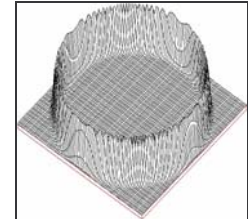
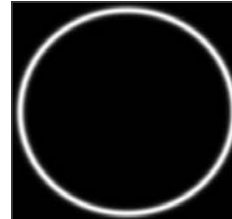
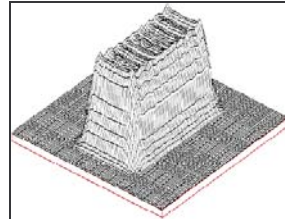
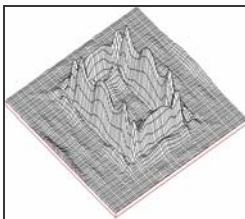
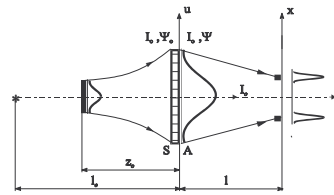
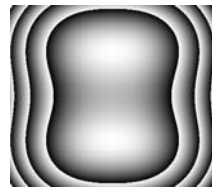
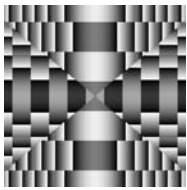


# Diffractive Optics *from Holo /Or*



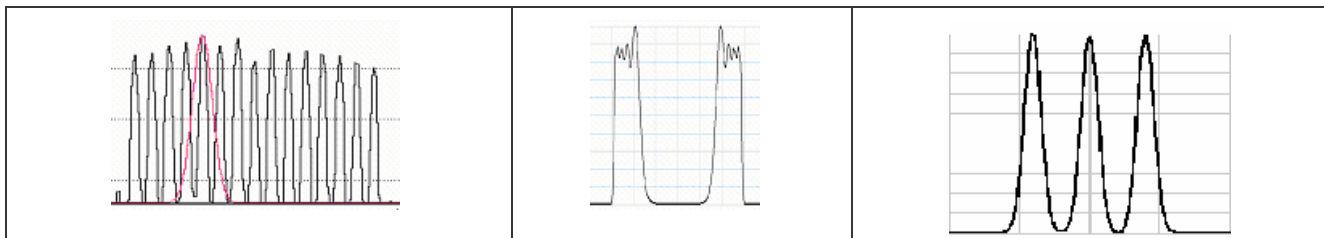
In the past 15 years we developed, designed and manufactured a variety of diffractive optical elements that accomplish difficult tasks, conventional optics fails to address effectively. Proven solutions developed for high power lasers include:

- ❑ Uniform Splitting of beams
- ❑ Tailored Shaping of spots
- ❑ 1D, 2D and 3D spot array generation
- ❑ Diffusers and Homogenizers
- ❑ Top-Hat Beam Shaping
- ❑ Lenslet Arrays, symmetric and asymmetric
- ❑ Beam Sampling
- ❑ Chromatic and Spherical Aberration Correction
- ❑ Intensity profile management
- ❑ Elongating Depth of Focus
- ❑ Frame focuser
- ❑ Tailored spot SHAPES and sizes

The company employs highly skilled technical personal, and occupies a production facility at the Kiryat Weizmann High-Tech Industrial Park, Rehovot, Israel. Holo-Or has a full capability of developing and manufacturing diffractive optical elements in clean room facilities. The company holds the key patents on its method of manufacturing multi-level elements. Holo-Or is cooperating with Laser Components, GmbH.

