

TuoTuo Technology



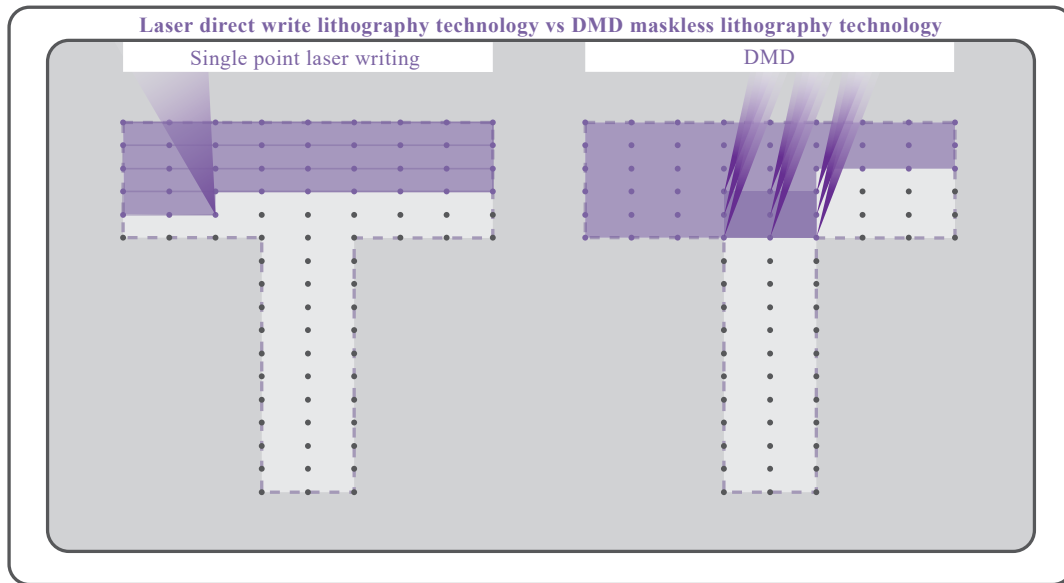
ANALYSE
ANALYTICAL INSTRUMENTS

Maskless UV Lithography



TuoTuo Technology (Singapore) Pte. Ltd.

Laser direct writing lithography technology and DMD maskless lithography technology



Laser direct write technology performs high-precision processing directly on the material surface using a laser beam, while **DMD maskless technology** uses a digital micromirror array to project light beams for patterning, making it suitable for large-area lithography.

Introduction of DMD maskless lithography technology

Principle

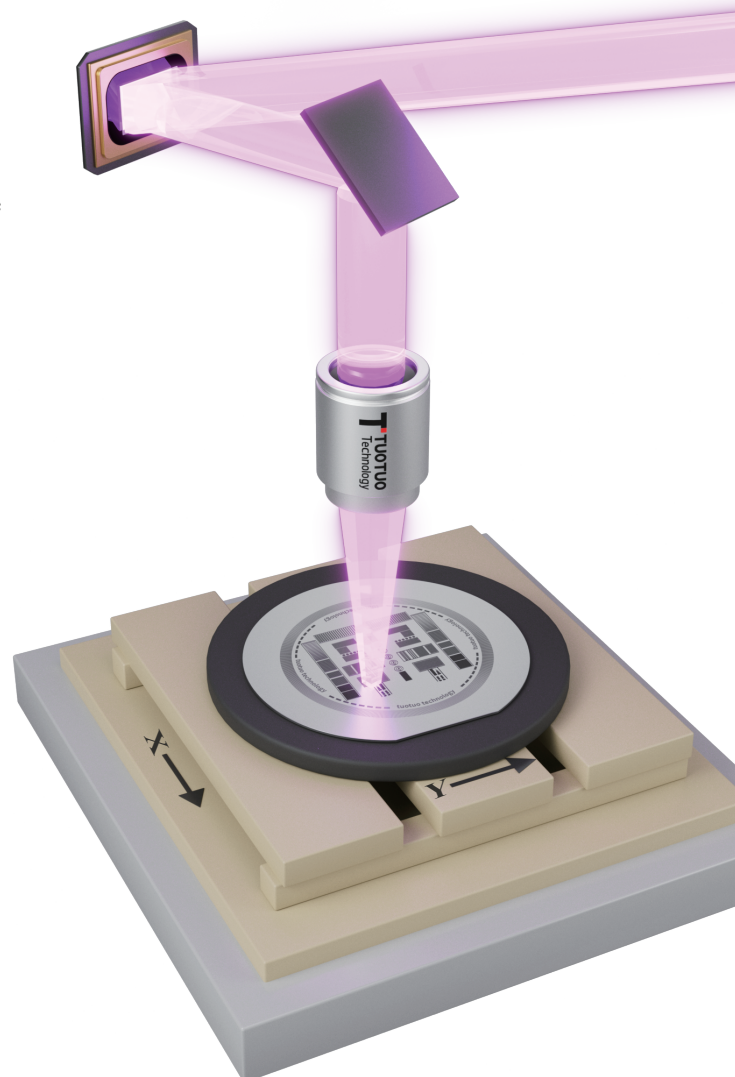
DMD maskless lithography technology uses a digital micromirror device (DMD) to control the angle of the micromirror, thereby quickly forming an image or lithography pattern on the surface of the material through a projection system. These micromirrors will accurately adjust the reflection angle according to the control of the electrical signal to project the laser or light source to a specific location.

