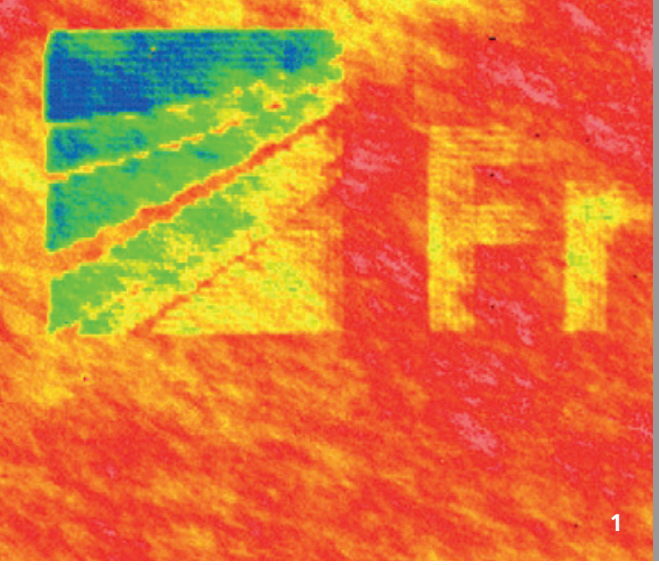

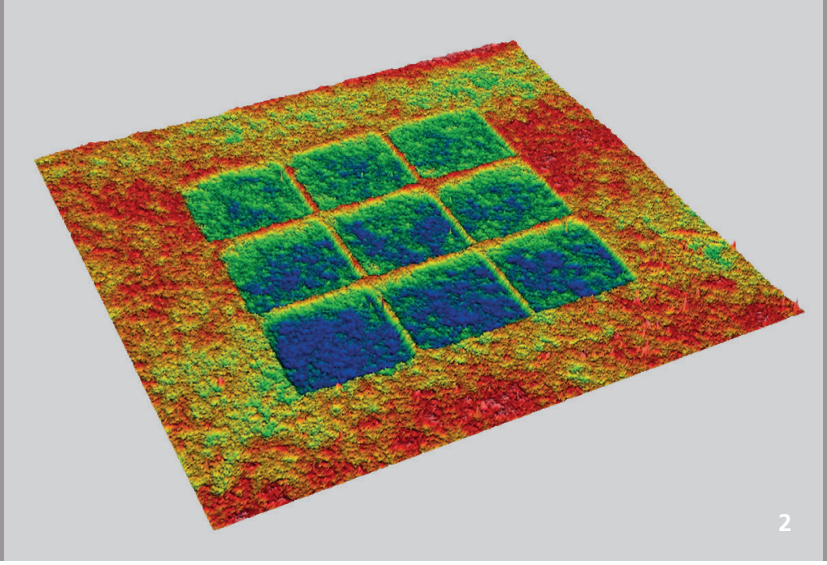

LASER FORM CORRECTING OF OPTICS

Task

Compared to spheres, glass aspheres have technical advantages in terms of imaging. They are, however, significantly more expensive to manufacture with currently established production methods. By means of laser polishing, optical systems of any surface shape, aspheres included, can already be processed in a short amount of time, and the roughness reduced to sufficient values 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 as a complement to laser polishing.

Method

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

1 White-light interferometry image to demonstrate the selective fine ablation.

2 Test fields for fine ablation on a conventionally polished glass surface.

Result

Laser shape correction 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. The initial roughness of the polished surface is not affected. By measuring laser-polished flat surfaces and detecting deviations from the desired form, Fraunhofer ILT can selectively process them by means of laser shape correction. Thus, the dimensional accuracy can be improved. As the method is adapted to curved surfaces, it will also be able to process aspheres in this same way 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 the quick and inexpensive form correction of non-spherical optical components in small to medium quantities. Laser shape correction can be combined both with the laser polishing as well as with conventional processing methods for optics manufacturing. Furthermore, a complete laser-based optical manufacturing system will be developed, in which the shape will be generated by material ablation with laser radiation.

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