## **SERVICES & CAPABILITIES**

- Diffractive optical elements: Custom & Stock
- Diffractive design and performance analyses
- Optical design incorporating diffractive optics
- Reactive ion and wet etching and photolithography for visible and IR materials
- Mask fabrication

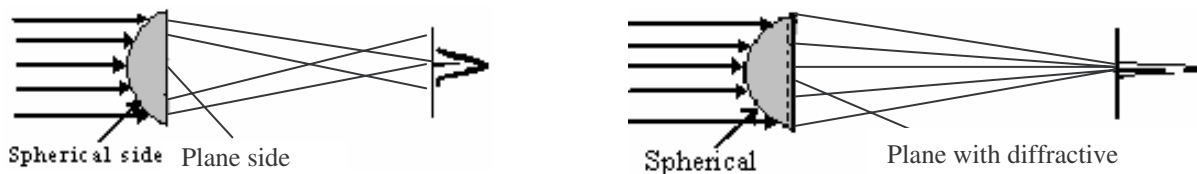


## **IN-HOUSE ELABORATED SOFTWARE**

**DOECAD** software for design, mask files generation and computer simulation of diffractive optical elements

## DIFFRACTIVE-CORRECTED FOCUSING LENS

Our single diffractive-corrected focusing lens demonstrates *sharp focusing* with diffraction-limited spot-size. The lens is fabricated by etching an *aberrations-correction diffractive microrelief pattern* on the plane side of a bulky spherical plano-convex lens.



Part number	Wavelength	Efl	Diam.
SE-1511	10.6 $\mu\text{m}$	1.5 "	1.1"
SE-2511	10.6 $\mu\text{m}$	2.5 "	1.1"
SE-2515	10.6 $\mu\text{m}$	2.5 "	1.5"
SE-3711	10.6 $\mu\text{m}$	3.75 "	1.1"
SE-5015	10.6 $\mu\text{m}$	5.0 "	1.5"

## LONG-FOCAL -DEPTH DIFFRACTIVE FOCUSING LENS

The "Easy-F" lens design yields a *longer focal depth* while still maintaining near to diffraction limited spot size, sharp and cleaner edges of the focal spot. "Easy-F" lenses achieve high cutting and drilling speeds, together with smoother and cleaner edges and the ease of focusing of longer-focal-length lenses



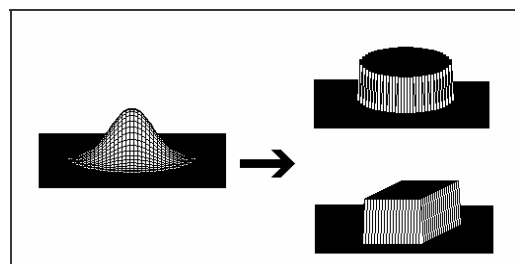
Conventional plano-convex lens

Diffractively-corrected lens

"Easy-F" diffractively-corrected lens

## TOP-HAT BEAM SHAPING

The *diffractive top-hat beam shapers* are diffractive phase optical elements used to transform a near-gaussian incident laser beam into a uniform-intensity spot of either round or rectangular shape with sharp edges. Applications include laser heat treatment, annealing of surfaces in machinery and microelectronics, optical heads of laser writers and optical information processing.



Part No.	Function	Dia.	Wavelength	Diameter	Working dist	Spot size(1/e2)	Spot Shape
TH-001	Top-Hat	1.5"	10600	25 mm	250 mm	3 mm	Round
TH-002	Top-Hat	1.1"	10600	12 mm	250 mm	6 mm	Square
TH-003	Top-Hat-1D	0.5"	10600	3.7 mm	42.5 mm	0.3X0.1mm	Line
TH-004	Top-Hat	1.1"	10600	12 mm	63.5 mm	0.39 mm	Round
TH-005	Top-Hat	1.1"	92500	12 mm	63.5 mm	0.35 mm	Round
TH-014	Top-Hat-Sharp edge	20 mm	1064	7.0 mm	42.52 mm	0.190 mm	Round
TH-015	Top-Hat-1D	1"	1064	5.1 mm	infinity	0.83 deg x nat. divergence	Line
TH-016	Top-Hat	1"	980	7.0 mm	infinity	0.94x0.94 deg	Square
TH-031	Top-Hat	1"	532	5 mm	52.4 mm	0.1 mm	Round
TH-032	Top-Hat	1"	532	10.9 mm	200 mm	2 mm (FWHM)	Round
TH-041	Top-Hat	1"	355	2 mm	100 mm	0.1 mm	Square
TH-042	Top-Hat	1"	355	2.5 mm	50 mm	0.05mm	Round
TH-044	Top-Hat	20 mm	337	8.0 mm	49.395 mm	0.020 mm	Round
TH-051	Top-Hat	1"	266	5 mm	42 mm	0.015mm	Round

## ABERRATION-CORRECTION PLATES FOR MULTILENS OBJECTIVES

We design diffractive microrelief pattern on a surface of refractive lens or window in order to correct for chromatic, spherical and other aberrations of broad-band objectives. Diffractive pattern results in reduced of number of components

Applications include thermal imaging and FLIR systems covering wavelength range the 8-12 $\mu\text{m}$  or 3-5 $\mu\text{m}$ .

