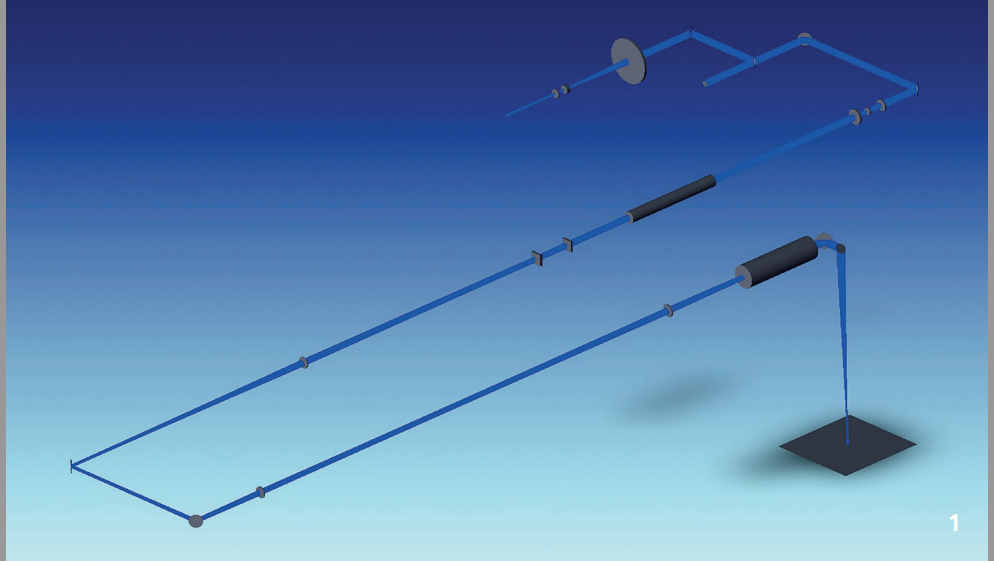

OPTICAL SYSTEM FOR HIGH-POWER LASER SINTERING

Task

The Selective Laser Sintering (SLS) of plastics has become established as an additive manufacturing process, in particular, for the production of complex prototypes and in small series. More and more, however, users are demanding both higher productivity through higher construction rates and a greater reproducibility of component properties. Therefore, a novel optical system for CO_2 laser radiation should be designed to improve both the productivity and consistency of SLS.

Method

By increasing the laser power as well as the laser beam diameter, Fraunhofer ILT aims to increase productivity. Thanks to the large laser beam diameter, large-volume core areas of the component can be exposed, thereby saving time (e.g. by increasing the layer thickness), which is analogous to the high-power Selective Laser Melting of metals. However, to maintain a high detail resolution and surface quality in the area of the component contour, the component contour should be exposed with a small beam diameter. To implement these different beam diameters, Fraunhofer ILT uses a 3D focusing system that allows for a dynamic and almost continuous variation of the beam diameter.

The reproducibility of the component properties shall be increased by homogenizing the temperature distribution in the exposure plane. This will be achieved both through the use of a homogenized intensity distribution and by the use of an acousto-optical modulator (AOM) so as to prevent power peaks when the laser is switched on.

Result

Fraunhofer ILT has completed the conceptual design of the optical system to adapt, both dynamically and variably, the beam diameter and the intensity distribution. Based on simulation results, the Gaussian beam diameter can be varied from 0.5 - 4 mm at laser powers of up to 600 W (instead of the usual 30 - 70 W). In addition, beam shaping optics can be integrated into the overall system to create homogenized intensity distributions (top hat or line distribution). In the next step, the system will be constructed and characterized in an experimental setup.

Applications

The optical system can be used in next generation high-power laser sintering systems.

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1 Schematics of the optical system beam path.