System

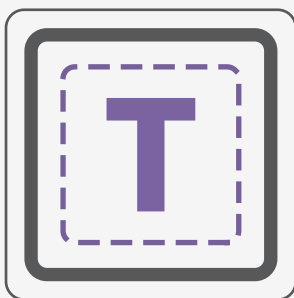
The maskless lithography system based on DMD is usually composed of light source module, light homogenizing module, DMD module, projection module, motion stage module and software. These modules work together efficiently and accurately to achieve fast maskless lithography of high-resolution patterns.

Workflow

The host computer sends the graphic data to the DMD module, which displays the corresponding pattern. The light reflected by the DMD carries the pattern information, and after passing through a series of optical components, it is projected onto the substrate, achieving the transfer of the pattern. The coordinated operation of the high-precision motion platform ensures the accurate stitching of different exposure areas, ultimately enabling dynamic exposure of large and complex patterns.



Core Functions

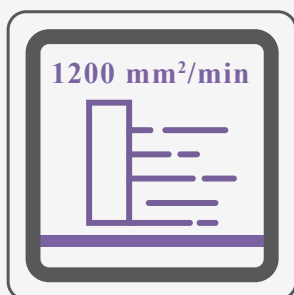
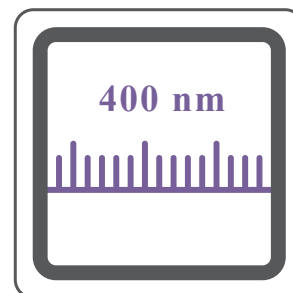


Flexible design, no need for masks.

Compared with traditional masked lithography, maskless lithography is more flexible and convenient, eliminating the time and money cost of plate making, and helping you quickly verify your ideas.

Critical dimension accuracy up to 400 nm

The critical dimension accuracy of 1 μm can meet most of the research requirements. For users with higher accuracy requirements, we provide products with up to 400 nm critical dimension for your selection.

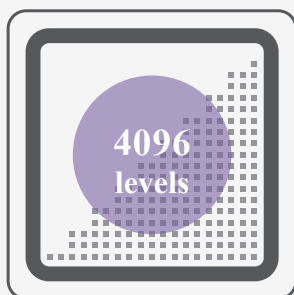
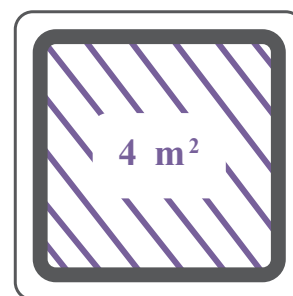


Speed up to 1200 mm²/min

For the processing of large-sized samples, efficiency becomes particularly important. We will provide you with high-speed, high-precision equipment to meet your needs.

Exposure area up to 4 m²

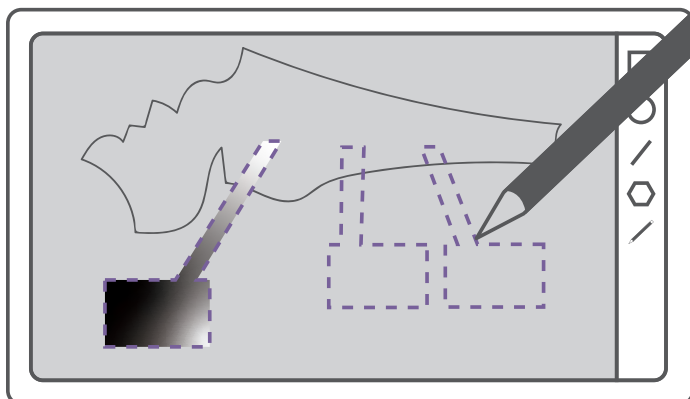
If you have the need for ultra-large format processing, we can provide products with a exposure area of up to 4 m² to meet your requirements.



