# Perfectly matching **Printing Materials**

**Think big. Print nano.**


nanoscribe.com

# High-performance 3D printing materials

**Benefit from perfectly matching high-performance printing materials for sophisticated microfabrication tasks, available for specific applications on different scales.**

Nanoscribe offers maskless lithography systems and 3D printers for microfabrication. High-performance printing materials play a crucial role in this technology to fully benefit from the precision potential of Two-Photon Polymerization. Our printing materials are recognized as the standard for high-precision microfabrication. Sub-micrometer resolution and outstanding shape accuracy as well as easy handling are key features of these photo-resins. IP Photoresins and IPX Photoresins are polymer printing materials for high-resolution microfabrication.

They are optimized for Two-Photon Polymerization (2PP), Two-Photon Grayscale Lithography (2GL®) and Aligned 2-Photon Lithography (A2PL®) with the properties required for high-precision additive manufacturing. The printer software offers advanced parameter presets optimized for specific photoresins and different applications. Meanwhile, the printing material classes also include a nanocomposite for 3D printing fused silica glass microstructures. With resins developed by our partner BIO INX®, Nanoscribe offers advanced bioprinting materials for biosciences and engineering.

## Printing material categories

| | Small Features | Medium Features | Large Features | Extra Large Features |
|---|---|---|---|---|
| **Universal** | | | | |
| | IP-Dip2 | IP-S | IP-Q | |
| | IP-L | | IPX-S | IPX-M |
| | | | IPX-Q | |
| **Functional** | | | | |
| | IP-G | IP-Visio | GP-Silica | |
| | | IP-n162 | | |
| | | IP-PDMS | | |
| | IPX-Clear | | | |
| **Biomaterials** | | Medium Features | | |
| | | Hydrobio INX N400 | PhotoGel | |
| | | Hydrotech INX N200 | PhotoHA-Stiff | |
| | | Degrad INX N100 | PhotoDextran | |
| | | | PhotoChitosan | |

# Open for custom materials

The microfabrication devices from Nanoscribe are designed as open systems, suitable for a broad selection of materials. The variety of materials extends further to third-party UV-curable photoresists, hydrogels or nanoparticle composite resins, and custom materials.
To satisfy the needs of material developers for testing new resins, a variety of materials and processes allow optical, mechanical, electrical, chemical and biological properties to be tuned as needed, e.g., in optics, photonics or biomedical engineering.

Post-print processes, e.g., casting, atomic layer deposition (ALD), chemical vapor deposition (CVD) or galvanization, allow modification of the 3D printed structures and permit the inclusion of further materials including ceramics, metals, glass or other plastics.

## Our printing material portfolio at a glance

"Perfectly matching printing materials for every application"

### IP Photoresins

Negative-tone photo-polymers for high resolution 3D printing

"Improved performance, precision and print speed"

### IPX Photoresins

Photopolymers tailored for Quantum X systems

"Explore microstructuring of glass by 3D printing"

### GP-Silica

Silica nanocomposite material for 2PP-based glass printing

## Further material options

### Third-party photoresins

- SU-8 – negative-tone, epoxy-based resists
- AZ ® photoresists – positive-tone resists
- ORMOCER ® polymers – inorganic-organic hybrid polymers
- Hydrogels and bioresins from Cellink

### Custom materials

- Hydrogels
- Degradable resins
- Composite materials
- Liquid-crystal elastomers

"Bring your applications to life with hydrogels for 3D bioprinting"

### Advanced BioMatrix biomaterials

### BIO INX biomaterials

# IP Photoresins for 2PP-based 3D printing

**High-performance photoresins specifically designed for microfabrication by Two-Photon Polymerization, available in cartridges for convenient dispensing by hand or automatic dispensing.**


Nanoscribe IP Photoresins are established standard materials for high-resolution microfabrication. Submicrometer resolution and shape accuracy as well as easy handling are key features of these negative-tone photoresins. Choose the photoresins best suited to your applications. Benefit from submicron features, overhanging elements, optical-quality surfaces, high-speed mesoscale fabrication, biocompatibility or high refractive index.

