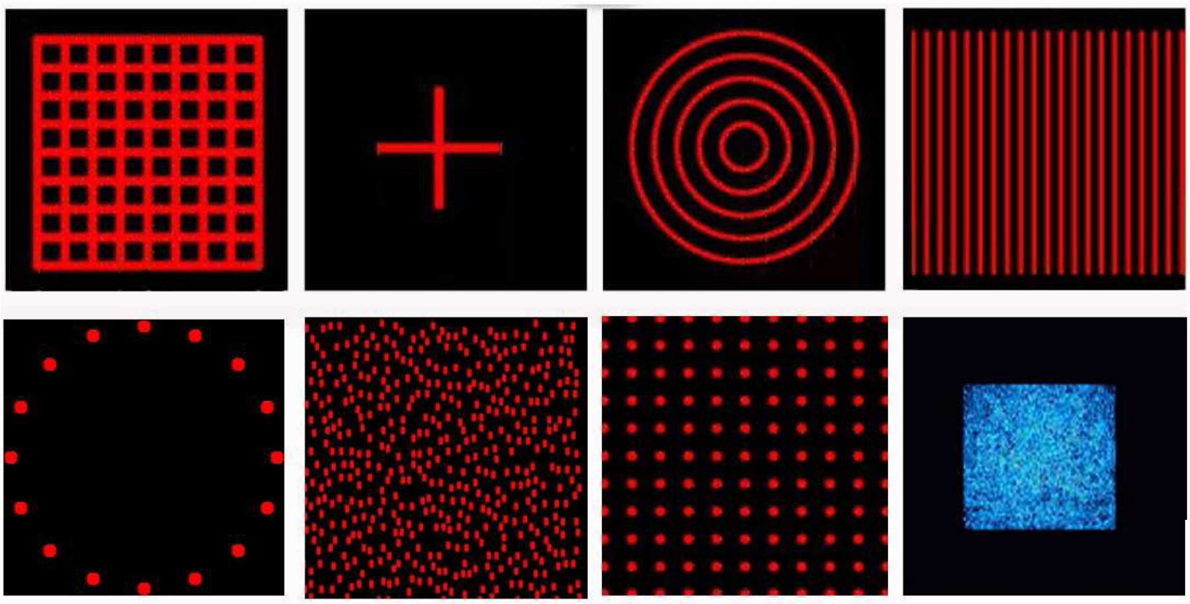
Diffractive Optical Elements



无锡奥普顿光电子有限公司

Wuxi OptonTech Ltd

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Wuxi OptonTech Ltd. specializes in diffractive optical elements (DOEs) and computer generated holograms (CGHs)for beam shaping, beam splitting and beam homogenizing (dif fusing). We design and provide standard and custom DOEs and CGHs for high-performance laser and LED applications at competitive prices. We address the market needs high precision (virtuallyzero reconstruction error within the signal window) and high efficiency.