Grayscale lithography up to 4096 levels

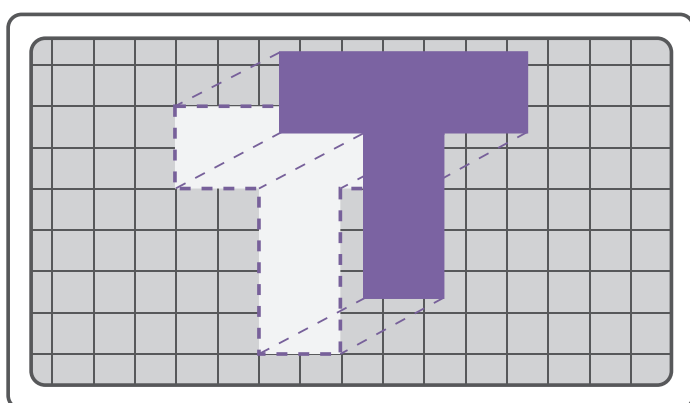
The 4096-level grayscale capability enables precise construction of highly complex and intricate microstructures or patterns on photoresist materials, offering exceptional process accuracy and a wealth of design possibilities for the micro-nano fabrication field.

Features



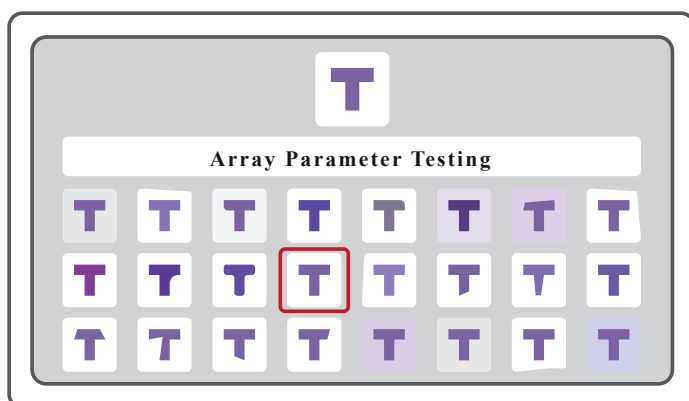
Direct Drawing

Direct drawing provides you with a flexible and convenient way to quickly validate your ideas.



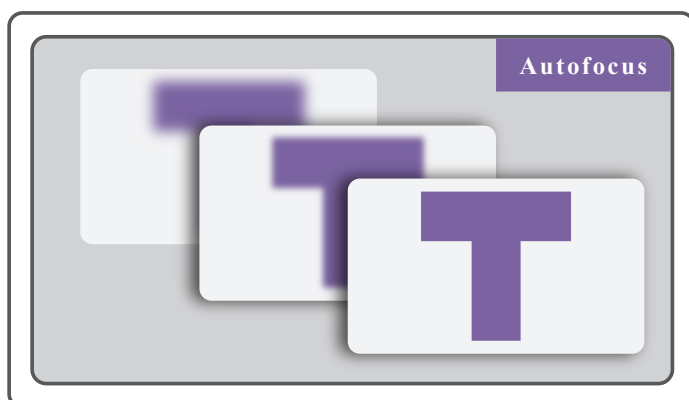
Accurate Overlay

Using green light as the guide light, it provides you with an alignment preview before lithography, ensuring precise overlay.



Array Lithography

Array lithography provides you with a fast way to confirm process parameters, helping you save time.