IP Photoresins are highly-efficient printing materials. The printer software offers specific parameter presets optimized for different photoresins and applications. They make the 3D printing or maskless lithography workflow straightforward and speed up the design iteration cycles for scientific and industrial use cases ranging from biomimetic surfaces, microoptical elements to mechanical metamaterials and 3D cell scaffolds.

## Material properties that match functionality

| | IP-Q[b] | IP-S[b] | IP-Dip2 | IP-L | IP-G | IP-Visio | IP-n162 | IP-PDMS |
|---|---|---|---|---|---|---|---|---|
| State | Liquid | Liquid | Liquid | Liquid | Sol-gel | Liquid | Liquid | Liquid |
| Refractive index[a] @ 589 nm, 20 °C | 1.513 | 1.515 | 1.547 | 1.519 | 1.515 | 1.511 | 1.622 | 1.450 |
| Young's modulus[a] [GPa] | 3.1 | 2.1 | 1.5 | 4.7 | 3.4 | n/a | n/a | 0.015 |
| Pre / post bake | no/no | no/no | no/no | no/no | yes/no | no/no | no/no | no/no |
| Biocompatibility | yes[c] | yes[d] | yes[c] | yes[e] | n/a | yes[d] | yes[d] | yes[d] |
| Print Set | LF | MF | SF | SF | SF | MF | MF | MF |

[a] Measured on 3D printed or UV-cured structures; results depend on the printing conditions and geometry
[b] Upon request available without photoinitiator
[c] No cytotoxic effect but a slight reactivity according to ISO 10993-5
[d] Non-cytotoxic according to ISO 10993-5
[e] Non-cytotoxic, evaluated by our customers, partly under stricter requirements than ISO 10993-5

Print Sets: SF – Small Features; MF – Medium Features; LF – Large Features

# Universal polymer printing materials

| | Properties | Application areas | Key Features |
|---|---|---|---|
| **IP-Q** | High-speed fabrication of mesoscale structures with print volumes > 10 mm³, designed for Dip-in Laser Lithography (DiLL) | ▸ 3D Microfabrication on the mesoscale<br>▸ Biomedical engineering<br>▸ Mechanical components | ▸ Refractive index matched material for Nanoscribe's Large Features Print Set |
| **IP-S** | Smooth surfaces for micro- and meso-scale fabrication with smooth surfaces and shape accuracy in optical quality, designed for Dip-in Laser Lithography (DiLL) | ▸ 3D Microfabrication on the mesoscale<br>▸ Microoptics<br>▸ Integrated photonics<br>▸ Microfluidics | ▸ Refractive index matched material for Nanoscribe's Medium Features Print Set<br>▸ Biocompatible |
| **IP-Dip2** | Finest submicron features and high aspect ratio structures, designed for Dip-in Laser Lithography (DiLL) | ▸ 3D Microfabrication on the submicron scale<br>▸ Microoptics<br>▸ Micromechanics & MEMS<br>▸ Integrated photonics | ▸ Refractive index matched material for Nanoscribe's Small Features Print Set<br>▸ Biocompatible |
| **IP-L** | Finest submicron features and low shrinkage, designed for oil immersion configuration | ▸ 3D Microfabrication on the submicron scale<br>▸ Materials engineering<br>▸ Integrated photonics | ▸ Refractive index matched material for Nanoscribe's Small Features Print Set<br>▸ Biocompatible |

