



Q-SWITCHED MULTIMODE HIGH-POWER FIBER LASER

Task

As part of »GEWOL«, a project funded by the Federal Ministry of Education and Research (BMBF), a Q-switched, multimode high-power resonator with an output power of more than 500 W and pulse durations of less than 100 ns was developed as an alternative to pulsed fiber amplifier systems.

Method

To determine the possible operating points of a Q-switched fiber laser, Fraunhofer ILT used time-resolved simulation software it developed in house. With this software, the achievable peak power, pulse durations and repetition rates were calculated as a function of the available pump power. One result of the simulation is that a Q-switch with a particularly high contrast ratio is necessary due to the high gain in the active fiber at the targeted output power and at the repetition rates in the range of 10 to 100 kHz.

The Q-switched fiber resonator consists of an active Yb-doped XLMA fiber with a beam quality factor of $M^2 \sim 15$ and broadband mirrors. The spectrum of the laser is limited by a bandpass filter. For the Q-switch, Fraunhofer ILT used soldered Pockels cells it developed, which have a contrast ratio of > 40 dB.

Results

At a repetition rate of 60 kHz, a peak power of approx. 250 kW with a pulse duration (FWHM) of approx. 10 ns could be demonstrated at an average power of 525 W. Since the laser has not yet been limited in pump power, further power scaling (e.g. via the repetition rate) is possible.

Applications

Due to their high efficiency and robust construction, pulsed fiber laser systems are increasingly being used in industrial applications such as surface stripping. Because it is less complex compared to multi-stage fiber amplifier chains, a Q-switched high-power fiber laser offers a rugged, lower-cost alternative.

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1 Q-switched multimode fiber laser.