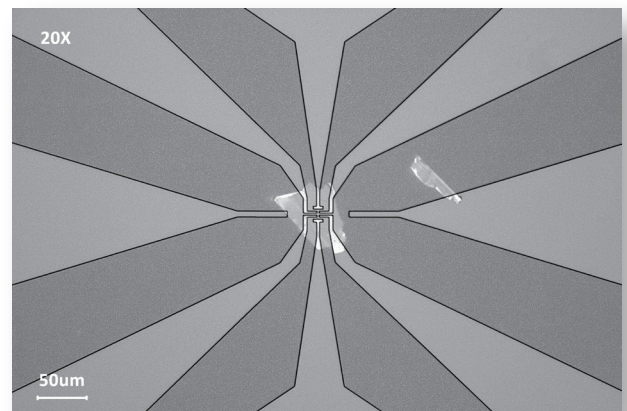
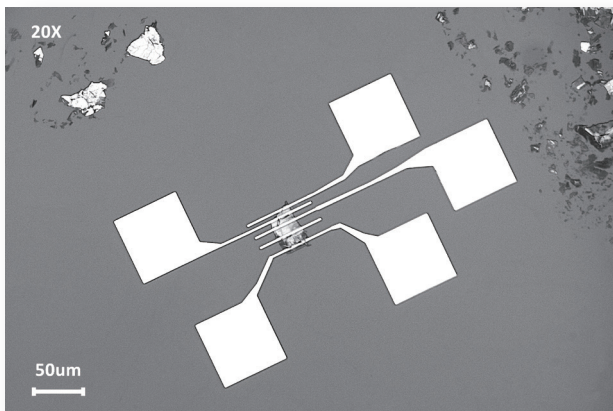


Autofocus

Autofocus provides you with real-time alignment before lithography, ensuring clear focus for each exposure.

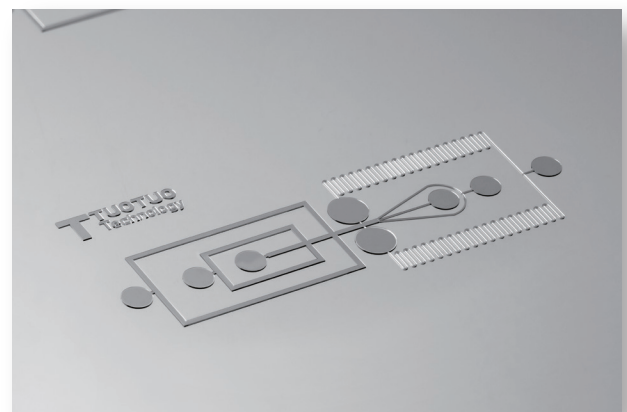
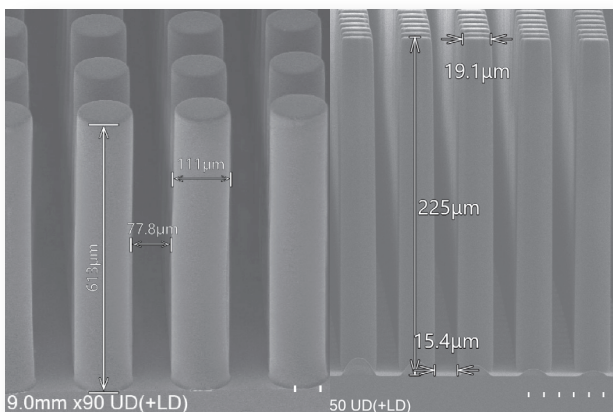
Application: 2D materials

The ' **guiding light** ' and ' **direct drawing** ' functions independently developed by TuoTuo Technology are flexible and efficient in drawing electrode patterns directly on 2D materials



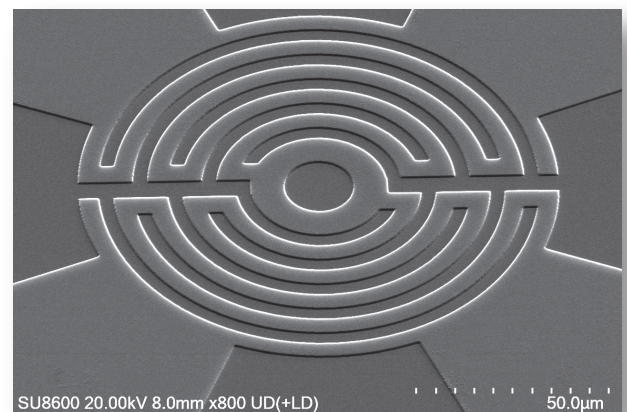
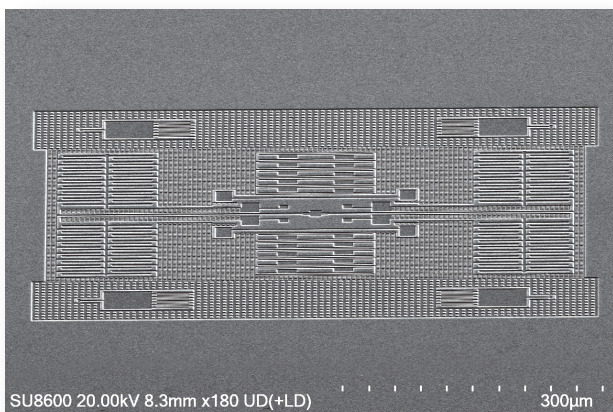
Application: Microfluidics