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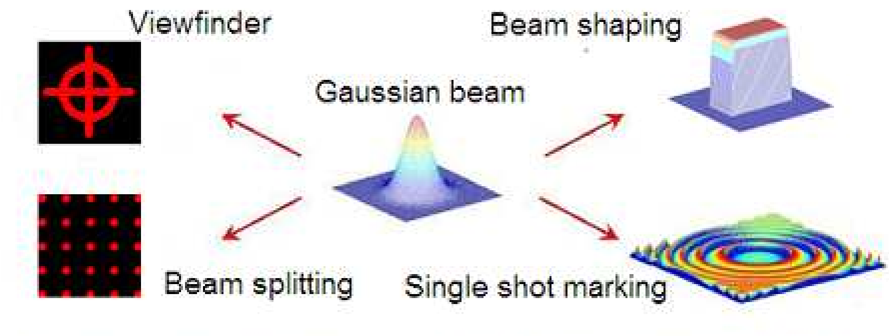
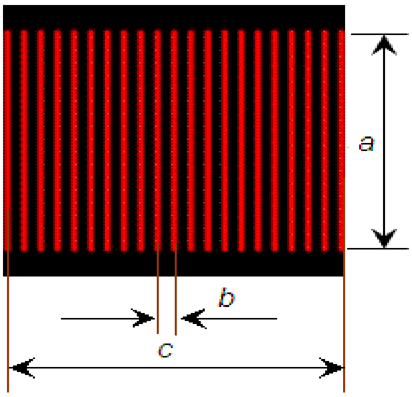
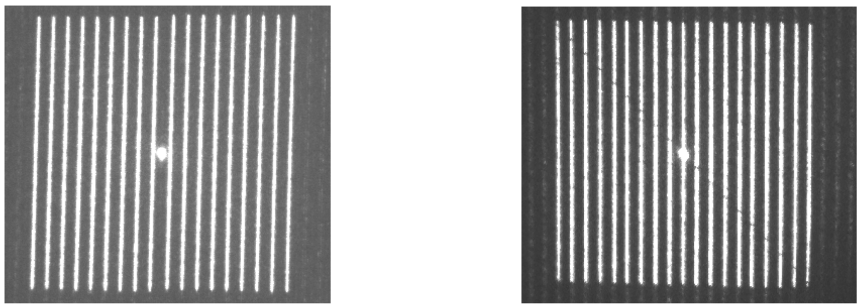


DOEs can convert a Gaussian beam to a beam with almost any intensity distribution

Multi-line



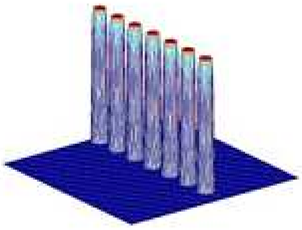
Measured multi-line images generated by our DOEs



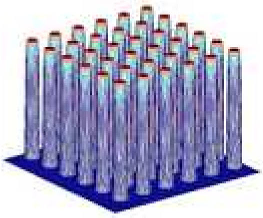
Item No	Light receiving area	Separation angle at 650nm corresponding to a, b and c	Imagesizeat650 nm and working distance of 1000 mm	Remarks
L1	6.5x 6.5 mm	$a = 4.91^\circ$ $b = 0.27^\circ$ $c = 4.62^\circ$	$a = 86$ mm $c = 4.7$ mm $c = 81$ mm	18 lines
L2	6.5 x 6.5 mm	$a = 4.5^\circ$ $b = 0.24^\circ$ $c = 4.34^\circ$	$a = 78$ mm $b = 4$ mm $c = 76$ mm	19 lines

Beam splitter

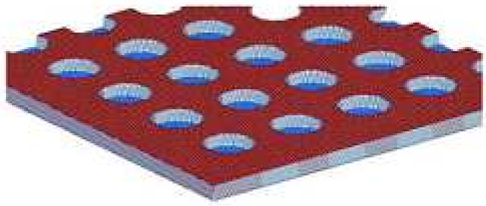
Beam splitters can be used for simultaneous laser drilling (perforating) of multi-holes, fiber coupling, etc. Specific applications of laser drilling include pre-weakening of cartons and metal-foils in packaging industry, high-speed laser texturing, cigarette filters, etc. We can split a single beam into up to a million highly uniform beams.



