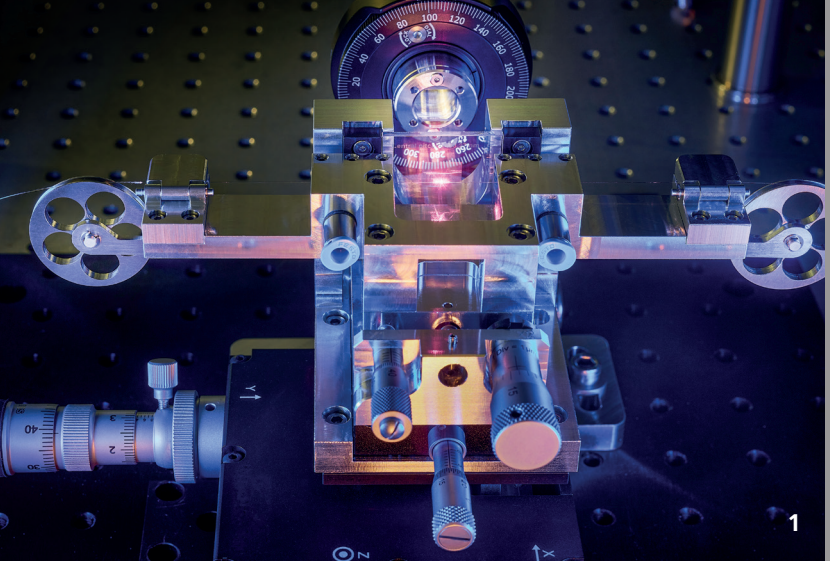

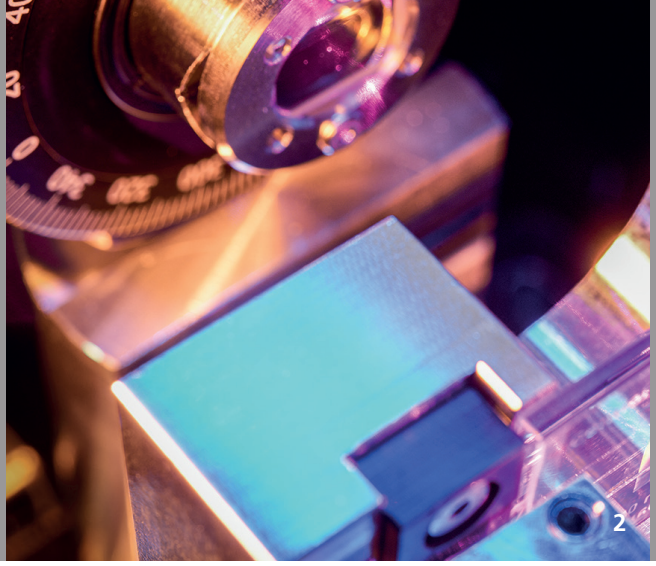

FIBER BRAGG GRATINGS FOR THE FREQUENCY STABILIZATION OF MULTI-MODE HIGH PERFORMANCE LASERS

Task

Fiber lasers and fiber-coupled diode lasers are among the cheapest, most efficient and most flexible beam sources for cw laser applications and are, therefore, used for many industrial applications. However, applications such as the efficient pumping of some laser-active media require a comparatively narrow emission bandwidth and a stable central wavelength. Fiber Bragg gratings (FBG) function as fiber-integrated external, wavelength-selective resonator output mirrors and are, thus, used for frequency stabilization both for fiber-coupled diode lasers and for fiber lasers. While various FBGs are commercially available for transverse fundamental mode radiation, there are currently no solutions for multimode radiation.

Method

FBGs consist of a periodic modulation of the refractive index along the propagation direction of the light in the fiber core. While the distance of the modulations is directly proportional to the reflected wavelength, the contrast and number of modulations influence the spectral width of the reflection and the reflectance. Using an ultrafast laser in the infrared emission region and two-beam interference, Fraunhofer ILT has selectively written these periodic modulations into the fiber core. The basis for the writing process is the non-linear absorption in the glass, which eliminates the need to pretreat the fiber. Therefore, the method can be used for a variety of commercially available fibers.

Results

The modular setup for writing FBGs, developed in the BMBF project »Ekolas«, makes it possible to use adapted processing optics for different fiber geometries. The FBGs thus produced were used as external resonator output mirrors for frequency stabilization of high-power fiber and diode lasers.

Applications

The technology offers fiber-coupled multimode high-power diode and fiber lasers the ability to build fiber-integrated frequency stabilization, eliminating the need for additional optical elements.

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1 FBG workstation.

2 Long exposure of the FBG writing process using ultrafast laser radiation.