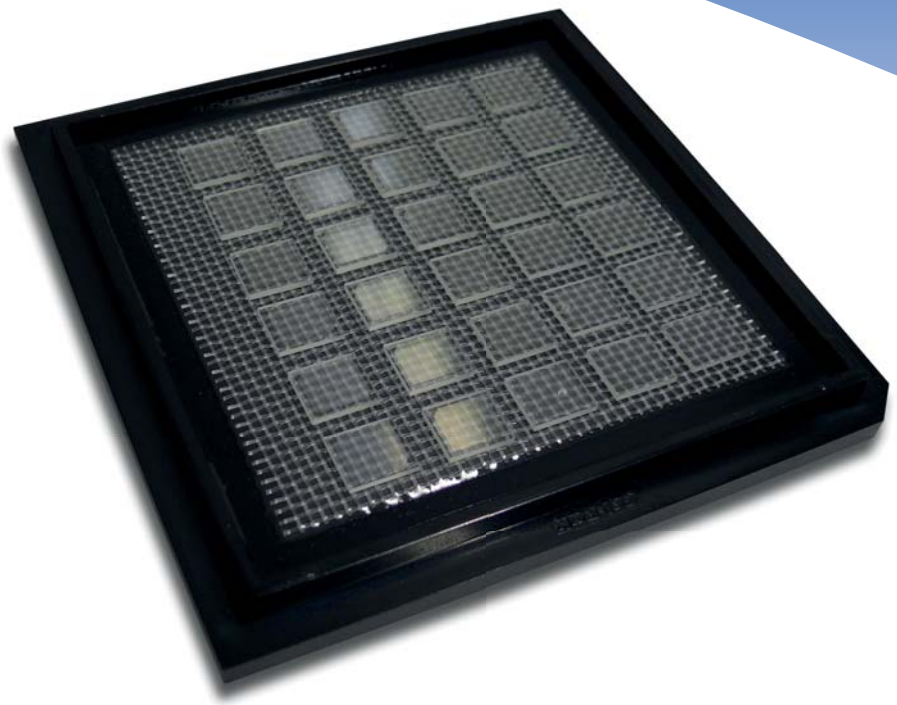
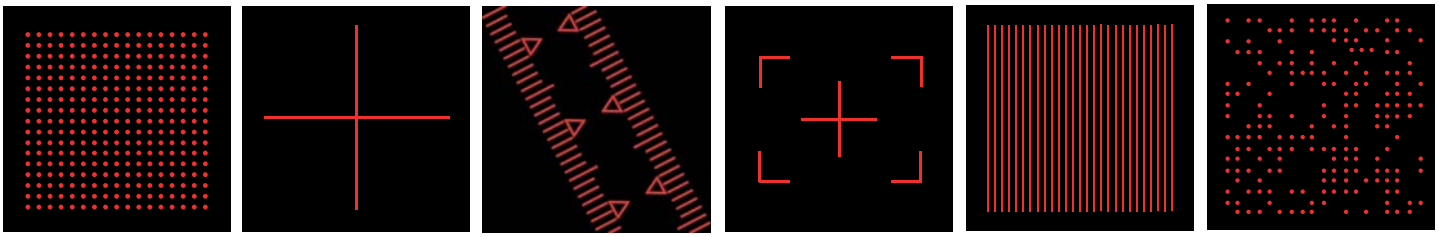
DOE

Diffractive Optical Elements





HOLOEYE

Pioneers in Photonic Technology

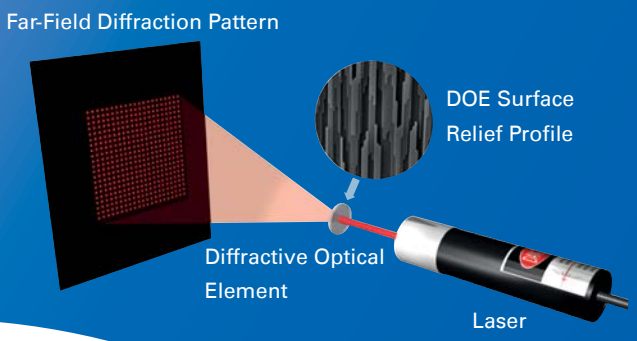
HOLOEYE Diffractive Optics Products and Services

