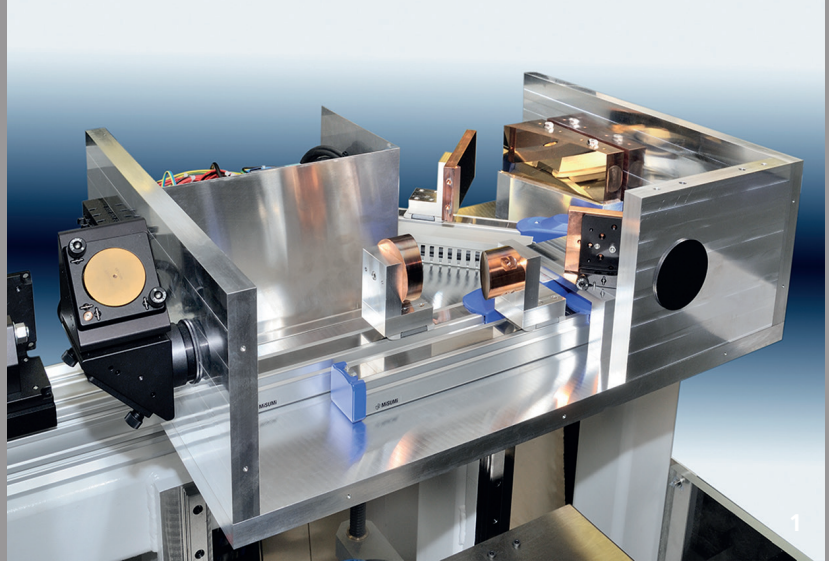

DISPERSION-FREE, CONTINUOUS EXPANSION OF HIGH-POWER LASER RADIATION

Task

Many laser material processing applications require the raw beam emitted from the laser source to be adjustable so that the focus can be adapted onto the workpiece surface. Due to the thermal lens effect of semiconductor materials (e.g. ZnSe) when CO_2 laser radiation is used, transmission-based optical concepts are not expedient for applications with high process sensitivity to thermo-optical effects. By contrast, mirror-based concepts enable a more effective dissipation of the heat loads produced and, moreover, wavelength-independent beam forming. Reconfiguring the folded optical path is, however, challenging for the optical design and for automation.

Method

For the use of high-power laser radiation (P > 6 kW), Fraunhofer ILT should develop a mirror-based zoom telescope that enables continuous, variable expansion of a collimated laser beam by a factor of 2.2. A major challenge is generating the common optical axis where the beam should enter into and exit from the optical system.

Result

A fully automated, mirror-based zoom telescope has been developed. The beam path has three aspherical and two flat mirrors that can be moved by means of three linear axes. The main specifications are:

- A diffraction limited design for 10.6 µm and for 1064 nm
- Permissible laser power: P_{cw} = 30 kW
- Variable expansion: 0.9 to 2.2

Applications

The mirror-based zoom telescope can be applied to a wide variety of fields. Besides being used for high-power CO_2 laser radiation, the concept is particularly relevant for applications which have a great sensitivity to the thermally induced focal shift.

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1 Fully automated high-power zoom telescope.

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