# Functional polymer printing materials

| | Properties | Application areas | Key Features |
|---|---|---|---|
| **IP-G** | Complex 3D designs including overhanging elements. Submicron features and low shrinkage, designed for oil immersion configuration | ▸ Micromechanics & MEMS<br>▸ Materials engineering | ▸ Sol-gel material<br>▸ Low shrinkage |
| **IP-Visio** | Non-cytotoxic material for biocompatible microstructures with low autofluorescence for microscopy of subcellular components, designed for Dip-in Laser Lithography (DiLL) | ▸ Multi-cell scaffolds<br>▸ Tissue engineering<br>▸ Biomedical devices<br>▸ Life sciences | ▸ Non-cytotoxic<br>▸ Low autofluorescence<br>▸ Protein adsorbent resin for cell attachment |
| **IP-n162** | High refractive index and low absorption for infrared. For polymer, infrared or – combined with IP-S – for achromatic microoptics, designed for Dip-in Laser Lithography (DiLL). | ▸ Microoptics<br>▸ Integrated photonics | ▸ High refractive index<br>▸ Low absorption at 1200-1550 nm<br>▸ Low Abbe number and high dispersion |
| **IP-PDMS** | 2PP printing of soft, flexible and highly elastic structures, designed for Dip-in Laser Lithography (DiLL). | ▸ Life sciences<br>▸ Microfluidics<br>▸ Micromechanics & MEMS<br>▸ Materials engineering | ▸ Highly elastic with low Young's modulus<br>▸ Low refractive index<br>▸ Non-cytotoxic<br>▸ Highly flexible |

# IPX Photoresins for Quantum X systems

**Perfectly matching printing materials specifically designed to exploit the maximum printing speed, highest precision and best performance of the Quantum X systems, using Two-Photon Polymerization (2PP) and Two-Photon Grayscale Lithography (2GL®).**

The IPX Photoresins are specifically designed for the Nanoscribe Quantum X systems. The industry-proven platform offers both 2PP-based 3D printing with the highest precision and innovative Two-Photon Grayscale Lithography (2GL®) for the microfabrication of 2.5D structured topographies. To take advantage of the performance, precision and print speed of the Quantum X systems, the IPX series has been developed for different feature sizes, qualities and processes.

IPX-S is ideal for printing mesoscale structures with micrometer precision using 2GL®, while IPX-Q is optimized for the same scale and type of structures, but using 2PP. IPX-M is tailored for high-throughput macroscale printing with print volumes up to 30 cubic centimeters in a single pass. IPX-Clear offers excellent transmission across the visible spectrum and is ideal for printing high-precision microoptics.

## Material properties that match functionality

| | IPX-S | IPX-Q | IPX-M | IPX-Clear |
|---|---|---|---|---|
| State | Liquid | Liquid | Liquid | Liquid |
| Refractive index[a] @ 589 nm, 20 °C | 1.510 | 1.511 | 1.499 | 1.544 |
| Young's modulus[a] [GPa] | 2.2 | 2.2 | 1.3 | – [d] |
| Biocompatibility[b] | yes | yes | yes[c] | – [d] |
| Print Set | LF | LF / XLF | XLF | SF / MF / LF |

[a] Measured on 3D printed structures; results depend on the printing conditions and geometry
[b] Non-cytotoxic according to ISO 10993-5
[c] No cytotoxic effect but a slight reactivity according to ISO 10993-5
[d] Test results to follow

Print Sets: SF – Small Features; MF – Medium Features; LF – Large Features; XLF – Extra Large Features

