InterLitho

VIL 1000

Automatic Step-and-Repeat Interference Nanopatterning System

- Sub-50 nm Feature Size
- Diverse 1D / 2D Nanopatterns

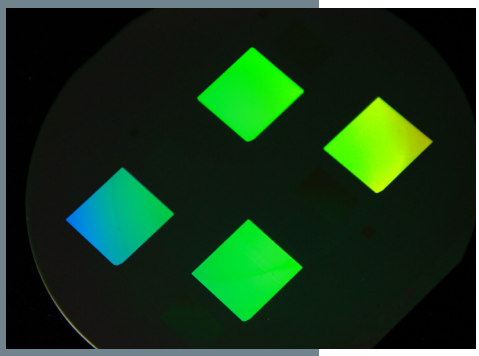
Change The World One Step At A Time

www.interlithotech.com

VIL 1000

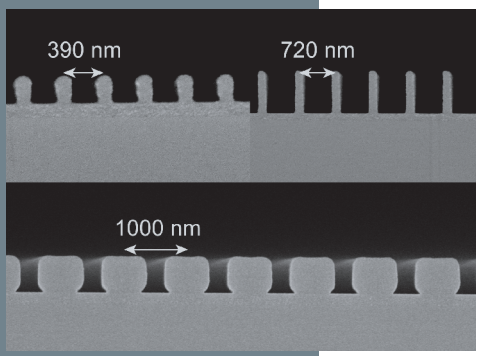
The VIL 1000 nanopatterning system possesses powerful functions, such as fast reconfigurable beam delivery, active interference pattern stabilization, step-and-repeat exposure with precise sample positioning, etc. All the functions are fully automated through our proprietary user-friendly control software LithoPro. After a sample is loaded, no more manual setting or adjustment is needed. The system can produce various nanostructures, such as 1D grating lines and 2D pillar/hole patterns with periods from below 240 nm to over 1500 nm on up to 8-inch large area through repeated exposures using patterning fields of standard 2cm-by-2cm square or user-defined shapes. Each patterning field can contain nanostructures with independently set periodicity, lattice, and feature sizes. Optional modules are available for extended functions of integrated UV contact photolithography, patterned modulation of feature sizes, and lithographic process simulation.

The VIL 1000 is ideal for quickly producing devices with multiple different nanopatterned regions, such as AR displays. It is also useful for parameter optimization when a large variety of nanostructures need to be fabricated and tested.



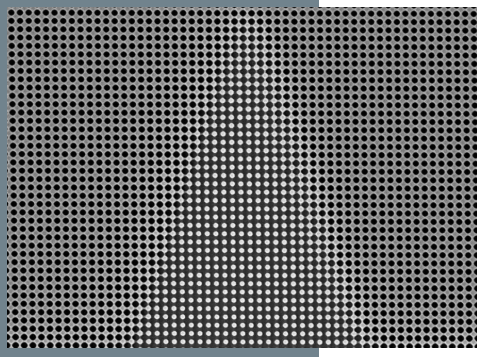
STEP-AND-REPEAT NANOPATTERNING

The standard VIL 1000 model supports step-and-repeat exposure on 4” wafers with an individual patterning area up to 2×2 cm^2. Upgraded with the **advanced sample positioning** module, the patterning area can be extended up to 6” or 8” wafer scale.



AUTOMATIC PATTERN SETTING

The **fully-motorized beam delivery** module and sample positioning stage provide great flexibility in fabricating nanopatterns of various periodicities and geometries, including lines, pillars, holes, checkerboards, rods, etc.

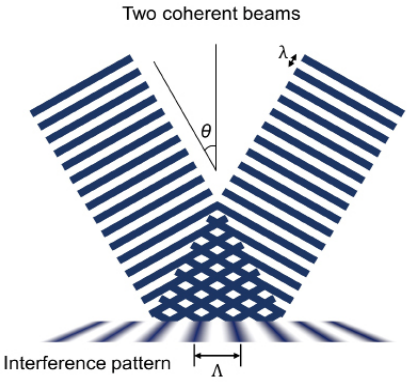


PATTERN SIZE MODULATION/ UV MASK EXPOSURE MODULE

The VIL 1000 can be upgraded with the **pattern size modulation** module for fine-tuning the filling ratio of 1D and 2D structures, further improving the pattern uniformity and producing arbitrarily designed spatial distribution of feature sizes. The optional **UV mask exposure** module is also available, which is compatible with contact photolithography for a wider range of applications.

