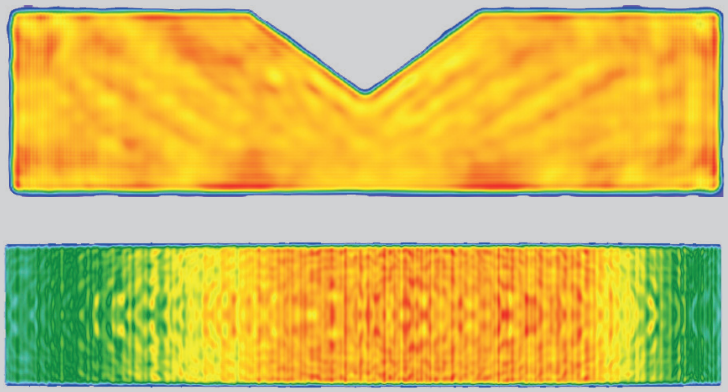
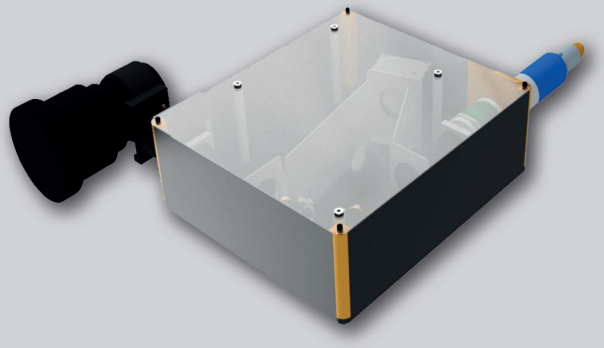


1



2

HIGHLY DYNAMIC ADAPTATION OF INTENSITY DISTRIBUTIONS FOR 3D LASER MATERIAL PROCESSING

Task

Laser-based surface processing methods, such as polishing or the functionalization of thin layers, either have too low processing speeds or are restricted to flat workpiece surfaces, both of which currently limit their broad industrial application. Application-adapted intensity distributions allow the temperature profile to be adapted to the process control in order to increase the processing speed. In addition, the processing of 3D surfaces requires intensity distributions to be dynamically adapted, which cannot be done with the previous approaches or only with insufficient dynamics.

Method

First, a static intensity distribution is generated by means of a diffractive optical element (DOE). With a piezoelectric, continuously deformable mirror, the phase front of the laser beam is then highly dynamically modulated (switching times < 5 ms) so that the desired intensity distribution can be established after the laser beam is focussed. In addition, the deformable mirror compensates for the distortion effects of the scanner-based beam deflection on the intensity distribution. Additionally, the intensity distribution can be adapted depending on its position when surface data of the workpiece are taken into account.

Result

The developed optical system enables 3D surfaces to be processed at an angle of incidence of up to 60 degrees while maintaining a distortion-free intensity distribution. All optical components are designed for laser powers up to 2 kW.

Applications

The generation of a constant, distortion-free intensity distribution during the processing of 3D surfaces creates the prerequisite for transferring a large number of laser-based processes to the processing of 3D surfaces.

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1 Application-adapted intensity distributions for laser polishing.
2 3D model of the optical system (Source: Pulsar Photonics).