# Universal polymer printing materials

| | Properties | Application areas | Key Features |
|---|---|---|---|
| **IPX-S** | Rapid 2GL printing for 2.5D Microfabrication of micrometer- and millimeter-scale optics. High optical quality with smooth surfaces and excellent shape accuracy. | Rapid prototyping and mastering:<br>▸ 2.5D microoptics, microlens arrays<br>▸ Fresnel lenses<br>▸ Hybrid and freeform lenses<br>▸ Prism arrays | ▸ Optimized for Nanoscribe's Large Features Print Set<br>▸ High optical quality<br>▸ Biocompatible |
| **IPX-Q** | Rapid 2PP-based 3D Microfabrication. Printing up to centimeter-sized 3D objects. Parts with high aspect ratios and excellent shape accuracy. | Rapid prototyping:<br>▸ Life sciences<br>▸ Microfluidics<br>▸ Microneedles<br>▸ Mechanical components | ▸ Optimized for Nanoscribe's Large and Extra Large Features Print Set<br>▸ Biocompatible |
| **IPX-M** | High-throughput macroscale 3D printing for print volumes up to 30 $cm^3$. Full design freedom for 3D objects with arbitrary shapes and high aspect ratios. | Rapid prototyping and batch production:<br>▸ Mechanical components, etc. | ▸ Optimized for Nanoscribe's Extra Large Features Print Set<br>▸ Biocompatible[a] |
| **IPX-Clear** | Excellent transmission across the visible spectrum. Structures with smooth surfaces and superior shape accuracy at multiple scales. | Rapid prototyping:<br>▸ Microoptics<br>▸ Integrated photonics<br>▸ Micromechanics | ▸ Engineered for use across multiple scales: Print Sets SF, MF, LF<br>▸ Optimized for 3D printing by 2GL®<br>▸ High transmittance from 350 nm |

[a] the photoresin shows a slight reactivity

# Precise and clean dispensing of printing materials

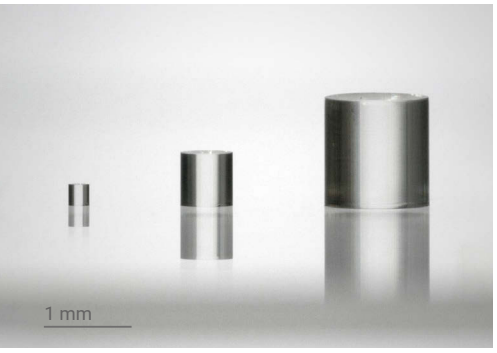
Nanoscribe's IPX and IP Photoresins are available in lightproof and resealable cartridges. Take advantage of convenient dosing by hand or automatic dispensing onto substrates, wafers, chips and other microparts – precise and bubble-free.
All printing materials are optimized for 2PP-based microfabrication and IPX-S is particularly optimized for 2GL-based printing. All photoresins feature remarkable properties required in high-precision additive manufacturing.
Further advantages:

- Improved cleanliness
- Avoidance of bubble formation
- Better handling and dispensing
- High-yield dispensing
- Automatic dispensing with Quantum X platform
- Very good substrate adhesion

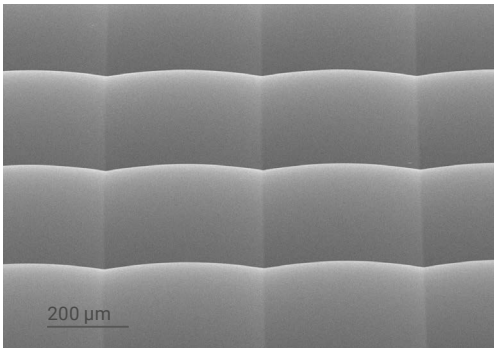
New

# IPX-Clear Photoresin

**Unparalleled transparency and precision with Nanoscribe's new photoresin for microoptics over multiple orders of magnitude across the entire visible spectrum.**



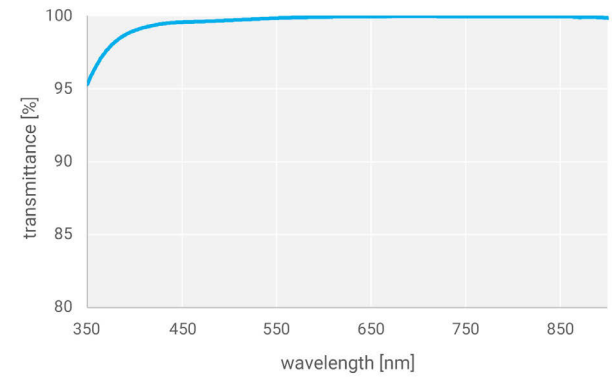





IPX-Clear is a high-performance material designed for creating highly transparent microoptical components with outstanding precision and throughput. Specifically tailored for broadband applications across the entire visible spectrum, it is optimized for 3D printing by 2GL® while remaining compatible with traditional Two-Photon Polymerization processes.

