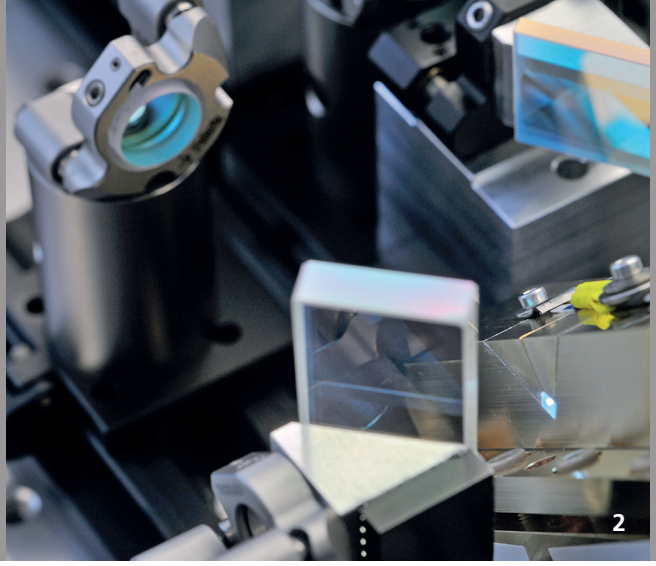

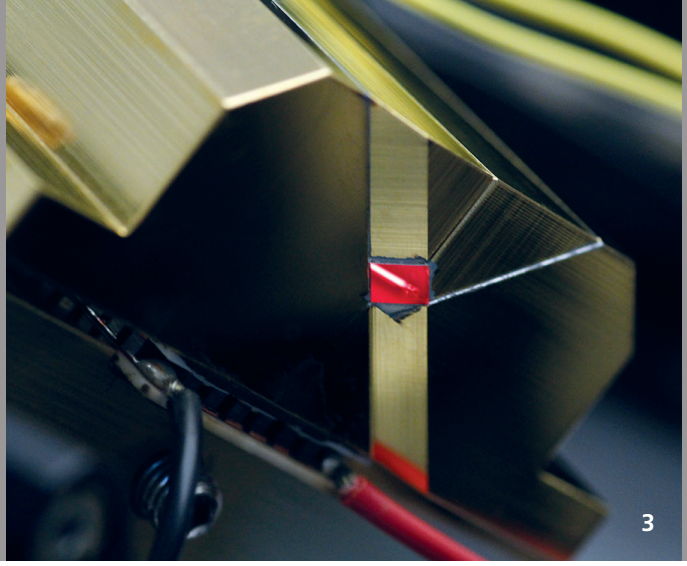

Q-SWITCHED SINGLE FREQUENCY DOUBLE PULSE OSCILLATOR AT 2 µm

Task

Laser beam sources in the wavelength range around 2 µm and with pulse lengths in the nanosecond range can be applied in many different areas: materials processing, remote sensing, science and medical technology can all make use of the special absorption properties of 2 µm radiation. As part of the DLR project »CHOCLID« and the ESA project »HOLAS«, a pulsed, spectrally narrow beam source with a wavelength of 2.051 µm is being developed to detect CO_2 in the atmosphere by means of LIDAR methods.

Method

Based on INNOSLAB technology, an Ho:YLF MOPA system has been designed using numerical simulations to generate the required double pulses with 45 mJ and 15 mJ pulse energy and a repetition rate of 50 Hz. The system is pumped by a diode-pumped Tm:YLF laser. In the oscillator, pulses should be generated at a constant energy of 2 mJ. During design, particular attention was paid to the electro-optical efficiency and compliance of critical energy densities to prevent laser-induced damage of optics.

Result

As a pump source for the Ho:YLF oscillator, a Tm:YLF rod laser was installed, having a cw power of 15 W, which is tunable between 1870 nm and 1892 nm and whose power is limited by the pump diodes used. The Ho:YLF oscillator pumped in this way generates longitudinally single-mode, diffraction-limited double pulses with a spacing of 750 µs at a 50 Hz repetition rate, 2 mJ pulse energy and a pulse duration of 25 ns. The spectral bandwidth is 1 MHz (RMS) and the time-bandwidth product is bandwidth limited to about 0.44. For single pulses with a repetition rate of 100 Hz, 11 mJ can be achieved. Testing at high pulse energies shows that there is a great distance from the damage threshold at the operating point of 2 mJ.

Applications

As well as a master oscillator for the following amplifier, the oscillator can be used in materials processing. The output wavelength of 2 µm is also advantageous for use as a source to pump efficient optical-parametric frequency converters for the long-wave infrared spectral region.

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2 Tm:YLF rod laser.
3 Ho:YLF oscillator.