nano scribe

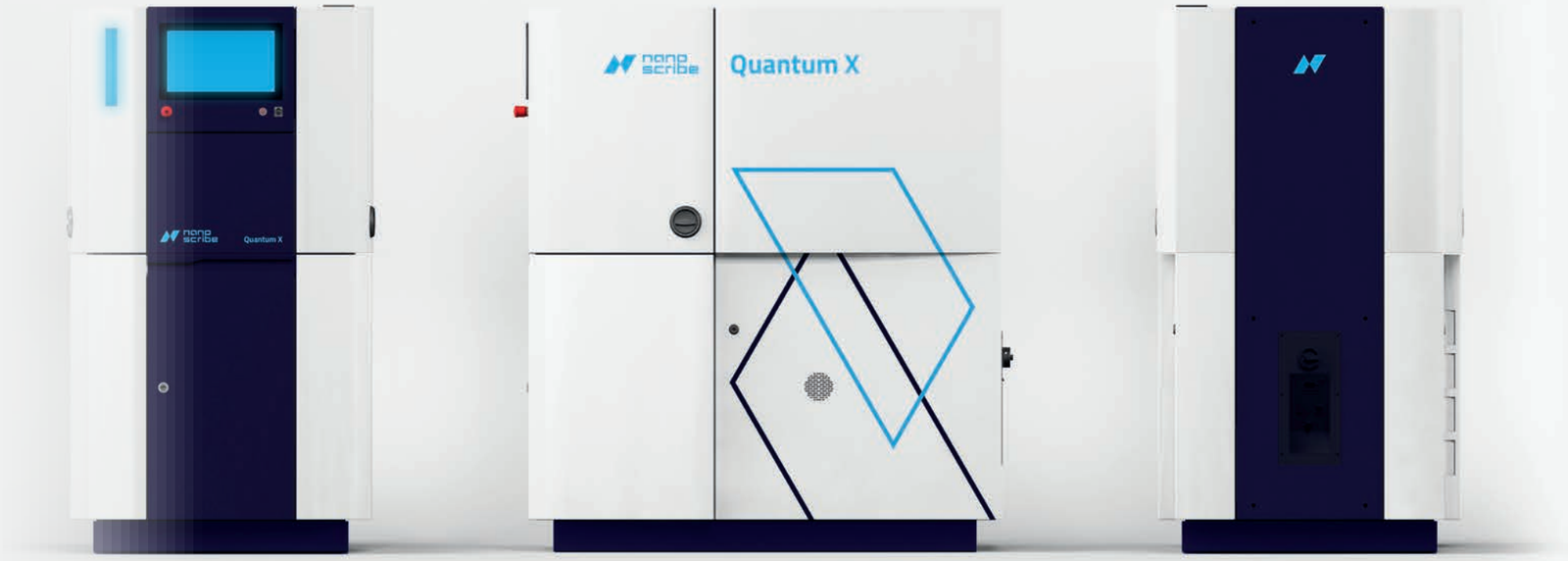
The new **Quantum X**

Redefining microfabrication.

nanoscribe.com

Experience Quantum X

World's first Two-Photon Grayscale Lithography system for maskless microfabrication of refractive and diffractive microoptics



The brand-new Quantum X system from Nanoscribe is designed for the microfabrication of prototypes and masters in industrial production processes. This maskless lithography system redefines the fabrication of free-form microoptics, microlens arrays and multi-level diffractive optical elements. The world's first Two-Photon Grayscale Lithography (2GL®) system combines the extraordinary performance of grayscale lithography with the precision and flexibility of Nanoscribe's pioneering Two-Photon-Polymerization technology.

The new microfabrication system offers high speed, full design freedom and the precision needed for additive fabrication of complex structures requiring high shape accuracy and ultra-smooth surfaces. Fast and accurate additive manufacturing processes drastically shorten design iteration cycles and enable cost-effective microfabrication.

