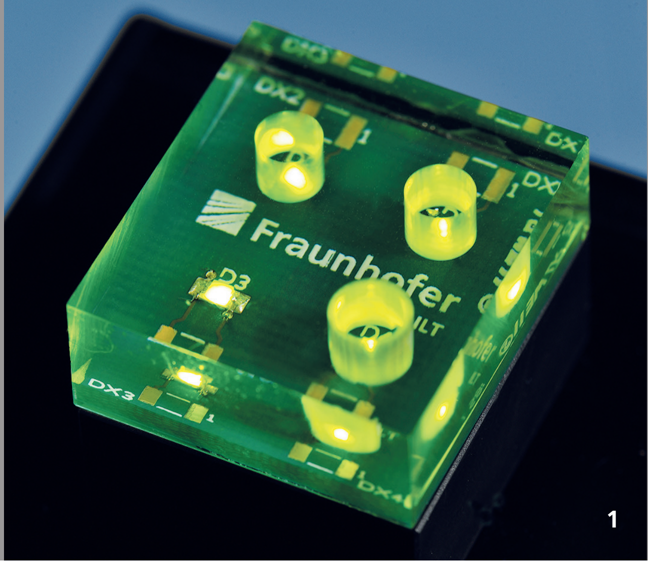
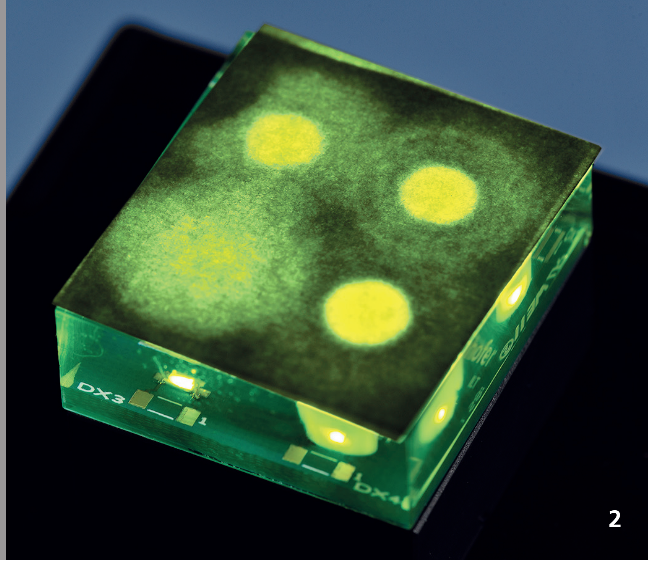


1



2

LIGHT ABSORBING STRUCTURES IN PRINTED OPTICS BY MEANS OF LASER MODIFICATION

Task

To date, optical systems have been composed of various optical elements such as lenses, mirrors, apertures etc. in order to achieve a defined function. Such systems are, however, difficult and generally expensive. The complexity of optical systems can be reduced significantly by using free-form surfaces. 3D printing of polymer free-form optics is possible with inkjet or stereolithography (SLA) technology. So that functions can be integrated to an even higher degree, light-absorbing structures, so-called baffles, can be created in the 3D printed optics by means of focused laser radiation.

Method

The polymer-based materials are modified with ultrashort laser beam pulses, thereby locally and selectively changing the optical absorption and scattering properties. The process is designed in such a way that the modification can be introduced during printing, but also subsequently in the volume, i.e. in the finished printed optics. For this purpose, areas are selectively processed on the basis of a three-dimensional digital model until the desired structure, such as apertures or diffusers, is created in the optics. A significant advantage is the great freedom of design of the digital model and the possibility to create almost any complex structure with a resolution of a few micrometers.

Results

Using the innovative laser process, Fraunhofer ILT could create light-absorbing structures several millimeters below the surface of 3D-printed refractive optics. The processing both laterally and in depth allows a great design freedom in the design of baffles. By adjusting process parameters and stacking structures, the institute was also able to adjust the degree of residual transmission of the structures. Moreover, it has produced a demonstrator with cylindrical baffles of different stacking density (1, 4 and 8) for adjusting the radiation pattern of LEDs. The shading function is shown in Figure 2.

Applications

In both the automotive and aerospace sectors, the technology promises new possibilities for the development of lighting concepts with extended design options and a great potential for lightweight construction. The high degree of integration also opens up new opportunities in medical technology and for metrological solutions.

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1 Optical baffles with different degrees of absorption.

2 Light shaping compared to the non-shaded LED.

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