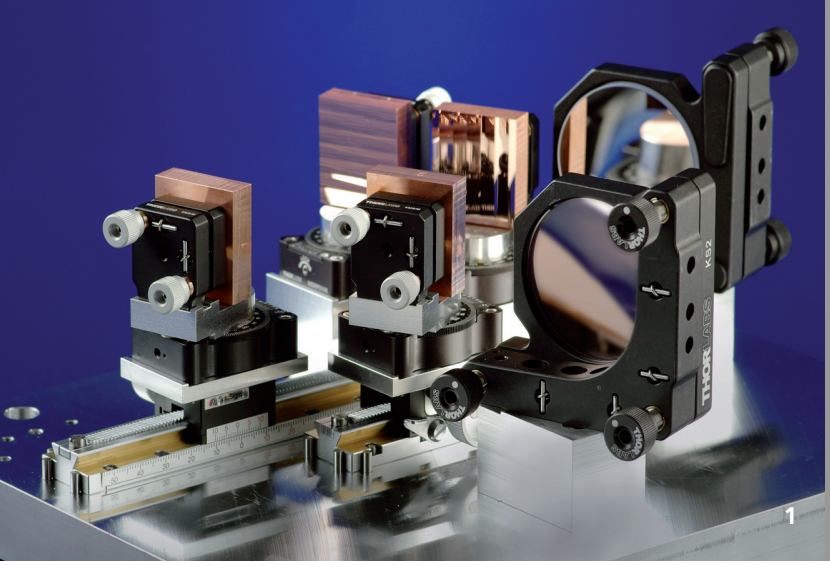

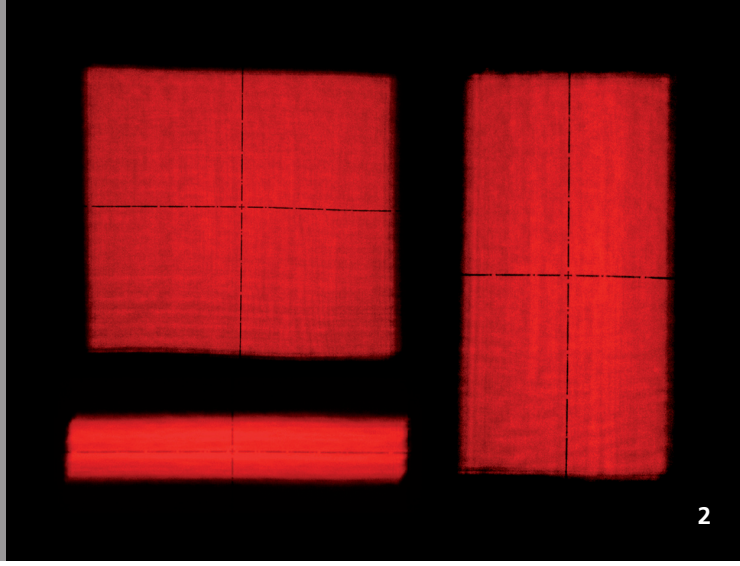

ZOOM HOMOGENIZER OPTICS FOR PROCESS-TAILORED CO_2 LASER MATERIAL PROCESSING

Task

The spread of efforts to increase flexibility in production environments for laser material processing calls for optical systems to generate flexible focal spot geometries with a homogeneous intensity profile. When using commercially available systems for CO_2 laser material processing the following problems can be identified at present:

- Predominantly static system behavior (fixed focal spot geometries)
- Use of crystal optics (ZnSe)
- Wavelength dependency

Method

By using cylindrically faceted optics, the input distribution is integrated with a highly homogeneous rectangularly symmetrical intensity profile. The exclusive use of metallic optics means crystal optics (e.g. ZnSe) do not need to be used and also provides virtual independence of the beam source wavelength. By integrating piezoelectric inertial drives, the optics can be adjusted in the folded beam path. This allows for continuous, two-dimensional scaling of the focal spot geometry during the machining process.

Result

The function for homogenizing the input distribution is successfully verified in the visible wavelength region and by burning tests using CO_2 laser radiation. The use of piezoelectric actuators enables the focal spot geometry to be adjusted precisely. At present, a multi-kW processing head is being implemented on the basis of the developed concept.

Applications

Owing to its better degree of absorption, CO_2 laser radiation is used to process continuous fiberglass reinforced thermoplastics in particular. The use of the developed optics concept provides optimized energy coupling and hence improved energy efficiency in the machining process.

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1 Zoom homogenizer optics.

2 Modified intensity distributions.

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