## KEY PROPERTIES

- Refractive index (20 °C, 589 nm): 1.544
- Transmittance* 350-400 nm: > 95%
- Transmittance* 400-900 nm: > 98%
- Surface roughness $R_a$: < 10 nm
- Engineered for use across multiple scales
- Optimized for 3D printing by 2GL®
- Suited for classical 2PP




Transmittance spectrum of IPX-Clear; *250 µm sample thickness. Measurements by 4th Physics Institute, University of Stuttgart.


**More information:**
Detailed information and specs at
nanoscribe.com/ipx-clear

# Glass printing with silica nanocomposites

**GP-Silica is the world's first photoresin for the 2PP-based 3D Microfabrication of fused silica glass, based on a sinter process after printing.**

Nanoscribe GP-Silica is the world's first photoresin for fused silica glass microfabrication by Two-Photon Polymerization (2PP). High optical transparency combined with thermal, mechanical and chemical stability enable to explore new applications in microfluidics, microoptics and other microtechnology fields. GP-Silica is the centerpiece of the Glass Printing Explorer Set and was developed in a joint research project with our partner Glassomer.

## GP-Silica at a glance

| | Properties | Application area | Key features |
|---|---|---|---|
| **GP-Silica** | The world's first photoresin for 3D Microfabrication of fused silica glass. Designed for Dip-in Laser Lithography (DiLL). | ▸ Life sciences<br>▸ Microfluidics<br>▸ Micromechanics & MEMS<br>▸ Materials engineering | ▸ High mechanical, chemical and thermal stability<br>▸ Optical transparency from the UV- to IR-region<br>▸ Smooth optical quality surfaces<br>▸ Inorganic material |

## Glass Printing Explorer Set

Our Glass Printing Explorer Set offers everything you need for printing freeform microstructures made of fused silica glass out of the box. The set includes the photoresin GP-Silica, silicon substrates, several print accessories and detailed processing instructions for a successful print. These instructions contain recommendations and notes on print job preparations, a preset of printing parameters and detailed information about the thermal post-process.

## Properties of GP-Silica in comparison

| | GP-Silica | IP-Q |
|---|---|---|
| Young's modulus [GPa] | 68.3 | 3.1 |
| Thermal stability [°C] | > 1,000 [a] | 242 [b] |
| Refractive index at 589 nm, 20 °C | 1.459 | 1.513 |
| Lateral resolution [µm] [c] | 20 | 5 |
| Post-processing | Sintering | – |
| Surface roughness Ra [nm] [c] | < 10 | < 10 |
| Sintering shrinkage [Vol. %] | 27 (isometric) | – |

[a] Glass transition temperature Tg
[b] Degradation temperature
[c] Dependent on structure and printing parameters

# 3D bioprinting with BIO INX bioresins

**Bring your applications to life with hydrogels and biodegradable materials of our partner BIO INX for high resolution 3D Microfabrication in life sciences such as tissue engineering.**

Nanoscribe's Two-Photon Polymerization (2PP) technology offers the highest resolution for 3D Microfabrication at the scale of biological cells and tissues, making it a key enabling technology in 3D bioprinting. Physiologically relevant models require compatible biomaterials to realize the full potential of 2PP technology, and drive innovations in life sciences and biology. Our partner BIO INX develops materials for 2PP-based 3D biofabrication.