The maskless lithography machine can be used to fabricate a **high aspect ratio (10:1)** structure, which has high precision and high flexibility in the manufacture of microfluidic chips. It is widely used in single cell analysis, sensors and other fields.



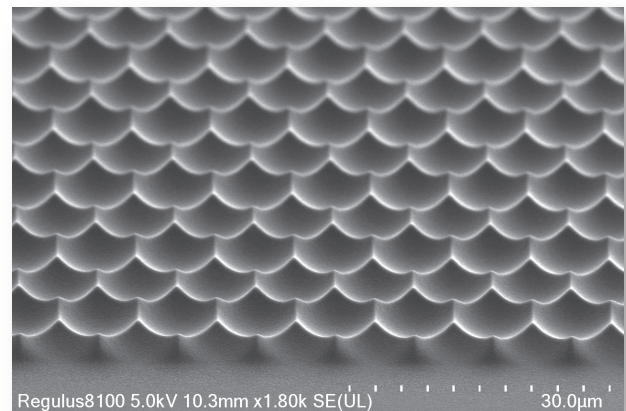
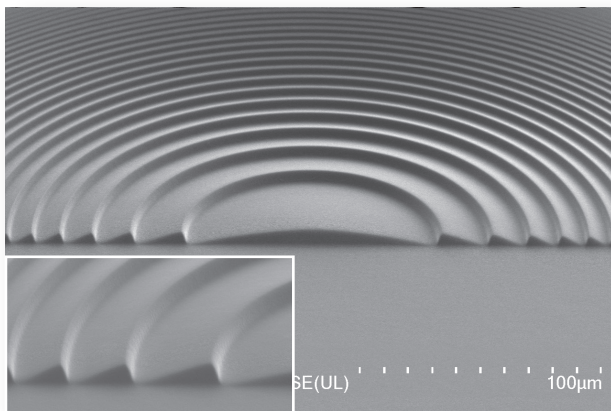
Application: MEMS

Maskless lithography technology is widely used in the MEMS field, enabling the high-precision fabrication of micron-level patterns. It allows for the processing of complex structures through **multi-layer alignment techniques**.



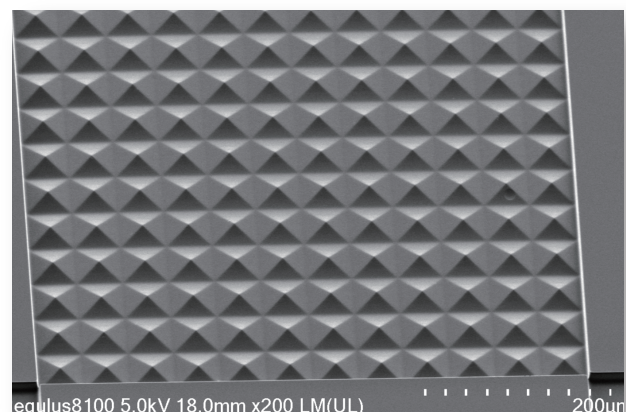
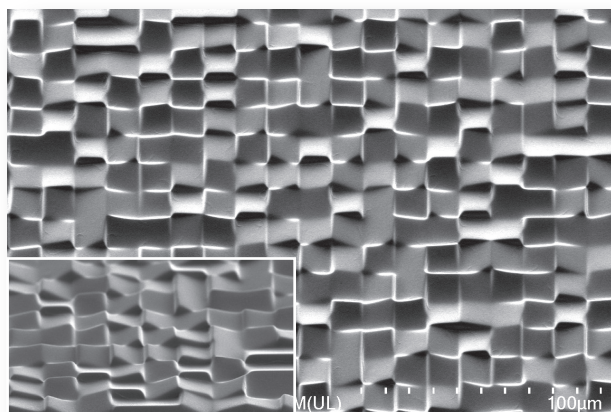
Application: Microlenses

By using **grayscale lithography**, the surface morphology can be precisely controlled to generate complex diffraction structures, such as gratings, Fresnel lenses, microlenses, and more.



