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CW-OPO IN MID INFRARED RANGE PUMPED BY A SEMI-CONDUCTOR DISK LASER

Task

The spectral range that can be addressed by using innovative optically pumped GaSb semiconductor disc lasers (OPSL) can be expanded considerably when the frequency is converted by optical parametric oscillators (OPO). As a design for a compact and cost-efficient tunable laser beam source in the mid-infrared, an OSPL-pumped OPO is to be demonstrated with an output wavelength above 4 μm in continuous wave operation.

Method

An appropriate OPSL at 1.9 μm was provided within the scope of a joint project with Fraunhofer IAF. Since the power of today's GaSb-OSPLs is not sufficient to operate the OPO in a singly resonant (SRO) setup, the single frequency operation of the OPSL is used to enhance the power in an external cavity. Stable input coupling is maintained by a Pound-Drever-Hall control. In addition, the enhancement cavity serves as a resonator for one of the parametric waves. In the literature, such a configuration is called a pump-enhanced singly resonant oscillator (PESRO).

Result

With the commercially established crystal material ppLN as nonlinear medium, an OPSL-pumped cw-PESRO has been demonstrated, having a MIR power of 20 mW at 3.3 μm (signal) and 4.5 μm (idler). With a laboratory setup, mode-hop-free operation over several minutes has been shown. When other crystal materials are used, the wavelength range can be expanded up to 15 μm .

Applications

Potential fields of application include optical near-field microscopy, spectroscopy with absorption bands in the MIR and photo-thermal common-path interferometry (PCI) to characterize optical components at MIR wavelengths.

Additional applications include the use as a narrow-band seed laser for high-power lasers in the spectral range of up to 15 μm .

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1 PESRO cw OPO with a ppLN crystal.