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VERTIGO - Versatile two micron light source

EU-project VERTIGO has developed ready-to-use OEM laser module for the 1.9 – 2.8 µm range

This European project explores the group III-antimonide (III-Sb) compound semiconductor materials system, and so, develops novel OPSDLs emitting in the 2.0-2.5µm wavelength range. This wavelength range is of special importance for applications such as gas detection, including long-range LIDAR applications, free-space optical communication, medical diagnostics, laser surgery and optical pumping of longer wavelength solid-state lasers. Within VERTIGO, all aspects from the design, growth and technology of the GaSb-based OPSDL semiconductor structure up to application specific OEM laser modules where covered. Three distinct laser modules have been realized within the project, all based on the GaSb-based OPSDL semiconductor gain chip with intracavity heatspreader, mounted in the VERTIGO submount (see Fig. 1).

Fig. 1: OPSDL semiconductor structure with transparent heatspreader, mounted inside the VERTIGO submount. This mounted chip is the core for all different laser modules.

1) Basic OPSDL Laser Module

This is a compact, high-power OPSDL laser module (Fig. 2) that reaches 2.5 W output power in CW-operation at room temperature with a 2.0 µm OPDSDL-chip and 1.8 W with pure TEM_{00} mode operation.

Fig. 3 shows a complete hermetically sealed laser system, based on a compact version of this 2.X µm module, which includes also the 980 nm pump diode, a monitor photodiode and a red pilot beam. By simply changing the mounted OPSDL gain chip, the wavelength of the OPSDL can be changed in the 1.9 – 2.8 µm wavelength range.

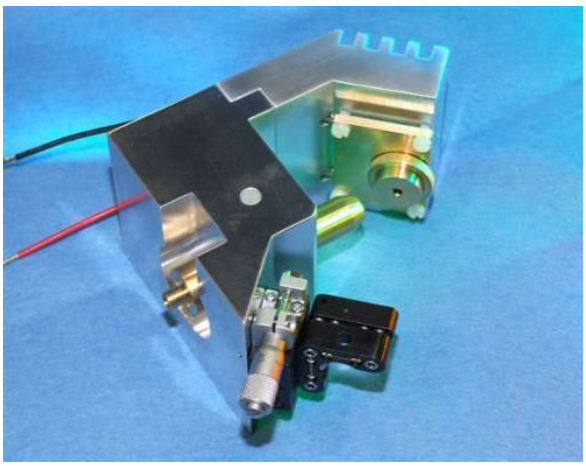

Fig. 2: VERTIGO Basic Laser Module

Fig. 3: Hermetically sealed OPSDL laser system, including pump laser, monitor photodiode and red pilot laser.

2) Narrow Linewidth OPSDL Laser Module

Consortium partner LISA laser OHG designed and constructed a compact Narrow Linewidth Module (see Fig. 4) which provides a very high mechanical and thermal stability of the laser resonator and the pump optics. Therefore wavelength shifts of the laser due to temperature changes of the components or mechanical vibrations are minimized. To suppress outside influences on the laser stability the housing is completely sealed. The heat deposited in the OPS chip from the pump radiation is removed by a TEC and a passive heat sink. A control loop is used to stabilize the OPS temperature.

The NLM can deliver over 200 mW of single mode laser power at room temperature when using a Volume Bragg Grating (VBG) as output coupler. With the VBG the laser emission wavelength can be precisely selected within the gain spectrum of the optically pumped semiconductor disk laser (OPSDL), developed by the VERTIGO consortium. The linewidth of the single mode NLM was measured to be below < 2.4 MHz, which was the resolution limit of the available Scanning Fabry-Perot Interferometer.

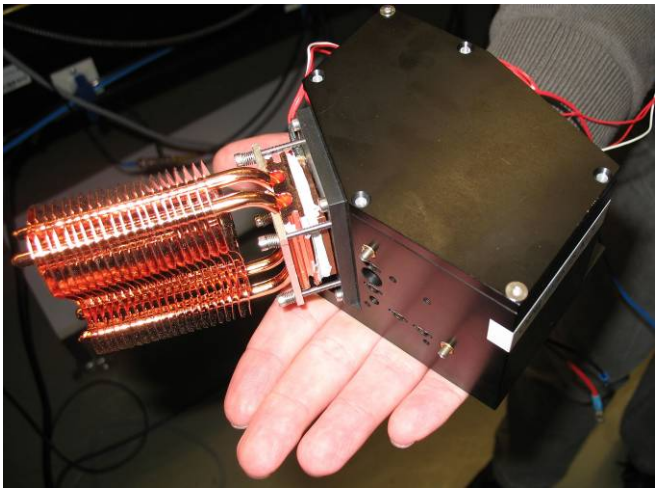

Fig. 4: Narrow Linewidth Module, emitting a TEM_{00}, single frequency (linewidth < 2.3 MHz), stable laser emission at 2 µm wavelength

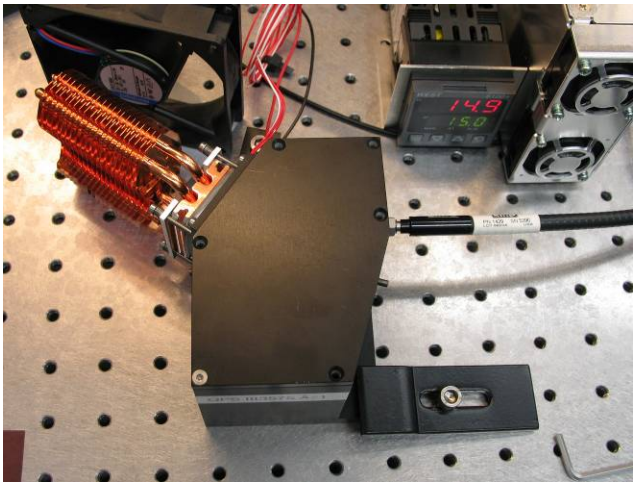

Fig. 5: Narrow Linewidth Module with heat sink, temperature controller and power supply for the TEC

3) Modulated OPSDL laser module

In order to serve applications, requiring a fast modulated laser source in the 2.X µm wavelength range, a modulated laser modules was realized, incorporating a compact 2.3 µm OPSDL laser and a fast Mach-Zehnder modulator, capable a modulation speed up to 1GHz. The characteristic of this module (excellent beam quality with TEM_{00} mode operation, fast modulated output) is ideally suited for spectroscopic applications (accustom-optic spectroscopy) or free-space optics communication.

For further information please do not hesitate to contact us: Marcel Rattunde, Project Coordinator, Fraunhofer Institute for Applied Solid State Physics (IAF), marcel.rattunde@iaf.fraunhofer.de

Information Society Technologies

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