1-D Beam Splitting



2-D Beam Splitting



Simultaneous laser drilling of multi-holes by 2-D beam splitters

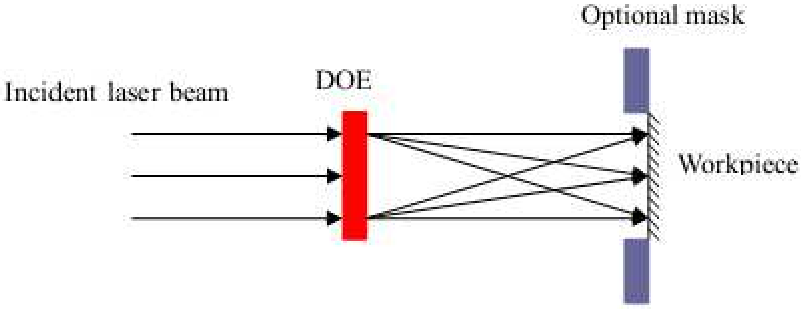
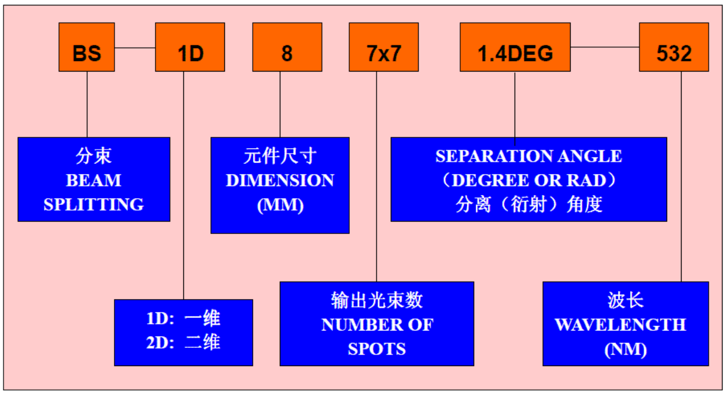
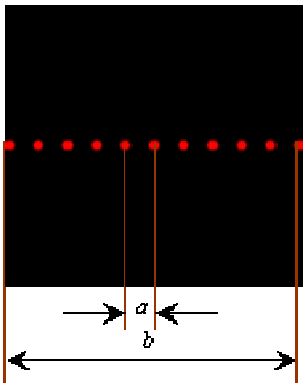
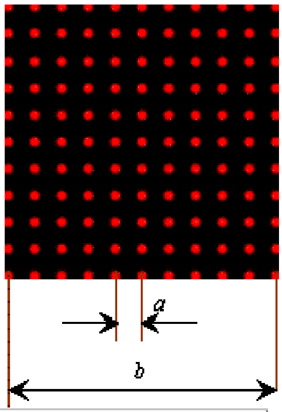


Illustration of laser processing setup with a diffractive beam splitter

Product nomination for diffractive beam splitter elements





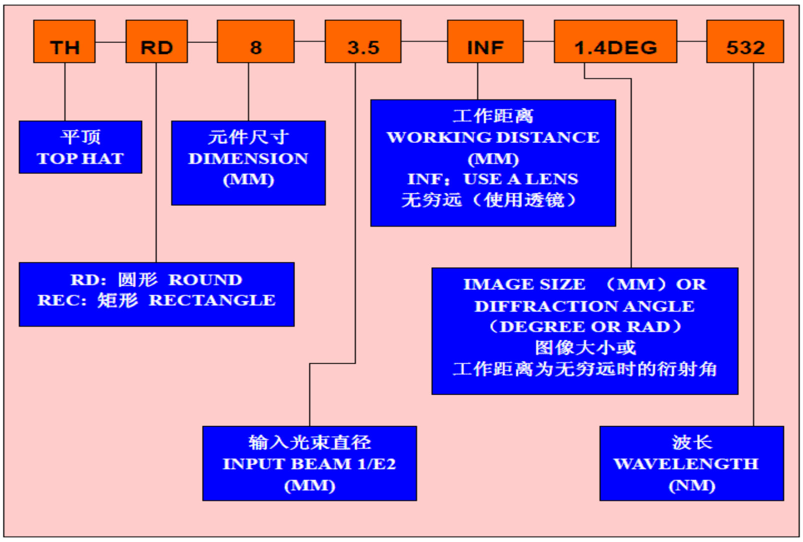


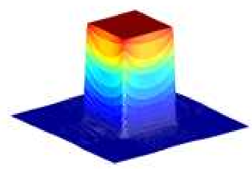
Product Item	Light Receiving area	Number of Spots	Separation angle corresponding to a and b	Wavelength
BS-1D-8-1x3-40DEG-808	8 x 8 mm	1x3	A = 40° B = 80°	808 nm（other wavelengths available）
BS-1D-8-1x24-0.17DEG-	7.5 x 7.5mm	1x24	A = 0.17° B = 4.0°	808 nm（other wavelengths available）
BS-1D-8-1x25-0.17DEG-808	7.5 x 7.5mm	1x25	A = 0.17° B = 4.2°	808 nm（other wavelengths available）
BS-2D-8-10x10-532	8 x 8 mm	10 x10	A = 0.38°	532 nm