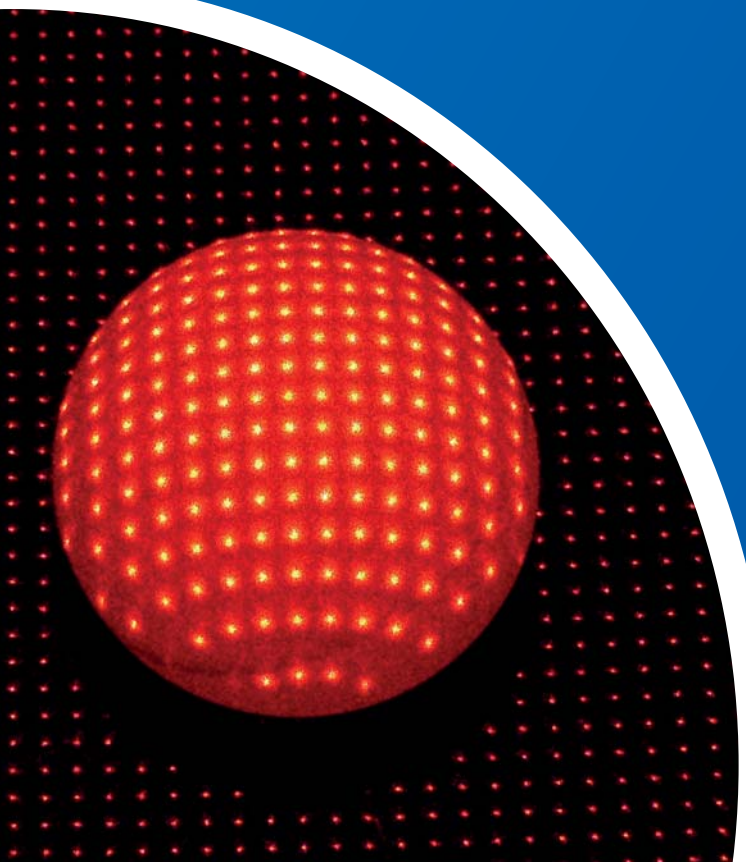
HOLOEYE offers off-she-shelf as well as customized Diffractive Optical Elements. The off-the-shelf elements are well suited to serve a number of applications, e.g. bar code scanners, 3D sensors, and viewfinders. For requirements beyond the available product range, we routinely develop new DOEs tailored to your application.

The different types of DOEs (beam-splitters, pattern generators, kinoforms, beam shapers and gratings) modulate the incident laser light utilizing their micro-relief surface. Just by the subsequent propagation, the light can thus be reshaped to almost any desired distribution. Compared to refractive optical elements, DOEs are typically much thinner and lighter, which makes them an attractive replacement in a number of applications, in particular for monochromatic light sources.

Operation Principle of Diffractive Optical Elements

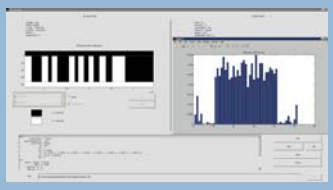
A Diffractive Optical Element (DOE) utilizes a surface with a complex microstructure for its optical function. The surface relief profile has two or more surface levels. The surface structures are either etched in fused silica or other glass types, or embossed in various polymer materials.





Design & Simulation of Diffractive Optical Elements

HOLOEYE utilizes its steadily growing experience in the design and simulation of diffractive optical elements to offer its customers a competitive solution. Both in-house developed and commercially available state-of-the-art software tools are used for the DOE design process.



Non-paraxial computation methods are used whenever necessary. Fabrication constraints are taken into account right from the start, and a tolerancing analysis is performed at the end. Also the tolerance of the element position within the optical system is determined, so that the assembly procedure can be designed accordingly.

DOE Mastering/Tooling

Electron beam or laser beam lithography are used for the creation of resist microrelief profiles or lithography projection masks. Using masks, contact or projection lithography is used to create copies of the microstructures or multilevel microrelief profiles. Using etching processes like reactive ion etching to transfer the etch mask into the substrate, fused silica optical elements or templates for UV-curing based replication processes are obtained.

Alternatively, electroplating can be used to create inverted resist profiles which are usable for embossing and molding processes of polymer materials.