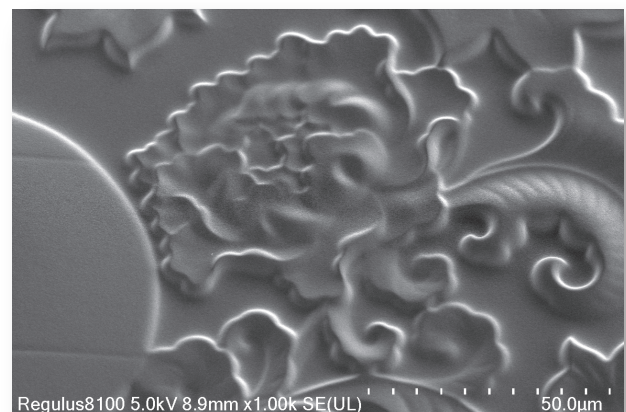
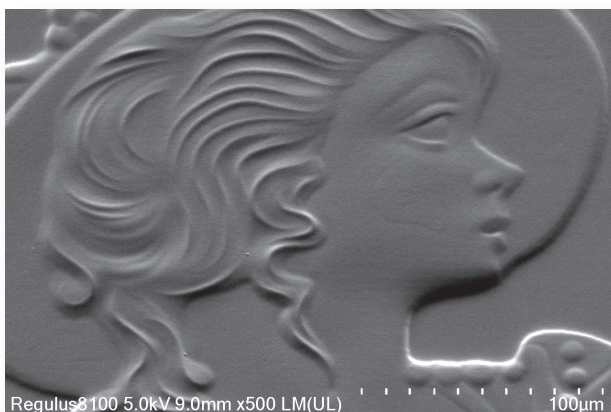
Application: Optical diffractive devices

Grayscale lithography in optical modulation devices is applied by precisely controlling the lithography intensity to fabricate highly detailed optical microstructures. These structures are used to optimize the modulation and transmission characteristics of light waves.



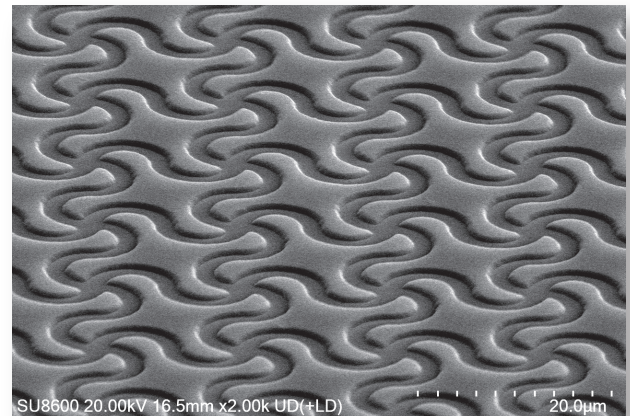
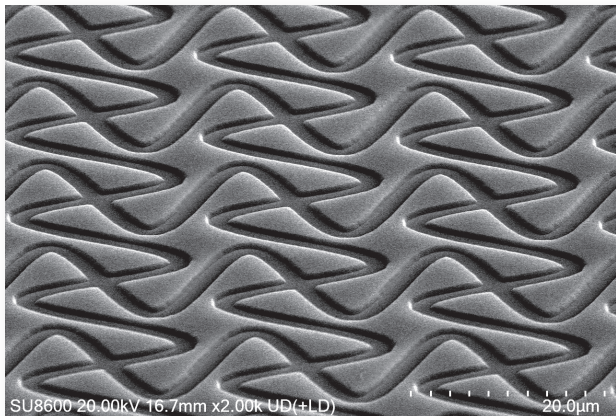
Application: Relief structures

Grayscale lithography in anti-counterfeiting relief structures is applied by finely controlling the light intensity to create high-precision 3D microstructures, enhancing the complexity and difficulty of replicating anti-counterfeiting markings.