Top Hat Beam shaper

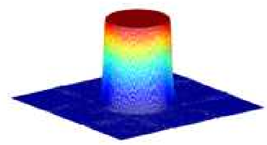
Diffractive beam shapers convert a laser beam with Gaussian intensity distribution into a beam with an accurate and almost arbitrary intensity distribution. Specific applications include precise control of treatment depth in laser heat treatment, laser hardening, cladding; turning a laser beam into a square or hexagon to increase the fill-factor in laser direct writing; and laser tweezers, etc.

Product nomination for diffractive top-hat beam-shaping elements





Guassian to rectangular top-hat



Guassian to circular top-hat

Product Item	DOE size	Image size	wavelength	Working distance
TH-RD-8-3-300-0.5-2080	8mm	0.5mm	2080nm	300mm
TH-RD-8-3-300-1-2080	8mm	1mm	2080nm	300mm
TH-RD-8-3-300-2-2080	8mm	2mm	2080nm	300mm
TH-RD-8-3-300-3-2080	8mm	3mm	2080nm	300mm
TH-REC-8-2-INF-20mrad-1064	8 mm	20 mrad	1064 nm	Infinate
TH-REC-8-2-200-4x4-1064	8 mm	4x4 mm	1064 nm	200 mm
TH-REC-8-2.5-INF-20mrad-1064	8 mm	20 mrad	1064 nm	Infinate
TH-REC-8-2.5-200-4x4-1064	8 mm	4x4 mm	1064 nm	200 mm
TH-REC-8-3-INF-20mrad-1064	8 mm	20 mrad	1064 nm	Infinate
TH-REC-8-3-200-4x4-1064	8 mm	4x4 mm	1064 nm	200 mm
TH-REC-8-3.5-INF-20mrad-1064	8 mm	20 mrad	1064 nm	Infinate
TH-REC-8-3.5-200-4x4-1064	8 mm	4x4 mm	1064 nm	200 mm
TH-REC-8-4-INF-20mrad-1064	8 mm	20 mrad	1064 nm	Infinate
TH-REC-8-4-200-4x4-1064	8 mm	4x4 mm	1064 nm	200 mm
TH-REC-20-8-1700-5x5-1064	20 mm	5x5 mm	1064 nm	1700 mm
TH-REC--8-3-200-4x4-532	8 mm	4x4 mm	532 nm	200 mm
TH-RD-8-3.5-200-0.5-532	8 mm	0.5mm	532 nm	200 mm
TH-REC-8-3.5-200-1x1-532	8 mm	1x1 mm	532 nm	200 mm
TH-REC-8-3.5-200-4x4-532	8 mm	4x4 mm	532 nm	200 mm

Intra-Cavity beam shaper

Traditional laser resonators generate laser beams with a Gaussian distribution. By using an intra-cavity DOE, the resonator can extract more energy an d generate a more uniform super-Gaussian beam, thus greatly improve the electrical-optical conversion efficiency.

Long / short focal depth DOE

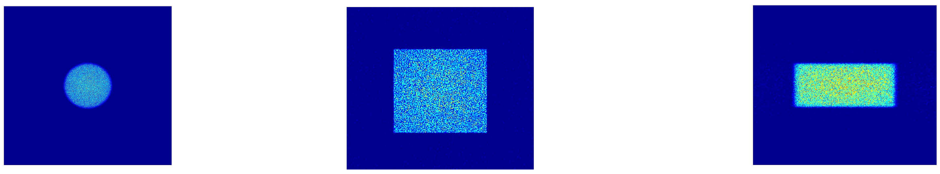
DOEs with long or short depth of focus can be achieved without changing the incident beam size or the working distance (focal length) as well as the focal spot size.

Beam sampler

Without affecting the main laser beam, a diffractive beam sampler produces two laser beams which are exactly the same as the main beam except for having lower power. These two low-power laser beam can be used for monitoring the intensity distribution of the main beam. We offer both reflective and transmissive beam samplers.

