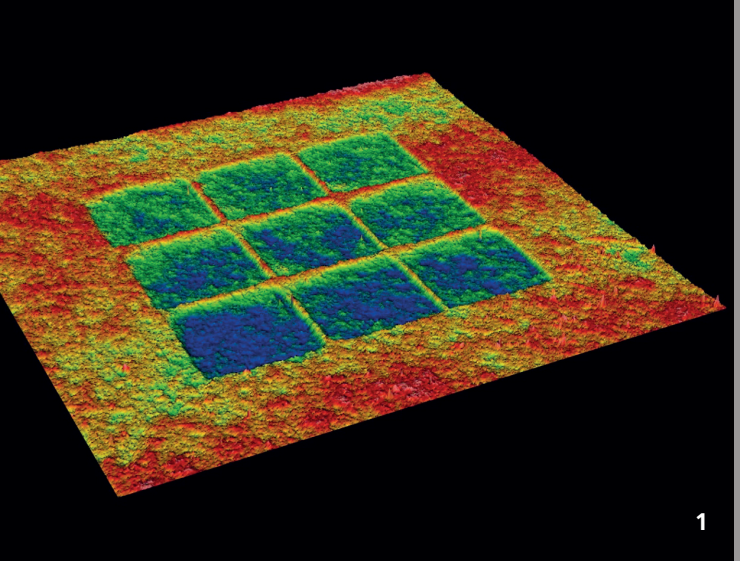
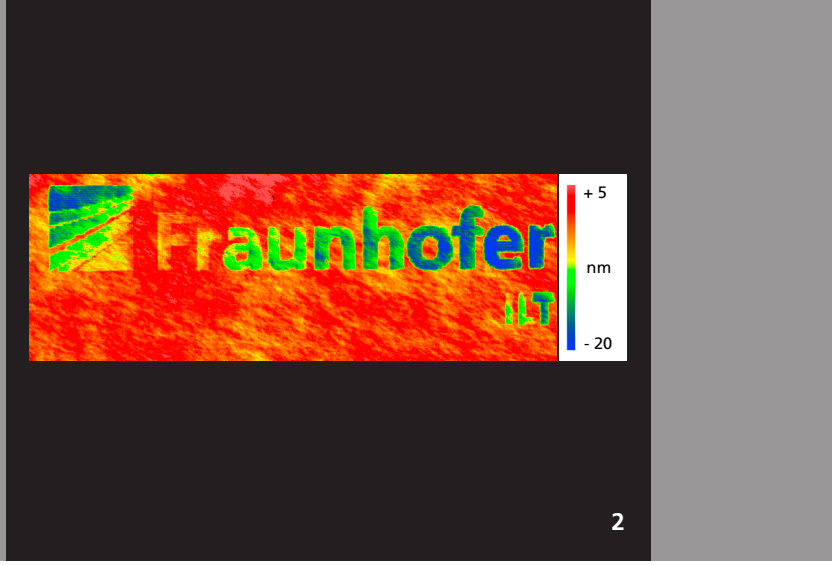


1



2

LASER BEAM FIGURING (LBF) OF FUSED SILICA

Task

Compared to spheres, aspheres have technical advantages in terms of imaging quality. However, glass aspheres are significantly more expensive to manufacture with currently established production methods compared to spheres. By means of laser polishing, optical systems of nearly any surface shape, aspheres included, can already be processed in a short amount of time. The roughness is reduced to values sufficient for illumination optics. To reduce the waviness remaining after laser polishing and to approach the actual target form, Fraunhofer ILT has developed a laser-based shape correction process (Laser Beam Figuring) as a complement to laser polishing.

Method

The active principle of laser-based shape correction is based on the selective ablation of the glass material by evaporation. The local ablation volume can be adapted with high accuracy by using modulated CO_2 laser radiation and varying the pulse duration. Thus, smallest amounts of glass material may be selectively ablated through Laser Beam Figuring.

1 Ablated test fields (ablation depth approx. 20 nm).

2 LBF of Fraunhofer brand.

Results

Laser Beam Figuring can be used to selectively ablate fused silica glass with a vertical resolution of less than 5 nm and a lateral resolution of 100 µm. By measuring laser-polished flat surfaces and detecting deviations from the desired shape, Fraunhofer ILT can selectively process them by means of Laser Beam Figuring. Thus, the shape accuracy can be improved nearly without influencing the polished micro roughness. By adapting the method to curved surfaces also aspheres and freeform can be processed with Laser Beam Figuring in the future.

Applications

Thanks to its short processing time and great flexibility regarding the surface shape to be processed, the process presented here can be mainly used for a quick and inexpensive shape correction of non-spherical optical components in small to medium quantities. Laser Beam Figuring can be combined both with laser polishing as well as conventional processing methods for optics manufacturing.

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