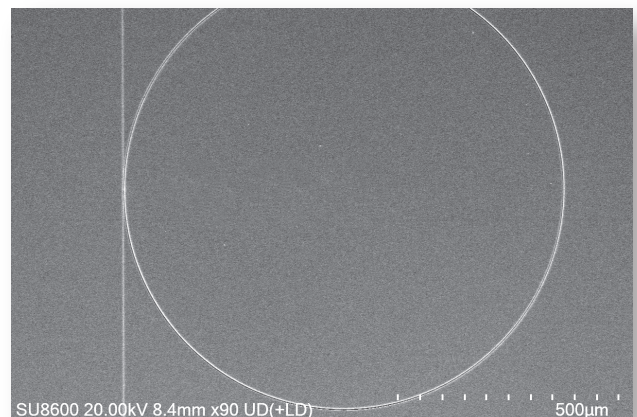
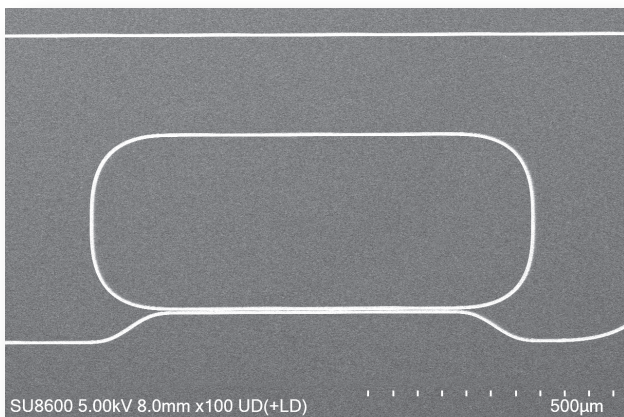
Application: Metasurfaces

Photolithography in the metasurface field is applied by **precisely fabricating micro-nano structures**, enabling fine control of light waves and modulation of specific optical properties such as wavelength and polarization.



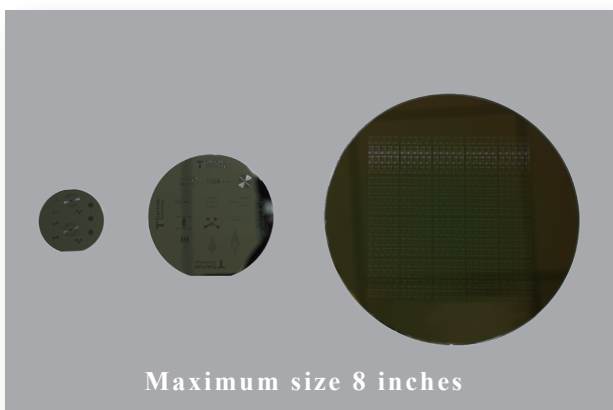
Application: Quantum optics

Photolithography in the direction of quantum optical waveguides is applied by precisely etching micro-nano scale **waveguide structures**, enabling the transmission and manipulation of quantum states, thus advancing quantum information processing and transmission technologies.

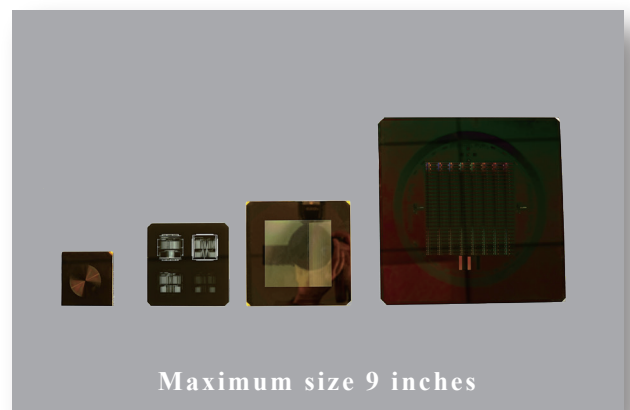


Application: Mask manufacturing

High-speed (up to 1200 mm²/min) maskless lithography machines are suitable for small-batch, customized mask plate fabrication. They reduce external dependencies and shorten the design iteration cycle.



Maximum size 8 inches



Maximum size 9 inches

Academic

High flexibility, high precision, maskless, suitable for scientific research.



- 6-inch exposure area
- 0.4 μm minimum critical dimension
- Stepper or Scanner lithography

Speed

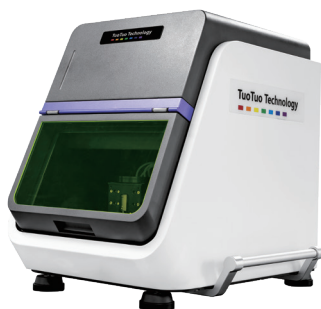
Faster processing speed, stronger equipment performance, suitable for small batch production and manufacturing.