Volume Production of DOEs

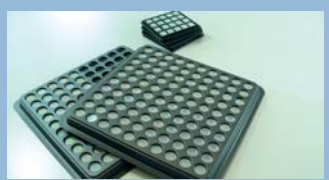
Holoeye offers diffractive elements fabricated by one of the following options:

(1) Bulk polymer elements, the substrate and a diffractive micro-relief surface are created by compression molding. Typical materials: Polycarbonate, PMMA, Topas ®

(2) Acrylate-on-polymer elements, the diffractive layer is created by UV curing on a polymer substrate

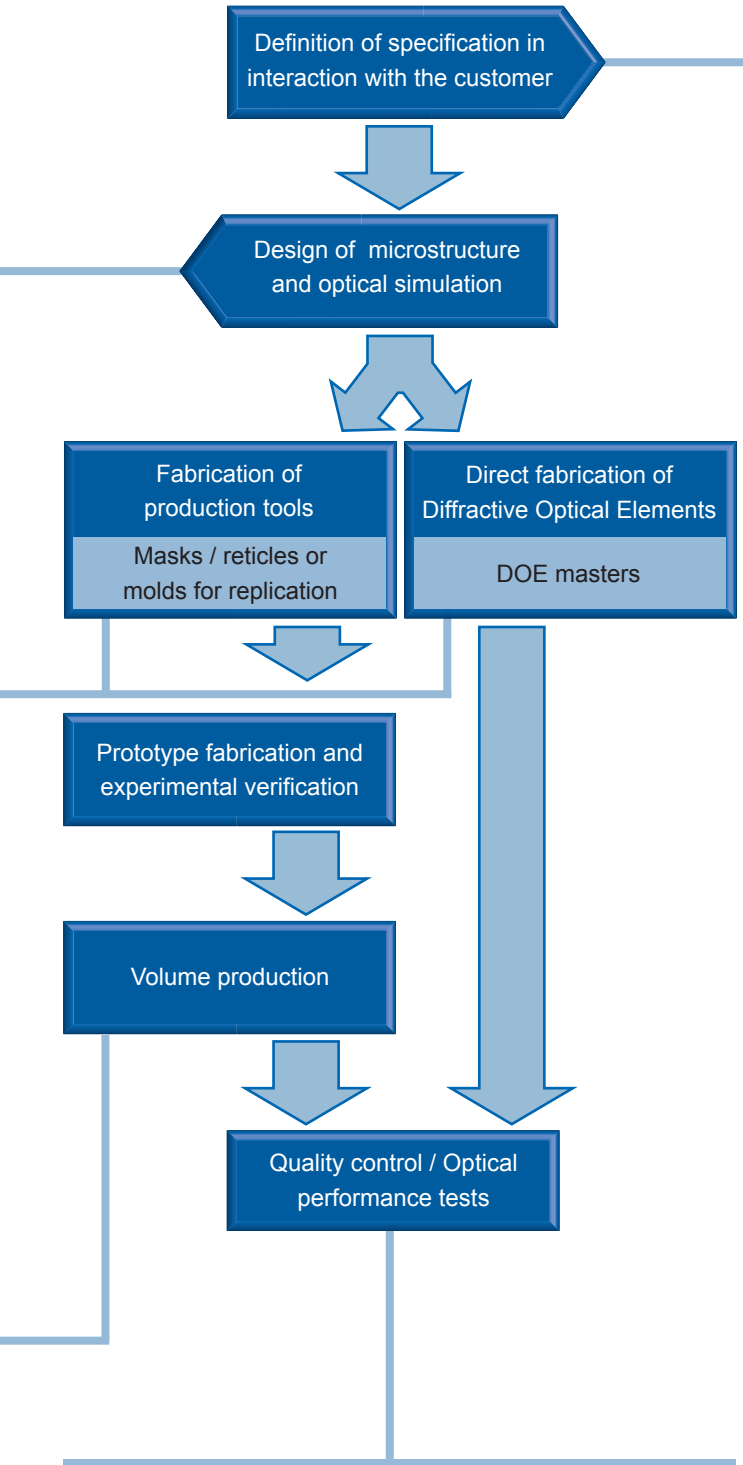
(3) Acrylate-on-glass elements, the diffractive layer is created by UV curing on a glass substrate

(4) Fused silica elements, the diffractive micro-relief surface is created by reactive ion etching.