KEY FEATURES

- High-speed 2.5D microfabrication
- Ultra-smooth surfaces and excellent shape accuracy
- Design freedom with sub-micrometer resolution
- Complete and ultrafast control over voxel size
- Automated processes, e.g. calibration, job execution and monitoring
- Wide choice of substrate–resin combinations
- Continuous execution of various print jobs by job queue
- Touchscreen and remote-control interfaces

DESIGNED FOR INDUSTRIAL TASKS IN

- Refractive microoptics – individual lenses and arrays
- Multi-level diffractive optical elements – designs of up to 4,096 levels
- Rapid prototyping of 2.5D microoptics
- Rapid tooling with patterned polymer masters for replication processes
- Small series production
- Wafer scale fabrication

TECHNICAL SPECIFICATIONS

Printing technology	Two-Photon Grayscale Lithography (2GL®)
Minimum XY feature size	160 nm typical; 200 nm specified*
Finest XY resolution	400 nm typical; 500 nm specified*
Finest vertical steps	10 nm, quasi-continuous topographies possible
Minimum surface roughness R_a	≤ 10 nm*
Area printing speed	3 mm²/h typical for diffractive optical elements

**Values may vary depending on the objective and photoresin in use.*

Request an offer

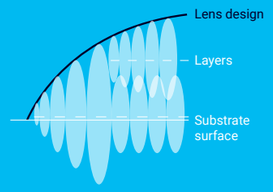
Send us an e-mail to sales@nanoscribe.com

Two-Photon Grayscale Lithography

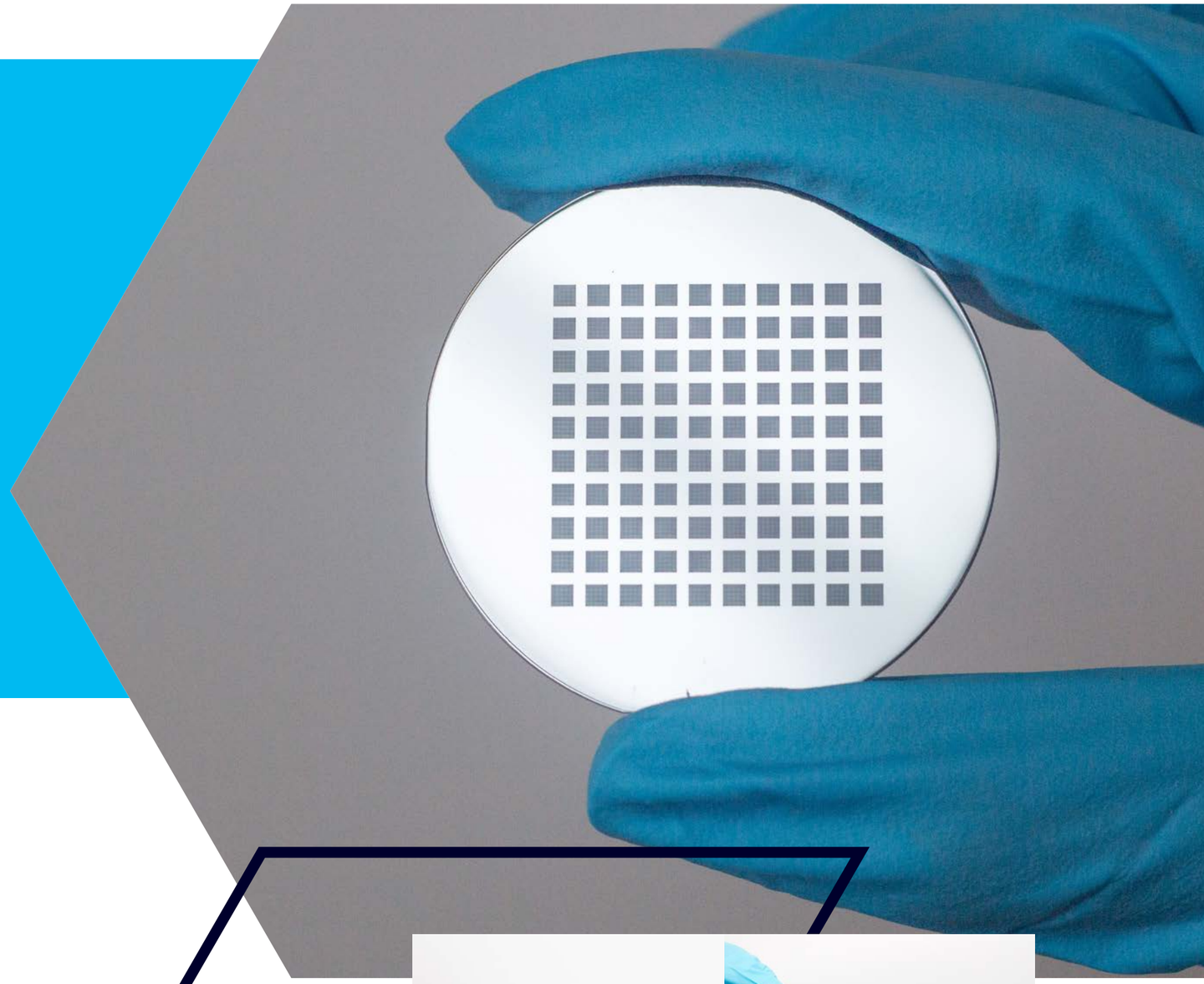
Additive microfabrication with ultra-fast voxel size tuning