The BIO INX bioprinting materials we offer include three state-of-the-art bioresins that are biocompatible and biostable specifically optimized for our Photonic Professional systems. Importantly, the Hydrotech INX N200 bioresin is also compatible with Quantum X bio. The direct use of BIO INX bioresins save researchers' time and cost needed to produce their own bioresins, while also increasing the reproducibility of experiments across batches. This will allow our users to better translate their bioprinting-based research from the lab into clinical trials.

## BIO INX materials at a glance

| | Description | Key Features |
|---|---|---|
| **Hydrobio INX N400** | This natural, gelatin based hydrogel is biodegradable and allows for cell encapsulation during printing with subcellular precision. | Tissue engineering of soft tissues that resembles the natural extracellular matrix (ECM). Printing of scaffolds for both cell seeding and cell encapsulation. |
| **Hydrotech INX N200** | Synthetic liquid hydrogel for printing micro and mesoscale structures that are highly flexible. DiLL suitable and compatible with Quantum X bio. | Soft and highly flexible material for organ-on-chip applications, tissue engineering and 3D cell cultures. Microfluidics enabled by in-chip printing. |
| **Degrad INX N100** | First biodegradable polyester for 2PP-based bioprinting. This material is highly elastic. | Enables highest resolution printing for tissue engineering and life science applications that require biomaterials with high mechanical stability and flexibility. |


STERILE

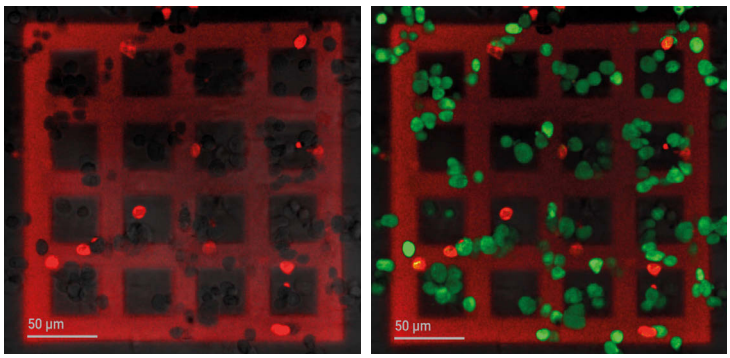
ISO 10993-5

**More information:**
Detailed information and specs at nanoscribe.com/bio-inx

# 3D bioprinting with Advanced BioMatrix

**Enhance your Quantum X bio applications using the bioresins from our official partner, Advanced BioMatrix, designed for high-resolution 3D bioprinting in the life sciences.**

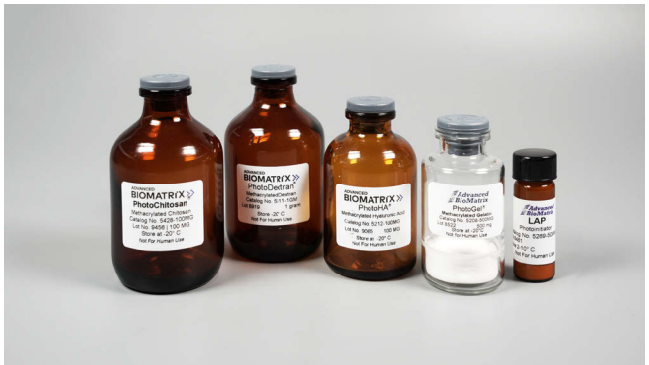
Photocrosslinkable 3D hydrogels are popular tools for tuning composition, stiffness and porosity. This is achieved by changing protein concentration, degree of substitution, or controlling temperature and pH-value. Our range of biocompatible, transparent printing materials from our partner Advanced BioMatrix (ABM) comprises four cutting-edge bioresins, compatible with our Quantum X bio system, which is also open to 3rd party resins and custom materials. The bioresins need to be combined with a photoinitiator (LAP) to be used in Two-Photon Polymerization.