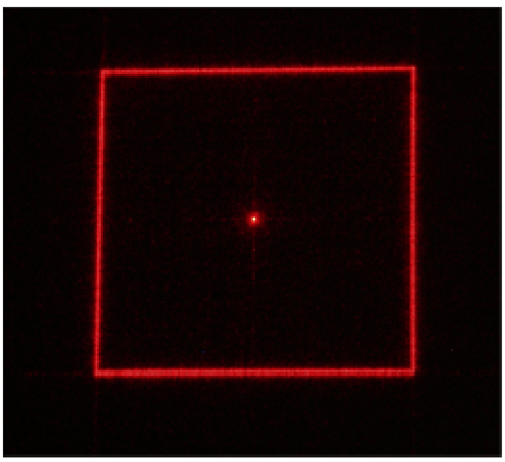
Beam homogenizer(Diffuser)

One main advantage of a beam homogenizer is its insensitivity to the incident beam quality and the change of intensity. Hence it is most suitable for the less stable lasers, laser with long pulse duration or multi-pulse laser applications. Due to the lengthy exposure time, the intensity fluctuation can be averaged to some extent. For a circularly symmetric output beam, the variation in intensity can be further impressed by rotating the beam homogenizer.



Output laser beam spots by diffusers

Square pattern



Full angle: 5.8 degrees at 650 nm

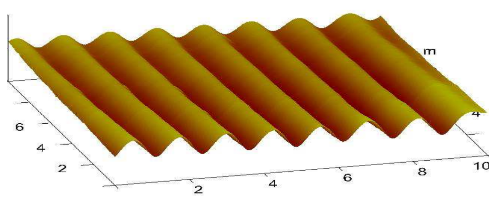
Zero order: ~2% of incident laser power

Intensity of ghost image: ~5% of the signal intensity

The left picture shows the image of the actualsquare pattern produced by our designed and fabricated DOE. The image was taken with a point-and shoot camera.

Phase gratings for optical linear encoder

Grating ruler general use infrared LED, visible light LED, and small light bulbs or semiconductor laser as light source, using moore provisions, diffraction or holographic principle to high precision position measurement, mainly used in modern machine tools, machining centers and various measuring instruments. Grating ruler can be used for linear displacement or angular displacement measurement, the accuracy is commonly from hundreds of microns to submicron, through interpolation, the resolution can reach one nanometer.



AFM image of our fabricated DOE.

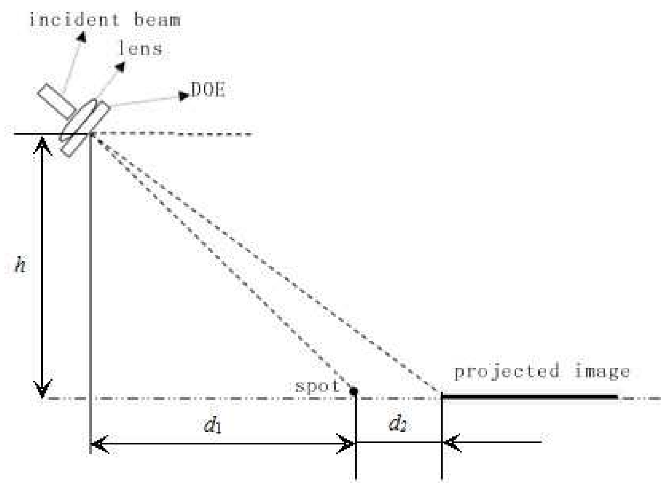
Size:10x10micron.

Laser virtual holographic keyboard

On July 31, 2012, our company successfully developed the domestic first diffractive optical element can be used for virtual holographic keyboard.