Two-Photon Grayscale Lithography (2GL®) paves the way for ultra-fast, accurate and free-form microfabrication without compromising speed or accuracy. Quantum X controls the voxel size along one scanning plane using synchronized laser power modulation at high speeds. In this manner complex shapes are produced and variable feature heights are achievable within one scan field. Discrete and accurate steps as well as essentially continuous topographies can be printed on up to six-inch wafer substrates without the need for additional lithography steps or mask fabrication.

The Quantum X wizard guides you through the print job creation. The integrated software accepts grayscale images for direct fabrication with 2GL. Diffractive and refractive microoptics in 2D and 2.5D materialize with smooth surfaces and high shape accuracy.



Two-Photon Grayscale Lithography for multi-layer fabrication of a micro-lens with accurate tuning of the exposure dose along the layers.



Highly efficient microfabrication

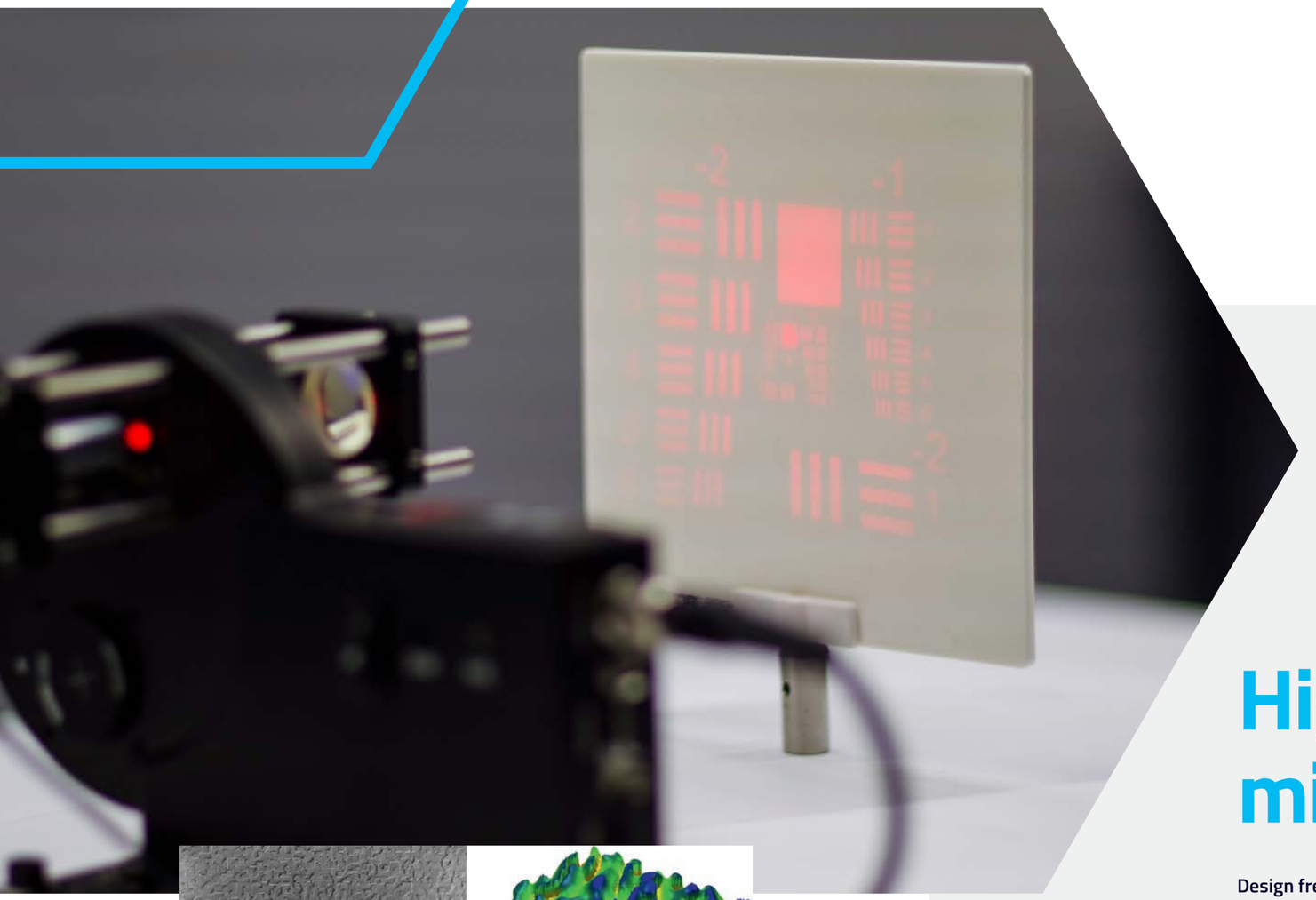
Powerful processes, materials and software

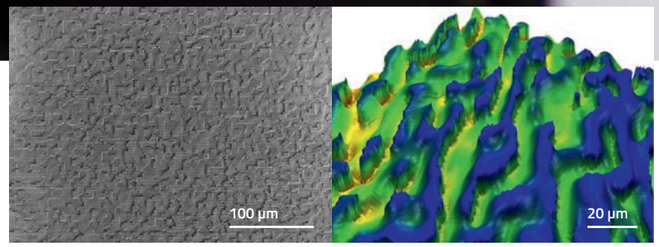
Lithography processes with Quantum X are flexible and straightforward for the user. These processes allow a wide range of substrates and don't require spin-coating, pre- or postbaking, or costly mask fabrication when used with Nanoscribe photoresins. Our tailor-made materials are specially suitable for fast 2GL processes and 2.5D microfabrication, allowing high aspect ratios and high structures that overcome optical limitations.

Quantum X software controls and monitors print jobs in real time and performs fully automatic calibration. The control system accurately synchronizes laser power modulation and exposure positioning within some nanoseconds, enabling full voxel size control within 2GL processes.

Graphical or remote user interfaces, including a touchscreen located on the printer, support advanced user–machine interactions. Users can check on the job status, adjust process controls and visualize printing in real time.

Top: Microlens arrays printed on a two-inch wafer substrate. **Bottom left:** Two-inch wafer substrate mounted on sample holder. **Bottom right:** Six-inch wafer substrate mounted on sample holder.