Confocal fluorescence microscopy images taken after a live-cell printing experiment. The lattice (200 x 200 µm²) was made from NIH 3T3 fibroblast cell-loaded GelMA. Cell viability one hour after printing is > 90% as determined by live-dead staining. The printed lattice can be seen in the red fluorescence channel. The black spots show the cells, which are encapsulated in the lattice. Green spots signify successful survival, contrasting with the red indicating cell demise during the process.

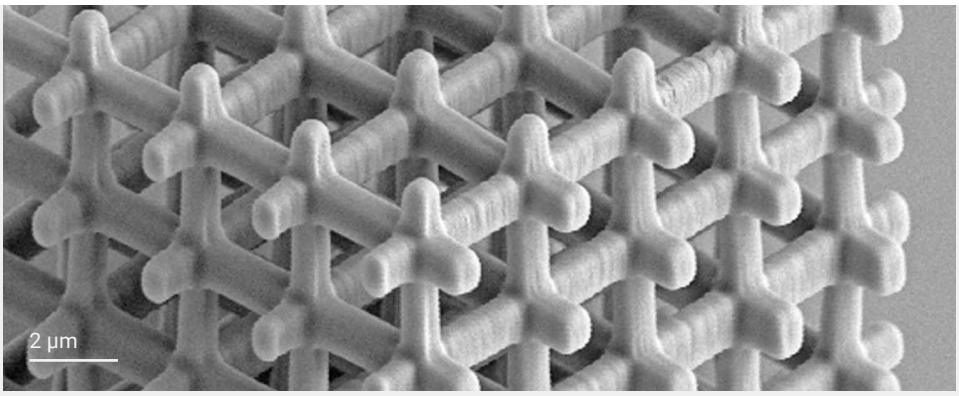
## An overview of Advanced BioMatrix materials

| | Description | Key Features |
|---|---|---|
| **PhotoGel® (GelMA)** | A hydrogel composition made from methacrylated gelatine. | Live-cell printing, cell seeding extracellular matrix scaffolds, tissue engineering |
| **PhotoHA®-Stiff** | A hydrogel composition made from methacrylated hyaluronic acid that allows for customizable stiffness. | Cell seeding, cell migration studies, membranes for cell culturing, extracellular matrix scaffolds |
| **PhotoDextran®** | A hydrogel composition made from methacrylated dextran that allows for customizable stiffness. | Tissue engineering, cell seeding, extracellular matrix scaffolds |
| **PhotoChitosan®** | A hydrogel composition made from methacrylated chitosan. Chitosan is a biopolymer derived from chitin. | Antimicrobial activity<br>Biodegradability<br>Photo responsiveness<br>Cell seeding, tissue engineering, drug delivery systems, regenerative medicine applications |



**More information:**
Detailed information and specs at nanoscribe.com/abm

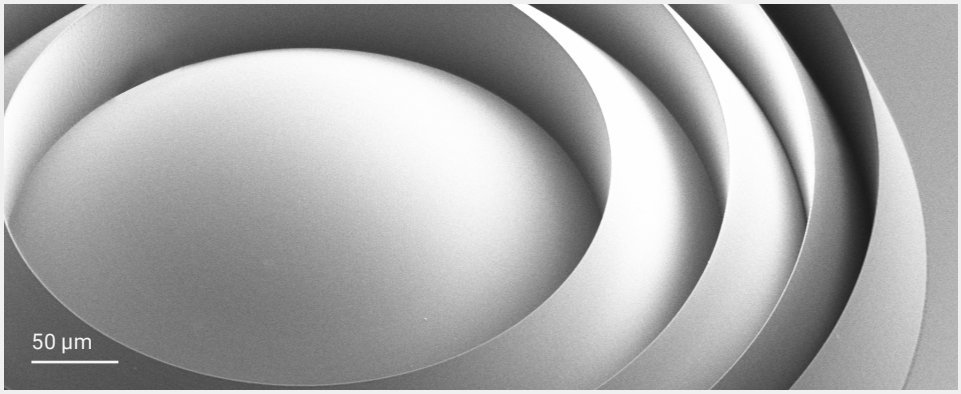
# Best performance, precision and results




