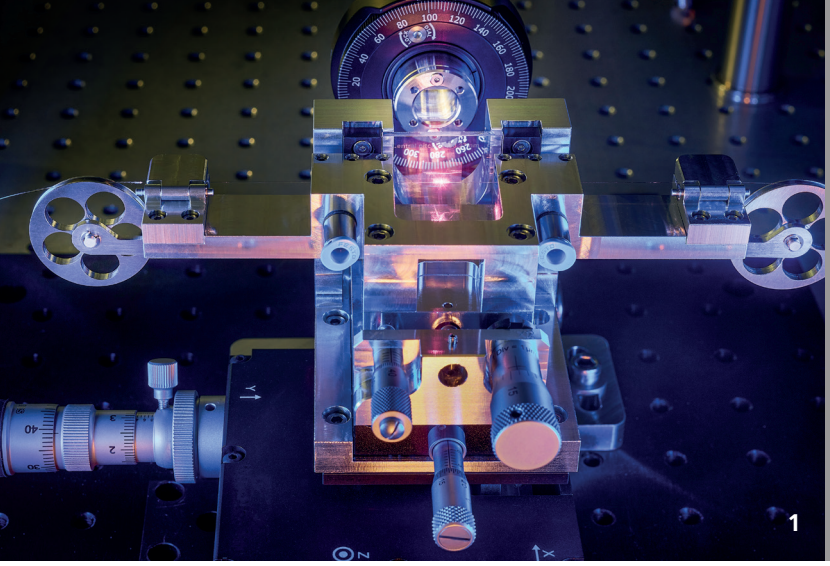

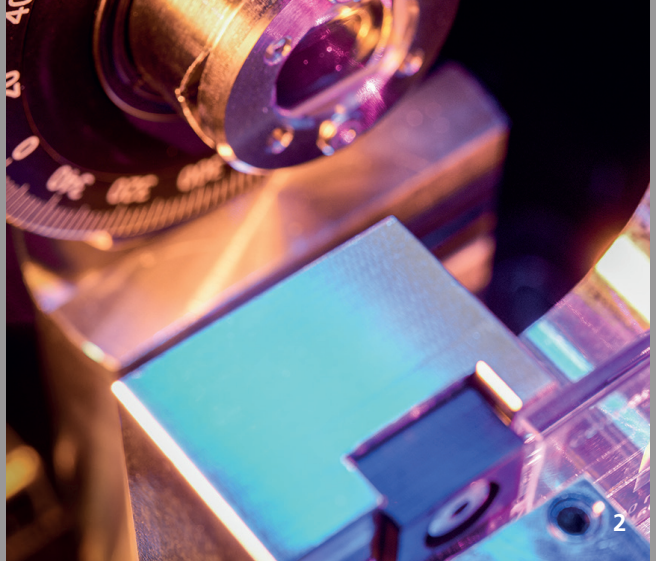

MULTIMODE FIBER BRAGG GRATING AS OUTPUT COUPLER MIRROR FOR XLMA-BASED FIBER LASERS

Task

Multimode fiber lasers are among the most cost-effective and efficient beam sources for cw laser applications and are, therefore, used for many industrial applications such as welding and cutting. For these sources, the resonator is usually formed by the active laser fiber and dichroic mirrors. Fiber Bragg gratings (FBGs) are periodic modulations of the refractive index written in fibers and act as fiber-integrated wavelength-selective mirrors. FBGs have only been used in transverse single-mode fiber laser oscillators so far. Within the BMBF project EKOLAS Fiber Bragg gratings for transverse multimodal fiber lasers have been developed as output coupler mirrors. This allows the construction of a fiber-integrated resonator, which can reduce the number of optical elements and thus increase the mechanical robustness of the system.

Method

The periodic modulation of the refractive index is written into the fiber core using an USP laser in the infrared emission range and two-beam interference. The basis of the writing process is the non-linear absorption in the glass, which eliminates the need to pre-treat the fiber. Therefore, the process can be used for a large number of commercially available undoped and doped fibers.

1 FBG workstation.

2 Long-term exposure of the FBG writing process using USP laser radiation.

Results

Thanks to the setup developed in the project, FBGs could be written into active »extra large mode area (XLMA)« fibers as fiber-integrated output coupler mirrors with reflection coefficients of < 10 percent and tested in laser resonators with output powers up to 800 W. Due to their property as wavelength-selective mirrors, FBGs also act as frequency stabilizing elements and can thus be used to improve the spectral brilliance of the laser system.

Applications

For fiber-coupled multimode high-power fiber lasers, this technology makes it possible to generate the output coupler mirror and to stabilize the frequency with fiber-integration at the same time, thus dispensing with additional optical elements.

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