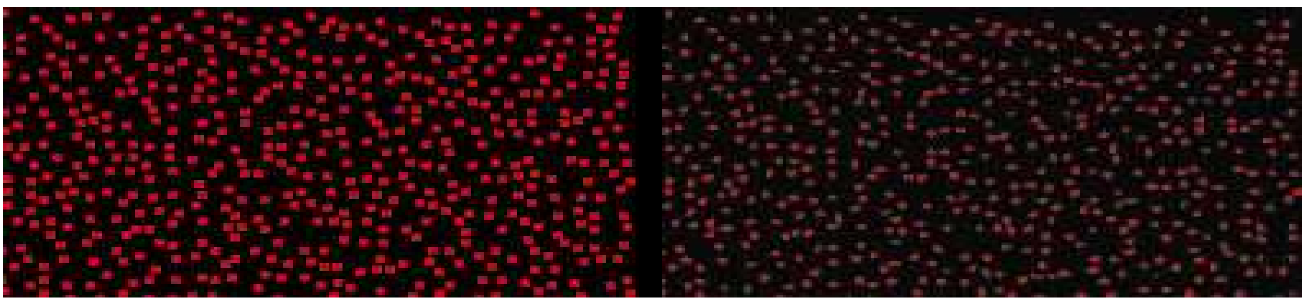
Virtual holographic keyboard, also known as Laser keyboard or Projection keyboard , generally use a red Laser as light source, through the diffraction optical element (also known as holographic element, CGH element, etc.) produce Virtual keyboard image in arbitrary plane, again ues the infrared Laser and CMOS sensors to perception the user's finger position, the user can use virtual keyboard as general machinery keyboard or touch screen. Virtual holographic keyboard used in mobile phones, can solve the mobile phone keyboard is too small, do not accord with human body engineering defects.

To design a virtual holographic keyboard, we need you to provide holographic keyboard picture and size, diffraction element to the projection plane vertical distance h, diffraction element to the top of the image horizontal distance (d_1+d_2), and the projection plane of zero level to the top of the image distance d_2.



Motion sensing and gesture recognition

For Infrared laser based human body motion sensing and gesture recognition systems, diffractive optical elements (DOEs) are without doubt an ideal solution. This is because DOEs can convert a laser beam to virtually arbitrary intensity distribution that matches the requirements of customers very well.



The left pictures show a customer's desired pattern and the right is an actual pattern generated by our designed and fabricated DOE. It can be seen that the two patterns are in excellent agreement with each other.

Micro refractive and diffractive lens

We can provide both refractive microlens array and diffractive microlens array.

Tolerant and compact single-diffractive-optical-element-based laser collimation and its comparison with single-lens-collimation

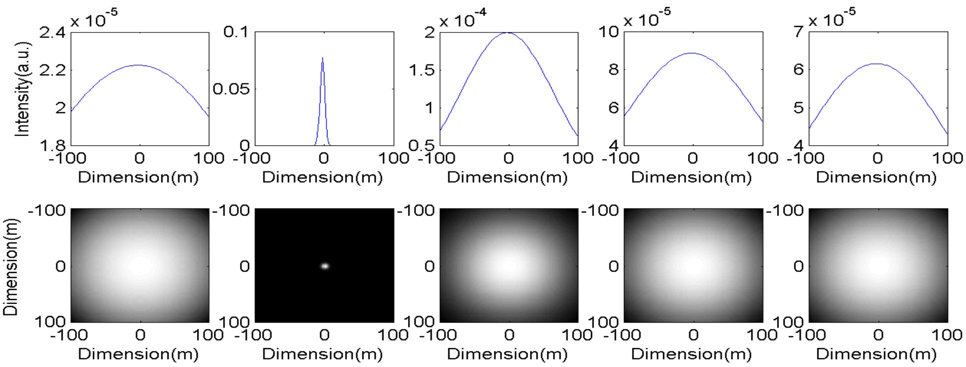
In many applications, one needs to compress the divergence of an incident laser beam. This is commonly referred to as laser beam collimation.

An inverted telescopes is often used to collimate an incident laser beam. The advantages of using an inverted telescope include excellent collimation performance, and the collimation performance being insensitive to the position of the telescope with respect to the laser beam's waist position. However, the disadvantage of an inverted telescope is that the system is big.