## IP-Dip2

**Submicron features printing**

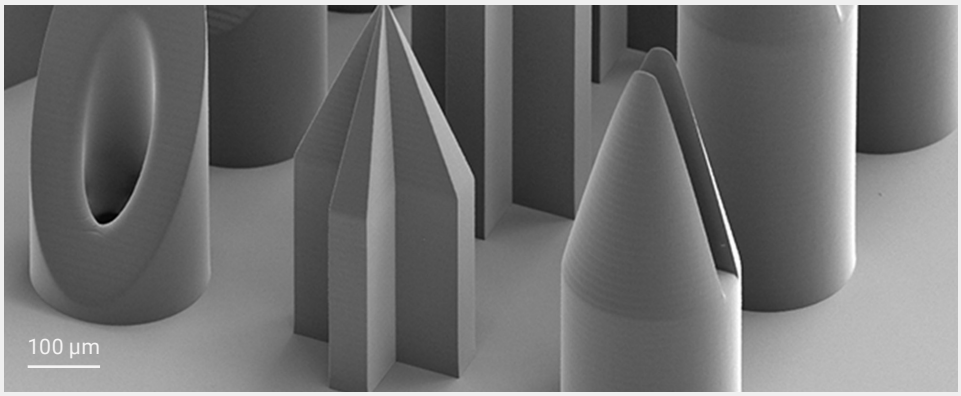
- The finest resolution in 3D printing
- Design complexity meets controlled fabrication




## IP-S

**Ultra-smooth microoptics**

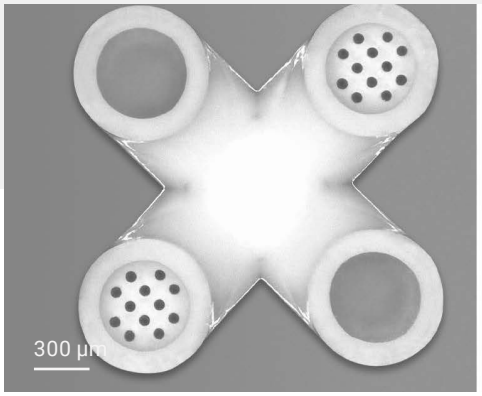
- Surface roughness of a few nano-meters
- Accurate and sharp corners and edges




## IPX-Q

**Rapid prototyping on the microscale**

- High aspect ratio structures
- Variable design, periodicity and distribution




## GP-Silica

**Complex glass microstructures**

- Filigree parts with channels, pores and filters
- Highly transparent, stable, and chemically inert

# Why Nanoscribe

As the pioneer and market leader in high-precision additive manufacturing, we are your reliable partner for microfabrication systems, software, and solutions. Founded in 2007 as a spin-off of the Karlsruhe Institute of Technology (KIT), we are a vibrant, award-winning company and part of the Lab14 Group since December 2024. With our field-proven systems, straightforward 3D printing workflows and all-in-one solutions, our more than 5,500 system users are driving future-shaping applications.

Our partners, customers and users are innovators and thought leaders across a broad spectrum of scientific research and industries including life sciences, microoptics, photonics, materials engineering, microfluidics, micromechanics and MEMS. Their fascinating innovations, published in more than 1,800 peer-reviewed journals, are opening up new applications and driving industrial markets. Join the Nanoscribe community!

### HIGH-PERFORMANCE MATERIALS DEVELOPMENT

Nanoscribe offers grayscale lithography systems and 3D printers for micro-fabrication. High-performance printing materials play a crucial role in this technology to meet the requirements of Two-Photon Polymerization printing. For this reason, Nanoscribe invests in material development with an own R&D unit and in cooperation with experienced partners.

Our material development works in constant interaction with our hardware and software team as well as with our process and application engineers. Also, close collaboration with our customers allows us to develop tailor-made solutions to satisfy the market needs.

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