Top: Diffraction pattern of the USAF Chart produced by a laser beam passing through a printed DOE. **Bottom left:** Scanning electron microscope image of a multi-level DOE structure with discrete levels. **Bottom right:** Confocal microscope image of a quasi-continuous DOE structure.

Microfabrication of diffractive optics

Discrete levels and quasi-continuous surface topographies are possible

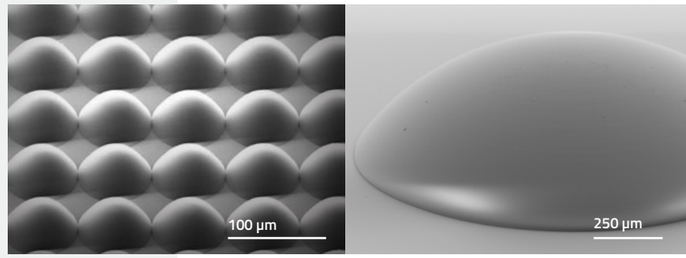
Based on Two-Photon Grayscale Lithography (2GL®), Quantum X directly fabricates multi-level diffractive optical elements (DOE) in a single layer. This additive microfabrication solution fulfills the high lateral and axial resolution requirements needed for DOE. Up to 4,096-level designs can be processed into discrete or quasi-continuous DOE topographies beyond traditional lithography. Quantum X redefines the fabrication of DOE prototypes and polymer masters for series production. Applications include beam shaping, splitting and homogenizing and diffractive security labels.

High-quality microoptics

Design freedom for innovative professionals

Single optical elements, arrays with high fill factors of up to 100%, and varying shapes such as spherical, aspherical and free-form lenses as well as other microoptics are directly printed in maskless processes. Quantum X fabricates almost any imaginable 2D and 2.5D shape on the microscale.

Microlens arrays can be printed in a single layer using the 2GL approach by modulating the laser power according to the lens contours. Ultra-smooth surfaces are printed rapidly, enabling optical-quality results with drastically reduced pro- cessing times. Processes are extensible to larger lenses with coarse slicing settings and nevertheless smooth and accurate contours owing to 2GL.



Left: Microlens array. **Right:** Single lens of 1.6 mm diameter.

The resulting refractive microoptics feature excellent shape accuracy and serve as prototypes or polymer masters for mass replication techniques, such as injection molding.

Why Nanoscribe

Rely on the pioneer and market leader! We are your partner for high-precision additive manufacturing technology in science, research and industry. We are a vibrant, award-winning company, supported by ZEISS and headquartered in Karlsruhe, as a spin-off of the Karlsruhe Institute of Technology (KIT). With more than 70 highly qualified employees we are successful for the 12th year in a row. This allows us to invest more than 25% of our annual revenues in the future of microfabrication.

More than 2,000 active users of our systems located in over 30 countries benefit from the continuous advancement of our technology. We deliver smart solutions that inspire our customers and enable them to materialize ground-breaking ideas.

CUSTOMER SUPPORT AND SERVICES

Trust and customer satisfaction are particularly important to us. Sales and support are provided worldwide from locations in Germany, China and the USA, as well as by a worldwide network of certified distributors. Our multilingual service team attends to your requests with comprehensive customer support:

- Commissioning, maintenance and repair
- Training sessions
- Assistance through NanoGuide, an extensive online knowledge base
- Phone, e-mail and remote support
- Application support beyond primary use cases
- Extended maintenance and guarantee options, upgrades and relocation servicess

Nanoscribe GmbH
Hermann-von-Helmholtz-Platz 6
76344 Eggenstein-Leopoldshafen
Germany

Phone +49 721 981 980 200
Fax +49 721 981 980 130

sales@nanoscribe.com
nanoscribe.com

Nanoscribe China Co., Ltd.
Shanghai, China
+86 21 2082 5547

Nanoscribe Inc.
Boston, USA
+1 857 444 4007