The sizes and shapes the DOEs can be specified by the costumer, and Fresnel-type surface reflections can be reduced by moth-eye micro-relief surface structures or dielectric coatings.

Development of customized DOEs:



Required Parameters for the Development of your Customized DOE

Light Source:

- ►Type (cw laser, pulsed laser, LED, other)
- ►Wavelength (center and bandwidth)
- ►Polarization
- ►Power/Energy (average and/or peak)
- ►Beam profile (diameter, divergence, M^2 quality)

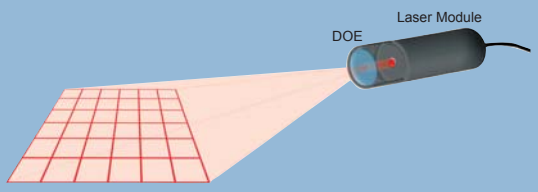
Optical Function:

- ►Desired light field distribution (shape, uniformity, contrast,...)
- ►Target surface/object (inclination, shape, ...) and sensor (CCD/CMOS/human eye/...)
- ►Field of view and working distance, or diffraction angles

Application:

- ►Eye Safety requirements
- ►Element form factor (size, shape)
- ►Element material (glass/polymer/...)
- ►Environmental conditions (temperature, humidity,...)
- ►Packaging requirements
- ►Storage conditions

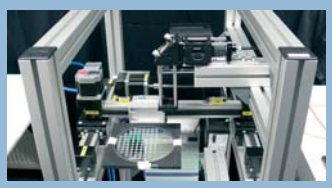
The required annual production volume and a price target are helpful in order to balance technical and economical requirements.



Application Example

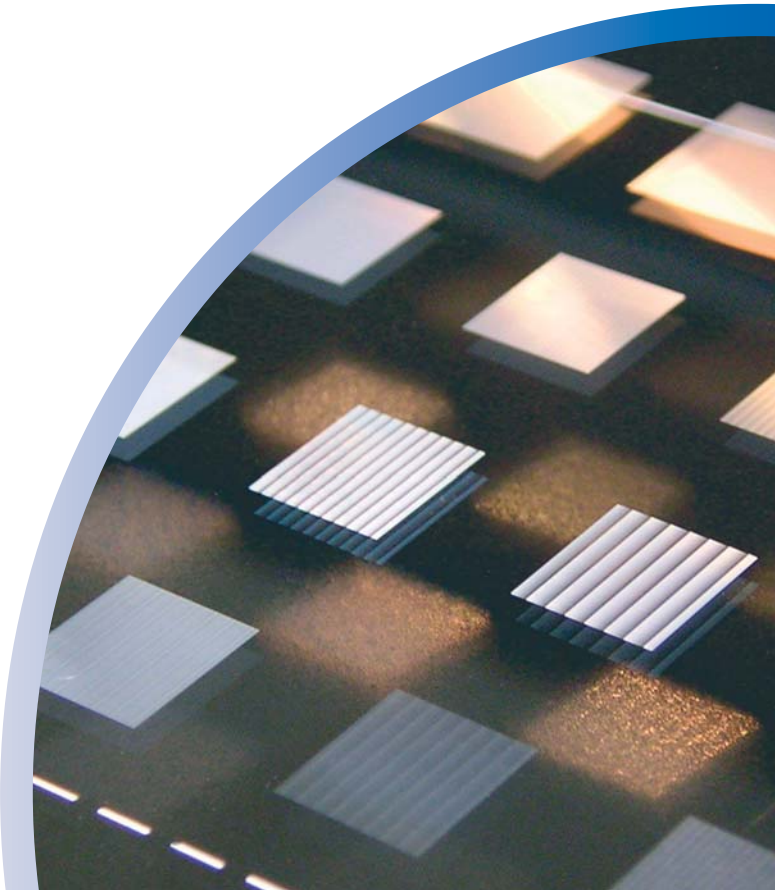
Quality Assurance and Implementation Support

After fabrication, HOLOEYE will validate the compliance of



the DOEs with the specification experimentally. For volume production of elements, optical key properties can be monitored using automated equipment.

We are ready to visit the customer's laboratories and provide assistance regarding the integration of the DOE into the optical system and the evaluation of its performance after assembly.



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