DIRECT GENERATION OF LASER RADIATION IN MIR

Task

As part of the project »DIVESPOT« with the Max Planck Institute for Structure and Dynamics of Matter, Fraunhofer ILT has investigated the direct generation and amplification of laser pulses in the MIR range at 3 µm output wavelength and with pulse durations between 100 ps and 1,000 ps. In addition, the institutes examined gain media that can address the wavelength range. Their goal is to develop a new precision tool for surgery.

Method

For generating laser light at a wavelength in the range of 3 µm, the chromium-doped II-VI compound semiconductor material zinc selenide was used as gain media. The pump source is a thulium solid-state laser emitting at a wavelength of 1.9 µm, which can be operated both continuously and pulsed with pulse durations of a few hundred nanoseconds. This laser was used to optically pump another resonator with Cr: ZnSe gain media. It then emits laser radiation in the wavelength range between 2.6 to 3 µm. The output wavelength can be tuned by selective elements in the resonator.

Results

Fraunhofer ILT has constructed a laser beam source that runs in continuous operation, has almost 2 W output power and an optical-optical efficiency of 21 percent. The emission wavelength was between 2.6 and 2.7 µm. In Q-switched operation, a pulse energy of 0.15 mJ was achieved at a repetition rate of 1 kHz.

Applications

Laser beam sources in the MID-IR range are suitable for use in medical technology, e.g. as a laser scalpel for soft tissue applications. Furthermore, these laser beam sources can be used for molecular spectroscopy. Another field of application is the processing of silicon.

The project »DIVESPOT« has been funded within the cooperation program between the Fraunhofer-Gesellschaft and the Max Planck Society.

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2 Cr: ZnSe laser with Tm pump laser.

3 Cr: ZnSe laser crystal.