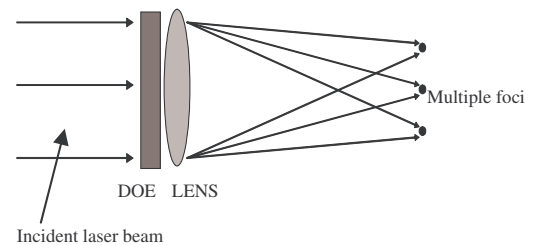
## PHASE DIFFRACTION GRATINGS

We produce transmissive phase diffraction gratings etched in materials like Fused Silica and ZnSe. Gratings can be binary rectangular-groove shaped or blazed multilevel. Grooved might be straight or curvilinear,

## BEAM MULTIPLICATION AND MULTIPLE-SPOT LENSES

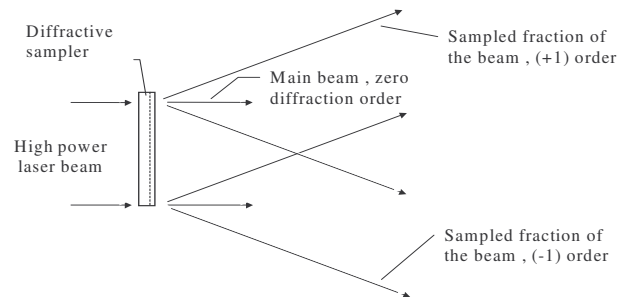
Diffractive beam-multiplication elements split a laser beam into several beams, each with the characteristics of the original beam except for power and angle of propagation. Focusing multi-spot elements provide a line or an array of identical focal spots located in the focal plane, with spacing between neighboring spots

Part No.	Function	Dia.	Wave-length	Collimation	Angle separation
DS-001	Double-spot	1.1"	10.6 $\mu\text{m}$	Collimated	1.35 deg
DS-002	Double-spot	1.1"	10.6 $\mu\text{m}$	Collimated	2.70 deg
TS-004	Triple-spot	1.1"	10.6 $\mu\text{m}$	Collimated	1.35 deg
DS-006	Double-spot	1.0"	1.06 $\mu\text{m}$	Collimated	2.53 deg
TS-008	Triple-spot	1.0"	1.06 $\mu\text{m}$	Collimated	1.27 deg
DS-015	Double-spot	1.0"	0.532 $\mu\text{m}$	Collimated	1.27 deg
DS-016	Double-spot	1.0"	0.355 $\mu\text{m}$	Collimated	0.85 deg
DS-017	Double-spot	1.0"	0.266 $\mu\text{m}$	Collimated	0.64 deg



## BEAM SAMPLER

Diffractive beam samplers are used to monitor high-power lasers by extraction of exact sampled copies of the beam with only a small fraction of the total power. The passing beam corresponds to the zero diffraction order, while two sampled beams propagate at the symmetrical angles of the first diffraction orders. We offer our high quality beam samplers for various angles and power fractions of sampled beam.

