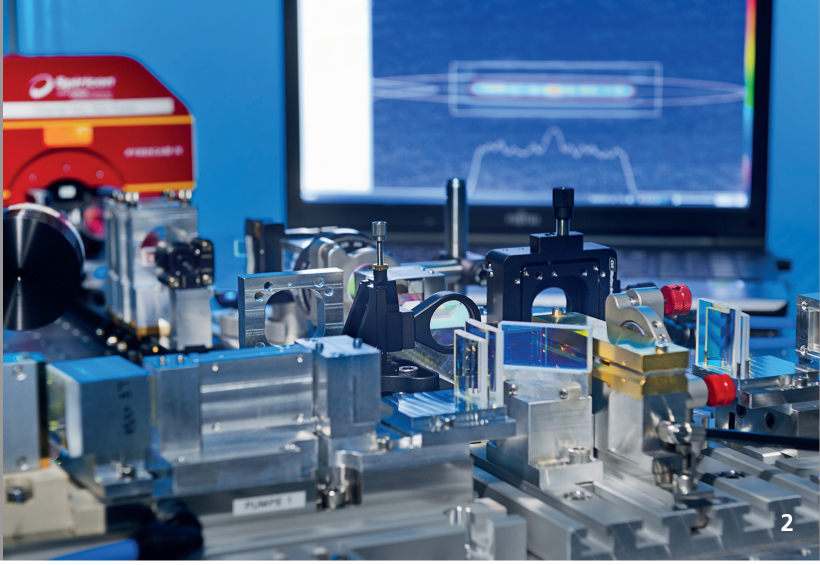

Q-SWITCHED INNOSLAB LASER OSCILLATOR AT 1.9 µM EMISSION WAVELENGTH

Task

Within the Fraunhofer Max Planck cooperation project DIVESPOT, the partners are developing pulsed laser beam sources, among others, that emit in the near infrared (IR-B) at wavelengths from 1.9 to 2.9 µm. Short high-energy laser pulses at 1.9 µm are used for efficient optical pumping of the Cr:ZnSe gain medium. These are necessary because the luminescence lifetime of Cr:ZnSe at room temperature is only a few µs.

Method

The pulsed pump light radiation with a wavelength of 1.9 µm is generated with a Q-switched solid-state laser. Here, an INNOSLAB laser oscillator with Tm:YLF is used as the gain medium. For this purpose, an adapted oscillator design with resonator-internal lens was developed, a design that allows the use of an acousto-optic modulator as a Q-switch. The slab-shaped laser crystal was installed into an optimized heat sink by means of a soldering process to achieve very good and homogeneous heat dissipation. The Tm:YLF laser medium is pumped on both sides with high-brilliance laser stacks at 793 nm.

Results

Fraunhofer ILT built a Q-switched INNOSLAB oscillator, emitting at a wavelength of 1.9 µm. A pulse energy of more than 30 mJ was achieved at a pulse repetition rate of 1 kHz. At a repetition rate of 3 kHz, 22 mJ was generated, corresponding to an average optical output power of 66 W. The optical-optical efficiency was up to 20 percent. The pulse length was just under 600 ns. The beam profile had a top hat distribution (M^2 ~ 200) in one beam axis and a Gaussian distribution (M^2 ~ 1.3) in the beam axis orthogonal to the first beam.

Applications

This laser-beam source is suitable for optical pumping the Cr:ZnSe amplification medium thanks to its beam distribution, especially for slab-shaped amplifiers. Due to the high absorption of laser radiation at 1.9 µm in water, the laser beam source lends itself to processing hard and soft tissue in medical technology. After the beam profile is symmetrized, low-loss transport fibers can be used for beam transport and, thus, can easily be integrated into processing systems.

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2 Q-switched 1.9 µm INNOSLAB oscillator.