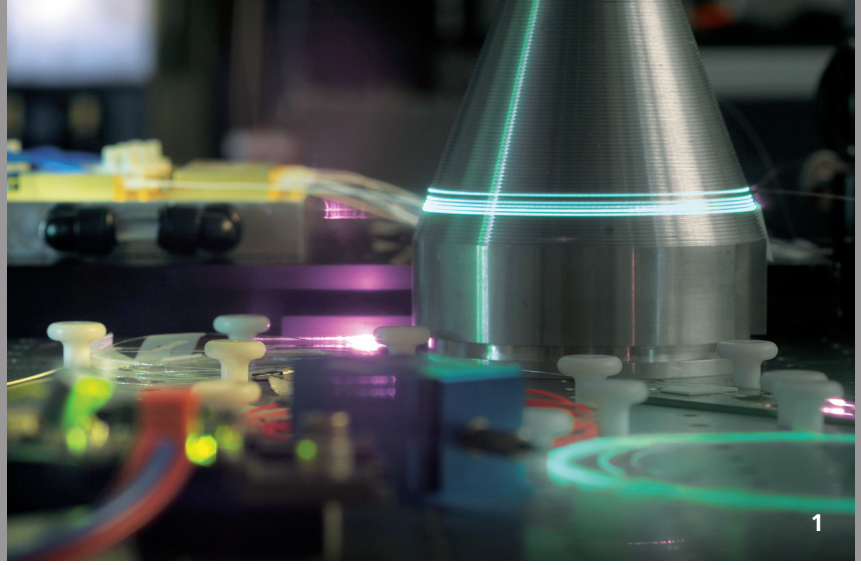

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FIBER AMPLIFIER WITH ADJUSTABLE PULSE SHAPE

Task

In the project »Fazit« diode seed sources with variable pulse parameters and the subsequent amplification are investigated. Based on pulsed diode drivers delivered by the project partner Picolas, compact fiber amplifiers with variable repetition rate and pulse duration in the region of 0.5 ps to 10 µs and peak power in the kW region are being developed for further power scaling. A fiber amplifier with arbitrary pulse shape is also to be implemented as part of the project. On the one hand, the adjustable pulse shape can be used to pre-compensate the pulse deformation that occurs in the fibers during amplification, thus reducing the influence of nonlinear effects. On the other hand, a freely adjustable output pulse shape is also advantageous for a host of materials processing applications.

Method

A two-stage, linearly polarized fiber amplifier for pulse duration in the ns region with arbitrary pulse shape is to be set up using commercial step-index fibers. Thanks to direct pulse shaping via the seed diode driver, no free-space optical elements such as acousto-optic modulators are required, meaning the fiber amplifier can be configured as a completely fiber-integrated solution.

1 Active fibers.

Result

The implemented experimental setup of the fiber amplifier produces an average output power of more than 10 W and peak power of around 10 kW with pulse durations in the region of 20 - 200 ns.

The adjustable pulse shape enabled the time-dependent signal saturation and the associated pulse deformation to be pre-compensated successfully, allowing rectangular output pulses to be generated. In addition more complex output pulse shapes such as stepped pulses, trapezoids, sine modulations can be generated.

Applications

With a flexible repetition rate and flexible pulse duration, diode-seeded fiber amplifiers already cover a wide range of applications in material processing and metrology. Thanks to the additional degree of freedom of a freely adjustable pulse shape, the laser is ideal for setting the optimum temporal process parameters for materials processing such as drilling or ablation.

This research was funded by Germany's Federal Ministry of Education and Research (BMBF) under reference code 13N9671.

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