Short-pulsed fiber amplifiers at 2 µm wavelength

As part of the ZIM project Diofast2, Fraunhofer ILT and the industrial partner PicoLAS are developing a compact and cost-effective short-pulsed fiber amplifier for wavelengths around 2 µm for various potential applications in materials processing, medical technology or metrology. The pulses shall be generated directly by a laser diode and amplified with subsequent fiber-based gain sections to several 10 W of average power at pulse durations below 500 ps. This approach offers technical and economic advantages over commercially available laser systems with comparable pulse durations, which are largely based on mode-locked oscillators.

Simulation and experimental realization

With updated simulation software, Fraunhofer ILT has developed a concept for the multistage amplification of thulium doped fibers to > 20 W average power for short pulses. Based on this, it built a polarized cladding-pumped fiber amplifier with pump diodes running at about 800 nm. As signal source a suitable DFB laser diode is used, which is gain-switched with novel electronics developed by the project partner PicoLAS, thereby providing pulse durations in the range of 50 to 200 ps.

Results and fields of application

The three-stage, single-mode fiber amplifier achieves a spectrally cleaned average output power of > 20 W at a center wavelength of approx. 1950 nm. With this system, peak powers of up to approx. 10 kW are achieved, with slightly broadened pulse durations in the range of 300 to 350 ps due to nonlinear effects. In addition to its use as an eye-safe beam source for LIDAR applications, these laser or individual amplifier stages of the overall system can be used for material processing, e.g. of plastics transparent in the visible wavelength range. Due to the high absorption in water and the hemostatic effect due to the coagulation effect, use for surgical precision applications is also possible.

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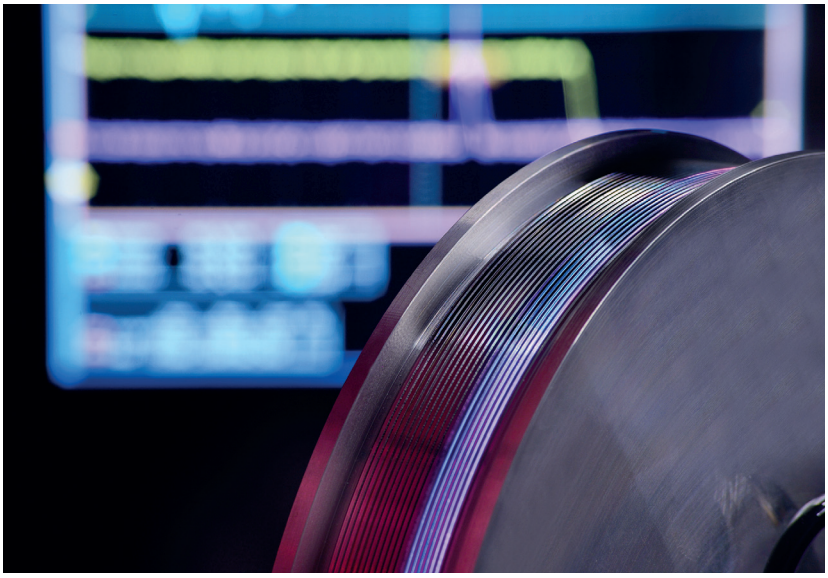

Thulium-doped short-pulsed fiber amplifier.