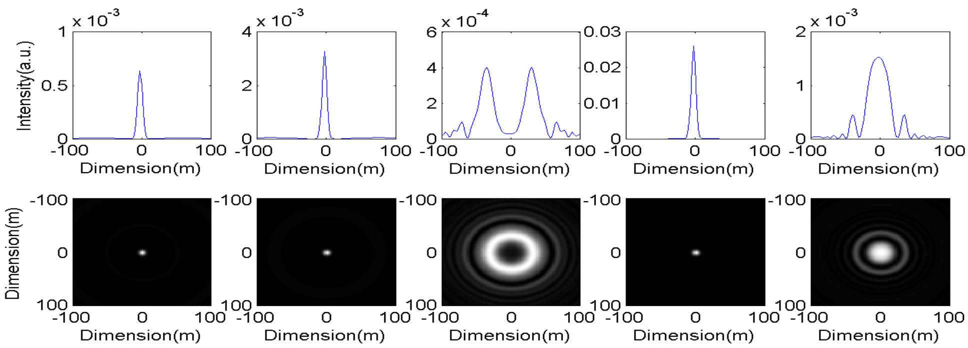
By contrast, using a single lens for collimation is opposite. It is small and compact, but the collimation performance is sensitive to the position of the telescope with respect to the laser beam's waist position. The incident beam beam waist should be located at the focal plane of the lens, otherwise the collimation performance is poor.

Using diffractive optical element can solve these two problems at the same time, i.e. the device is small and compat, while the collimating performance is tolerant to the position of the DOE with respect to the beam waist. Recently Wuxi OptonTech Ltd has developed this kind of DOE-based collimation device. We have achieved excellent collimation performance when the distance between the dOE and beam waist from 0up to 2000 mm, while the collimation distance can be as long as 40 km.

Without losing generality, we choose a lens with focal length of 200 mm. The following picture shows 1-D and 2-D intensity distribution at the collimation distance of 40 km when the distance d between the beam waist and the DOE is 100mm, 200mm, 300mm, 400mm and 500mm. It can be seen that the collimation performance is good only when the distance d is equal to the focal length f, otherwise the collimation performance is poor.



By contrast, the DOE developed by Wuxi OptonTech Ltd can achieve excellent collimation performance when d varied from 0 to 2000 mm. The following picture shows the situation of our DOE, i.e. 1-D and 2-D intensity distribution at the collimation distance of 40 km when the distance d between the beam waist and the DOE is 100mm, 200mm, 300mm, 400mm and 500mm. It can be seen that the collimation performance is good when the distance d varied from 100mm to 500mm. The collimation performance is particularly excellent when d is 100, 200 and 400 mm.



We need the following parameters to provide you custom DOEs

DOEs you would like to order：

☐ Beam splitter； ☐ Top-hat beam shaper； ☐ Other beam shaping； ☐ microlens array；

☐ inclined surface beam shaping（virtual holographic keyboard）； ☐ Other applications

Required diffractive efficiency： ______________________________

Please attach your required target image (irradiance/intensity distribution) if necessary

Wavelength： ______________________________

Material： ______________________________

Dimensions and shape of DOE： ______________________________

Incident beam diameter(radius x 2)： ______________________________

The input laser power and laser type： ______________________________

Mode（Single Mode or Multi Mode）： ______________________________

☐（beam splitting）Separation angle of 2 adjacent output beams： ______________________________

☐（Tot-hat）working distance： ______________________________

Size of output beam spot or diffraction angle of output beam： ______________________________

☐（Laser oblique projection）Output image and the size： ______________________________

The vertical distance diffraction element to the projection plane h，Diffraction element to the image at the top of the horizontal distance (d_1+d_2)，

And the projection plane of zero level to the top of the image distance d_2： ______________________________

☐（microlens array）Pitch between microlens： ______________________________

Micro lens focal length： ______________________________

Overall size device（LWH）： ______________________________

If plating coating： ______________________________

Specifications

Material：Fused silica, BK7 (K9) glass, resin, PC, GaAS etc.
Wavelength: 193-10600 nm
Dimenstion,: up to Φ 150 mm
Phase levels: 16
Feature size: >300 nm

Contact us

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