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VERTIGO - Versatile two micron light source

Semiconductor Disk Laser for the 2.X μm range

Optically pumped semiconductor disk lasers (OPSDLs), also referred to as vertical-external-cavity surface-emitting lasers (VECSELs), have emerged recently as a new category of semiconductor lasers (see Fig. 1 for a schematic view of the laser setup). The OPSDL concept has been shown to be capable of multiple-Watt output power and laser emission in circular, nearly diffraction-limited beams even at high power levels; the combination of these properties is in general not achievable using conventional edge-emitting diode lasers. Thus, an OPSDL combines the advantages of semiconductor lasers (high efficiency, wavelength versatility) with those of conventional solid-state lasers (simultaneously high beam quality and output power). So far, research activities in this class of lasers was predominantly focused on AlGaAs/GaInAs/GaAs-based devices emitting in the 0.8 - 1 μm wavelength range.

This European project explores the group III-antimonide (III-Sb) compound semiconductor materials system, and so, develops novel OPSDLs emitting in the 2.0-2.5 μm 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.

The first 2.3 μm GaSb-based OPSDLs, the project consortium realized, show already the tremendous potential of these long wavelength lasers (see Fig. 2). At a heat-sink temperature of -20°C a maximum output power of 1.5 W is obtained, limited by the available pump power rather than by thermal rollover. The optical power efficiency of 16 % corresponds to a high external quantum efficiency of 35 %. Increasing the heat-sink temperature to $+10^\circ\text{C}$, the output power still exceeds 1 W at a power efficiency of 13 % (28 % external quantum efficiency).

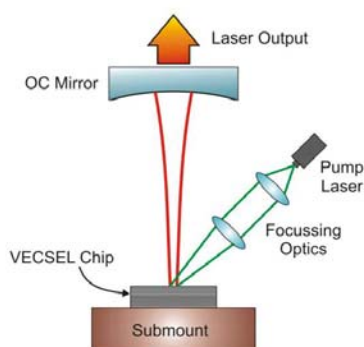


Fig. 1: Schematic OPSDL setup

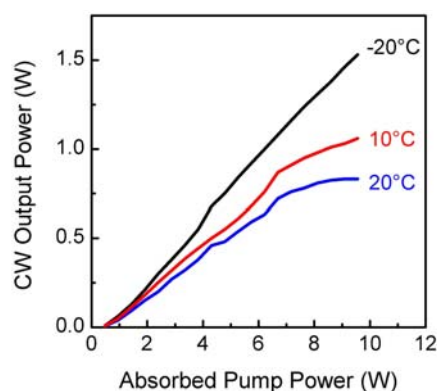


Fig. 2: CW output power vs. absorbed pump power of a 2.3 μm OPSDL for several heat sink temperatures.

For further information please do not hesitate to contact us:

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