- 8-inch exposure area
- 0.5 μm minimum critical dimension
- Scanner lithography

Young

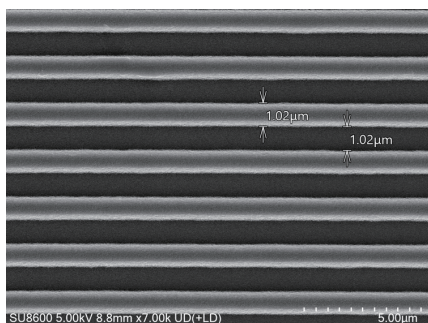
The desktop maskless lithography machine is flexible and compact, making it ideal for experimental courses in advanced processing and manufacturing of microelectronics, integrated circuits, and other applications.



- 2-inch exposure area
- 1.5 μm critical dimension

*The specifications and parameters of all the above products depend on individual process conditions and may vary based on equipment configuration. The writing speed depends on the exposure area.

Academic



- Stepper lithography
- Multi-lens automated switching
- 6-inch exposure area
- 0.8 μm critical dimension

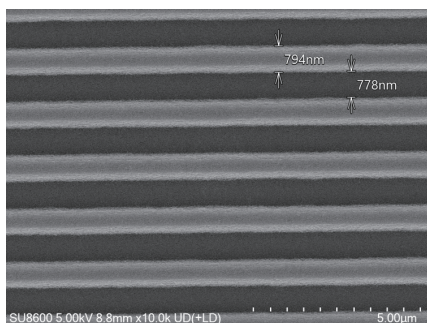
Model	UV Litho-ACA
Critical dimension	0.8 μm
Minimum lines and spaces	1.0 μm
Exposure speed	Lens①:3mm ² /min Lens②:20 mm ² /min Lens③:100 mm ² /min
Overlay accuracy (5 mm × 5 mm)	400 nm
Overlay accuracy (50 mm × 50 mm)	1000 nm
Wavelength*	LED:405 nm / 380 nm
Automated lens switching	Supported
Grayscale	Optional
Substrate size	3 mm × 3 mm(min) & 150 mm × 150 mm(max)
Substrate thickness	0-10 mm
Data format	GDS & DWG & DXF
Dimensions (L×W×H)	750 mm × 800 mm × 700 mm
Weight	320 kg
Installation requirements	Total area:1.6 m × 1.4 m Power:2.1 Kw; Temperature:20–30 °C; Humidity:RH 40-60 % Power supply:220 V ±5 %, 50 Hz ±1 Hz, 10 A

*The specifications and parameters of all the above products depend on individual process conditions and may vary based on equipment configuration. The writing speed depends on the exposure area.

*The standard light source is 405nm, with other wavelengths available as options.

*Specifications and parameters are subject to change without prior notice.

Academic



- Stepper / Scanner lithography
- Higher resolution
- Optical active autofocus
- 6-inch exposure area
- 0.4 μm critical dimension

Model	UV Litho-ACA Pro+	UV Litho-ACA Master
Critical dimension	0.4 μm	
Minimum lines and spaces	0.8 μm	
Exposure speed	Lens①:1 mm ² /min Lens②:3 mm ² /min Lens③:20 mm ² /min Lens④:100 mm ² /min	Lens①:10 mm ² /min Lens②:60 mm ² /min Lens③:150 mm ² /min
Overlay accuracy (5 mm × 5 mm)	350 nm	
Overlay accuracy (50 mm × 50 mm)	700 nm	
Wavelength*	LED:405 nm / 380 nm	LED:405 nm / 390 nm
Automated lens switching	Supported	
Grayscale	Supported	Non-optional
Substrate size	3 mm × 3 mm(min) & 150 mm × 150 mm(max)	
Substrate thickness	0-10 mm	
Data format	GDS & DWG & DXF	
Dimensions (L×W×H)	1150 mm × 950 mm × 2000 mm	
Weight	590 kg	
Installation requirements	Total area:2.2 m × 1.7 m Power:1.9 Kw; Temperature:20–30 °C; Humidity:RH 40-60 % Power supply:220 V ±5 %, 50 Hz ±1 Hz, 10 A	

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*The standard light source is 405nm, with other wavelengths available as options.

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