic of nanoplus DFB laser

The **nanoplus DFB laser concept** (see schematic) is based on an **overgrowth-free etching process**.

In nanoplus DFB lasers, the complex coupling is achieved by combining a **ridge waveguide structure** with **metal gratings** on top of the waveguide layer on both sides of the laser ridge.

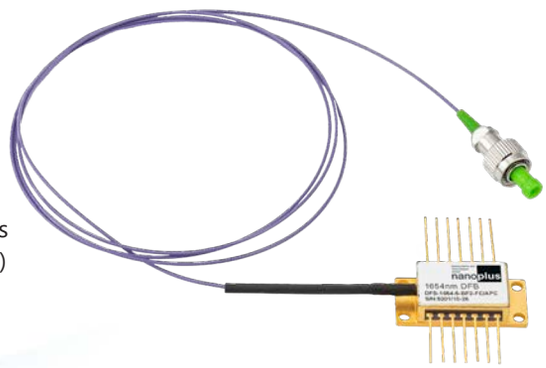
This high-precision process is carried out using electron beam lithography and allows the emission wavelength of the resulting DFB laser to be defined down to the nanometer range. In this way, the lasers can be precisely specified for their spectroscopic task.

Compared to other production technologies, the nanoplus concept eliminates high-grade orientation-independent growth or patterning-related defects near the active layer.

"High-precision single mode lasers for ultra fine measurements."

This patented manufacturing system offers many further advantages. It can be transferred to **any material system** such as GaAs, InP and GaSb, ICL, QCL (**wide wavelength range**), is **easily customizable** (**short time-to-market**) and achieves **high yields** (**cost-effective production of large quantities)**.

nanoplus uses this technology to manufacture laser sources for gas sensor applications in the visible, near infrared (NIR) and mid infrared (MIR) wavelength ranges. The devices are available at any customized wavelength between 760 nm and 14000 nm.


nanoplus laser in butterfly package with single mode fiber

REGISTERED COMPANY ISO 9001 14001

ATTENTION OBSERVE PRECAUTION FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES

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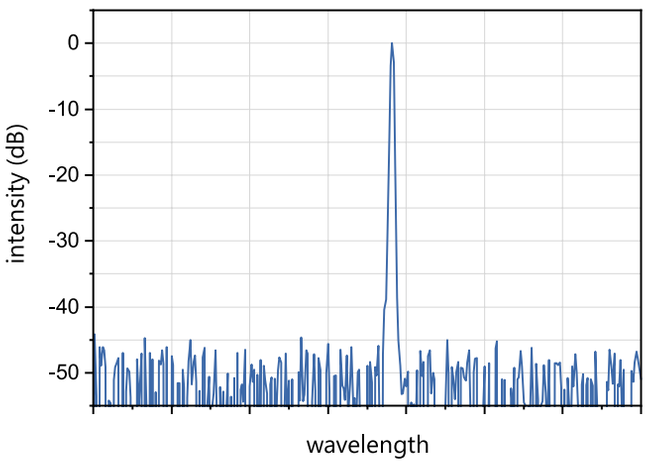
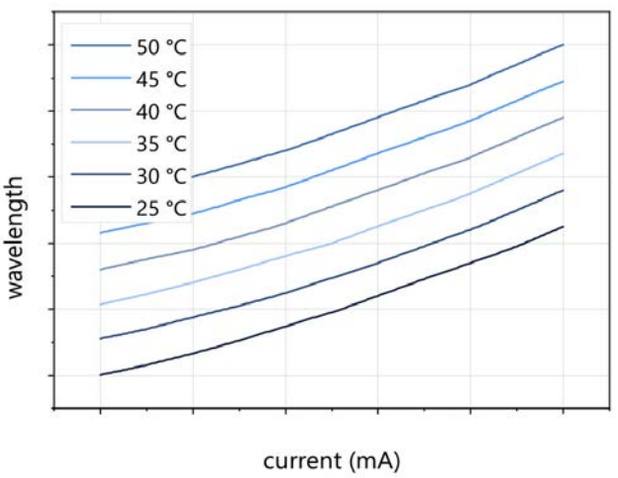
Distributed Feedback Lasers: 760 nm - 14000 nm

With its unique production technology nanoplus designs three types of laser structures covering the nearly visible, NIR and MIR wavelength regions:
Bipolar Laser Diodes, Interband Cascade Lasers, Quantum Cascade Lasers.

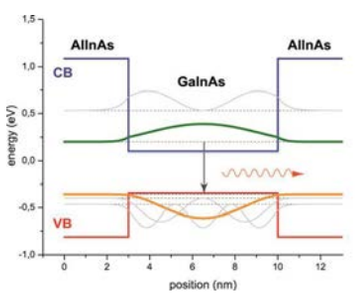


Typical cw spectrum of a nanoplus DFB laser at room temperature

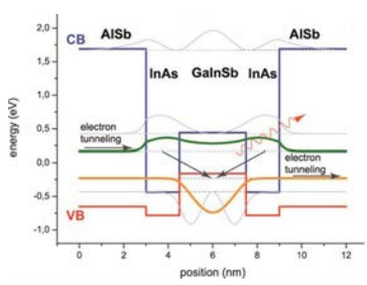


Typical mode-hop-free tuning of a nanoplus DFB laser by current and temperature

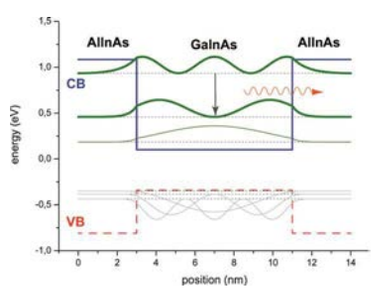
Bipolar Laser Diodes 760 nm - 2900 nm	Interband Cascade Lasers 2800 nm - 6500 nm	Quantum Cascade Lasers 6000 nm - 14000 nm
At the **p-n junction** of a semiconductor diode, there is an optical **interband** recombination of electrons and holes. This transition has a **high energy gap**. For this reason, we achieve a shorter wavelength range with these devices.	At the **W-shaped quantum well** of the semiconductor material, an optical **interband** recombination of electrons and holes occurs. The **energy** of this transition is **between** that of an **LD and a QCL**. For this reason, we achieve a medium wavelength range with these devices.	Electrons and holes recombine optically within the **conduction band** of the semiconductor material (**intraband**). The valence band is irrelevant for the optical transition. The **energy** of this transition is **low**. For this reason, we achieve a wider wavelength range with these devices.



Structure LD



Structure ICL



Structure QCL

Please check our literature on our website: nanoplus.com/literature.

Further technical notes

ESD precautions: How to avoid ESD damage to your laser.

Thermal management: How to maximize temperature stability to optimize laser performance.

Technical notes: nanoplus.com/downloads

Please contact sales@nanoplus.com for customized specifications, quotes and further questions.

nanoplus Nanosystems and Technologies GmbH, www.nanoplus.com, phone: +49 (0) 3693 50 5000-0, email: sales@nanoplus.com

nanoplus.com

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