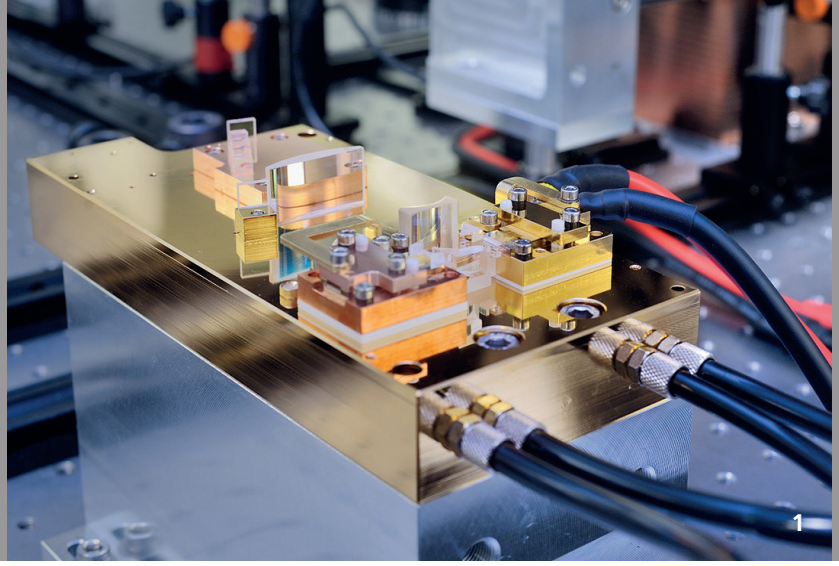

FIBER-COUPLED DIODE-LASER MODULE WITH DENSE WAVELENGTH MULTIPLEXING

Task

Dense wavelength division multiplexing (DWDM) is an established technology for the simultaneous scaling of output power and radiance. Within the EU-funded research project »BRIDLE«, Fraunhofer ILT has developed concepts which can be used to implement and test compact modules in the medium power range, from 10 W to 100 W output power, from a fiber having a core diameter of 35 µm and a numerical aperture of 0.2.

Method

To be coupled into low-mode fibers, emitters are used whose stripe width and beam parameter product were reduced to 35 µm and 1.8 mm mrad compared to the current state of the art. Ultrasteep dielectric edge filters, which are characterized at Fraunhofer ILT, enable multiplexing at a wavelength spacing of 2.5 nm. The chirped wavelength stabilization of mini bars is carried out both internally and externally.

1 Diode laser module (without fiber coupling).

Result

The radiation of a diode laser bar, in which each single emitter is stabilized at chip level on its own wavelength, was superposed for the first time. The same optomechanical design was also used for simultaneous external stabilization and superposition. The loss mechanisms occurring were analyzed in detail. To date, an output power of 26 W has been achieved with two bars from a fiber with 35 µm core diameter. In this power range significantly more compact and robust systems can be constructed through the use of internally stabilized diode laser at lower costs than with the previously known concepts for DWDM. For further power scaling in the range of 50 W to 100 W, the losses incurred are reduced by optimizing the diode lasers, optical design and assembly, in addition, a polarization coupling is integrated into the setup.

Applications

High-brightness sources with medium output power can open up new fields of applications in the area of pumping broadband laser crystals and additive manufacturing (e.g. multi-spot SLM) in the future. In addition, by using fiber-integrated combiners, one can scale this concept for use in laser-beam welding.

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