CORE TECHNIQUES

Our automatic step-and-repeat nanopatterning system can create multiple different nanopatterns on the same substrate within minutes.

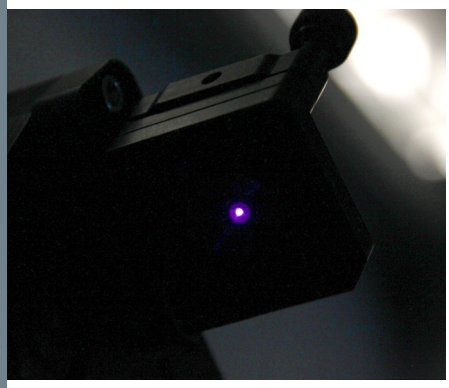


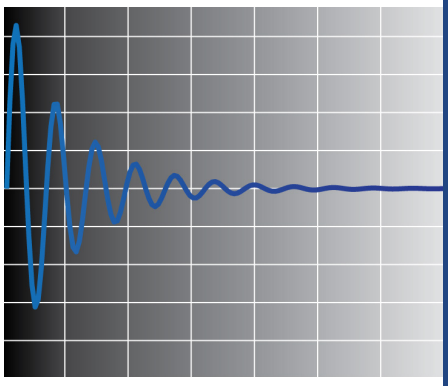
INTERFERENCE LITHOGRAPHY (IL)

Interference lithography (also known as holographic lithography) is a maskless nanolithography technique, useful for high-throughput fabrication of large-area periodic nanostructures. In a basic two-beam interference lithography configuration, a coherent laser beam is split into two sub-beams and the two sub-beams overlap on a photoresist-coated wafer with an angle. The periodicity of the interference pattern is determined by $\Lambda=\lambda/2\sin\theta$, where λ is the laser wavelength and θ is half of the angle between the two sub-beams.

FAST-RECONFIGURABLE BEAM DELIVERY

The periodicity of the interference nanopattern is determined by the angle between the two beams. Adjusting the beam angle on a conventional IL system is complex, time-consuming, and requires professional skills. Our VIL 1000 interference nanopatterning system employs a fully-motorized flexible beam delivery module. Through our proprietary control software, LithoPro, users can tune the periodicity conveniently, rapidly, and automatically. The reconfigurable beam delivery module in our standard model has a wide periodicity tuning range from 240 nm to 1500 nm. Wider tuning ranges of the periodicity could be customized upon request.





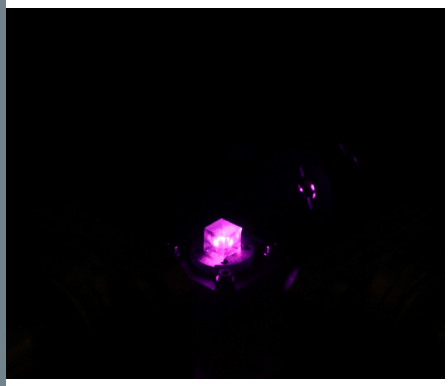
ACTIVE INTERFERENCE PATTERN STABILIZATION (AIPS)

Nanopatterns recorded in photoresist directly reflect the periodic intensity distribution of the interference patterns. To obtain high-quality nanostructures, a stable intensity distribution of the interference pattern is desirable, which is often affected by environmental disturbance and mechanical vibration. The AIPS module integrated with the VIL 1000 system employs innovative optical design, precise electronics, and advanced embedded firmware algorithm to automatically compensate phase variations with a high refresh rate, regardless of the beam incident angle.

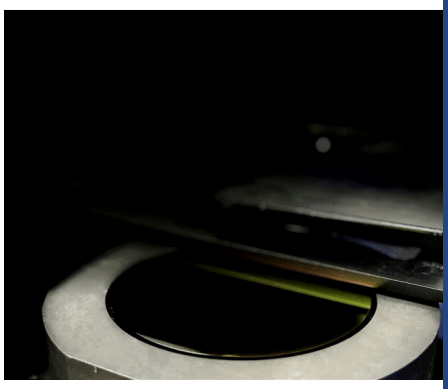
CORE TECHNIQUES

PRECISION OPTOMECHANICS

The VIL 1000 nanopatterning system adopts fine optomechanical adjustment components for accurate beam splitting and efficient beam delivery. A solid circular rail ensures stable beam pointing at any beam angle and motorized sliders enable automatic periodicity tuning with high accuracy. The VIL 1000 system features unprecedented automation in interference patterning with highly suppressed mechanical variation to achieve high interference pattern contrast. Our interference patterning modules are assembled on an air-suspension optical table with a specially designed enclosure to further eliminate the mechanical and environmental disturbance.