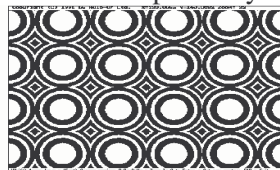


Part No.	Function	Dim.	Wave-length	Nomin. angle sep.	Ratio/ Angle
SA-010	Sampler	12x12mm	1.06 $\mu\text{m}$	15.2 deg	0.40%
SA-015	Sampler	1.0"	0.355 $\mu\text{m}$	5.1 deg	3.87%
SA-020	Sampler	1.1"	10.6 $\mu\text{m}$	12.8 deg	0.40%

## LENSLET ARRAYS

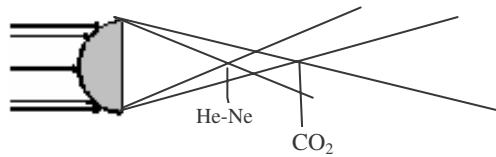
A set of small spherical, aspherical or cylindrical lenses on a single substrate is called a lenslet array. It is used for focusing and sampling as well as for diffusing of light. The Diffractive lenslet arrays we offer have the advantage of a fill factor of 100%, and a diffraction limited focal spot size. We also

have the flexibility to design each of the lens-elements independently from its neighbor.

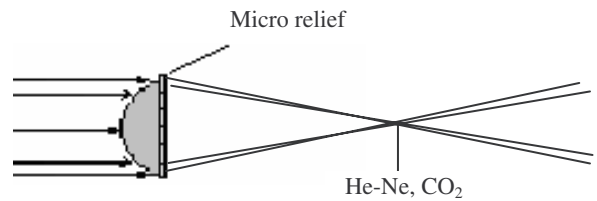


## DUAL WAVELENGTH LENS

The dual wavelength beam combiners are diffractive optical elements used to bring two incident beams with different wavelengths into the same focal point.



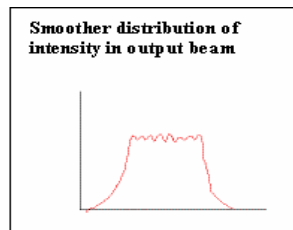
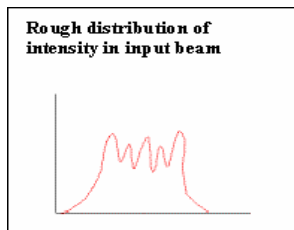
Performance of regular ZnSe lens in dual-wavelength beam of CO<sub>2</sub> and HeNe lasers



Performance of diffractive-refractive ZnSe lens in dual-wavelength beam of CO<sub>2</sub> and HeNe lasers

## HOMOGENIZERS

Unlike competing designs, Holo-Or's Diffractive Homogenizers consist of pure fused silica with an optional high power AR V-Coating on both surfaces. This can reduce the back reflection to 0.2% (0.1% per surface) depending on the coating grade ordered. Back reflection usually hinders the stable operation of the laser and should therefore be reduced to a minimum, as in this design.



Part number	Full Diffusing angle	Wavelength	Part number	Full Diffusing angle	Wavelength
DF-106	0.5°	1064nm	DF-035	0.17°	355nm
DF-075	0.35°	755nm	DF-026	0.125°	266nm
DF-069	0.33°	694nm	DF-024	0.12°	248nm
DF-053	0.25°	532nm	DF-019	0.09°	193nm

### General specifications for All Diffractive Optical Elements

<input type="checkbox"/> Mounting:	unmounted	<input type="checkbox"/> Substrate:	window or lens
<input type="checkbox"/> Wavelengths:	UV, visible, near IR, far IR	<input type="checkbox"/> Number of output beams:	up to 100
<input type="checkbox"/> Materials:	ZnSe, Ge, Si, fused silica, PMMA	<input type="checkbox"/> Efficiency:	up to 98%
<input type="checkbox"/> Power handling:	up to 3 kW		
<input type="checkbox"/> Coating:	AR/AR		

### Special effects in lenses

<input type="checkbox"/> Off-axis sharp focusing	<input type="checkbox"/> Control of the shape of focal spot
<input type="checkbox"/> Introduction of a custom spherical aberration	<input type="checkbox"/> Longer depth of focus ("Easy-F")
<input type="checkbox"/> Chromatic correction	<input type="checkbox"/> Double(multiple) - spot focus

*We can customize, material, wavelength, diameter, beam size, working distance, central thickness, and other special effects*

*Ask for our*

- *Standard Element leaflet that lists more designs and more details on them.*
- *Tailored Optics datasheet to get a better feeling of how close we can approach your ideal optical function within one optical surface.*