MULTI-AXIS SAMPLE POSITIONING



The multiple-axis sample positioning module in our VIL 1000 interference nanopatterning system has bidirectional positioning repeatability of 4 microns and rotation accuracy of 0.1°, which allows for precisely defining the pattern lattice and exposure field positions. Supporting components made of lightweight aluminum alloy mitigate mechanical vibrations. The computer-controlled sample positioning significantly improves patterning speed and enables automatic patterning of multiple exposure fields. The sample stage also contains a pneumatic exposure shutter that provides accurate exposure time control.

APPLICATON CASE STUDY

PSS

Patterned sapphire substrates (PSS) have been evolving towards smaller features at the nanoscale for further improving LED performance and exploring advanced LED products. The VIL 1000 is suitable for producing large-area nanostructures used in PSS.

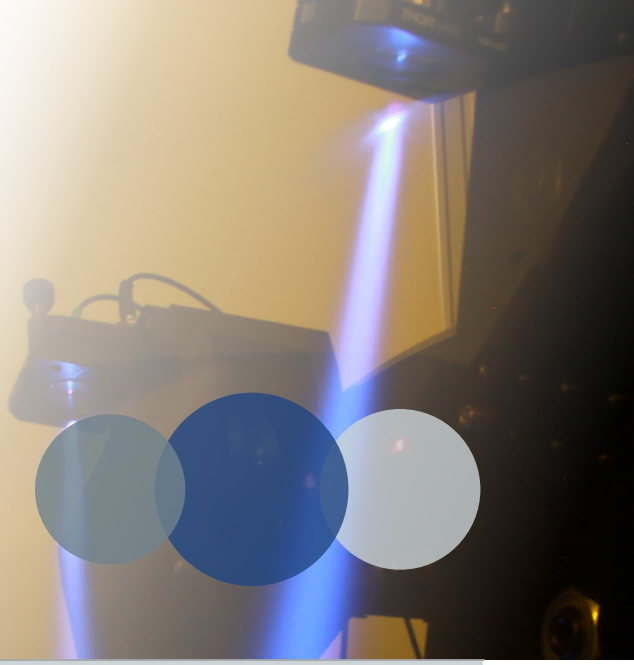
Biochips

Micro and nanostructured interfaces have been widely applied in microfluidics and biomedical applications due to the manipulation of liquid such as wetting, transportation, superhydrophobicity, etc. Our VIL 1000 is useful to fabricate large-area microfluidics and biochips to achieve high-responsiveness, low-cost, and lab-on-chip applications.

AR/MR

Diffractive waveguides are considered the most mature and promising augmented and mixed reality combiner technology. The VIL 1000 is a good fit to fabricate nanoscale gratings used in AR waveguides.

TECHNICAL DATA



Our VIL series is a fully automatic step-and-repeat nanopatterning system. It allows to pattern different nanostructures on the same substrate with independently set periodicity, lattice, and feature sizes. The system is perfect for producing devices with different nano-scale features and patterning regions, such as AR displays.

Exposure Parameters	
Period Adjustment Mode	Fully Automatic
Minimum Feature Size [nm]	50
Minimum Achievable Period [nm]	≤ 240
Maximum Achievable Period [nm]	≥ 1500
Exposure Field Size [mm x mm]	20 x 20 (customizable)
Processing Time per Field [min]	≤ 3 (typ.)
Line Edge Roughness (3σ) [nm]	≤ 5 nm
Patterning Uniformity	± 10%
Photoresist	h-line (405-nm-sensitive)
Pattern Lattice	1D/2D
System Features	
Laser Wavelength [nm]	405
Maximum Substrate Size [mm]	150
Software	LithoPro
Substrate Placement Accuracy (x, y) [um]	4
Substrate Placement Accuracy (theta) [deg]	0.1
Advanced Options	
Pattern Size Modulation System	Linewidth modulation with user-defined spatial profile to achieve enhanced uniformity or designed spatial pattern size variation
System Dimensions (TPP unit)	
Footprint (width × depth × height) [mm]	1500 mm x 1500 mm x 1800 mm
Weight [kg]	<1000
Installation Requirements	
Electrical	220-230V, 50/60 Hz, 16A
Optimum Lab Conditions	Temperature: 21℃ ± 1℃ Humidity<60%
Compressed Air	6-8 bar, stability ± 0.5 bar

InterLitho

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