ADDITIVE MICRO-/NANO MANUFACTURING

INKJET PRINTING I NANOIMPRINTING I
3D PRINTING

FROM RESEARCH TO PRODUCTION

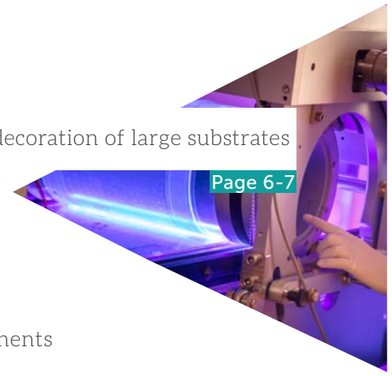
PROFACTOR®

FUNCTION FOLLOWS FORM. FORM FOLLOWS FUNCTION.

Functionalization of free-form surfaces as key for new products.

PROFACTOR is your expert for developing production processes.

Nanoimprint Lithography and Inkjet Printing are well established technologies, with one “problem”: they are limited to planar surfaces. Products and other items however naturally have other, irregular complex geometries. Finishing, functionalization and refining the surface also of 3D printed parts will not be possible if the restriction to flat surfaces is not lifted. These possibilities – functionalization and individualization of freeform surfaces using Nanoimprint Lithography (NIL) or Inkjet Printing – could be extremely interesting. New products can be envisioned, that cannot be produced using conventional fabrication technologies.



FUNCTIONALIZATION AND DECORATION OF FREE-FORM SURFACES

Micro-/Nanostructured surfaces enable innovative and functionalized products

Many products often have insufficient functionality and quality for the corresponding application because the production of complex surfaces was previously not possible. In medical technology, for example, implants (e.g. silicone implants) are renewed monthly due to the biofilm formation by bacteria and surgically replaced. Glass or polymer lenses have poor optical transmission properties due to surface reflections.

Nanostructures with antibacterial effect or nanostructures for reflection reduction (e.g. moth eyes) promise innovative solutions, which can also be economically applied to products.

The solution „3D NIL“ now offers the possibility of applying micro- or nanostructures to curved and free-form surfaces. The technology used is based on UV-NIL with laboratory equipment specially developed for this manufacturing process.

In addition to process development for the nanostructuring of different substrates using different material systems, PROFACTOR also offers the development and provision of prototype equipment.

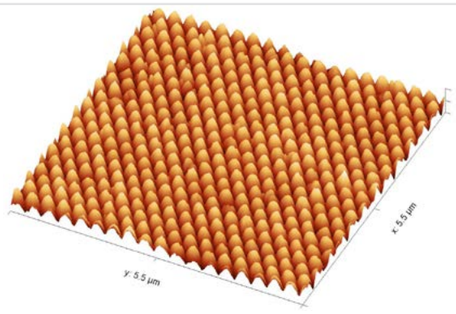
Your advantages

- Full functionality even on free-form surfaces
- Anti-reflective surfaces or anti-bacterial effects
- Fast and cost-efficient application of the structures
- High flexibility of the process with regard to substrate, materials and structure sizes/shapes

Application areas

- Optical products: Lenses and lighting elements
- Medical devices: Implants, surfaces
- Consumer products: Displays, glasses, sensors

3D-NIL: Functionalization of optical lenses with moth eye structures



Moth eye structures

Technical data:

- Application of micro- and nanostructures on free-form surfaces
- Based on UV-Nanoimprint Lithography
- Fast process
- Large material flexibility
- Large areas of up to 200 x 200 mm²
- Structure size resolution: µm-nm

Digital pad printing enables the individualized decoration of consumer products

First prototype for digital pad printing

Individual printing in high quality

Individual printing of objects and components with curved surfaces has so far only been possible to a very limited extent and with great effort or robotic guidance of the print head.

The “inkPAD” technology combines digital printing and analog printing in a single process - enabling individual printing of small objects in high quality. With this technology, an image is digitally printed on a pad made of silicone. To transfer the image, the pad is inflated and applied to 3D objects.

The solution „inkPAD“ offers the possibility to digitally print medium sized complex curved surfaces at high throughput without masks.

PROFACTOR concentrates on the further development of the entire transfer process for various non-absorbent substrates.

Application areas

- Small bent glasses
- Automotive components
- Polymer surfaces
- Metallic surfaces

Your advantages

- Flexible decoration of 3D objects
- Digitalization of pad printing
- Individualized products

References

- Consumer products

Technical data;

- Printable area: approx. 40 x 40 mm
- Flexible silicone membrane
- UV-curable inkjet inks
- Patents: EP1053882A2, WO2018015366A1

FUNCTIONALIZATION AND DECORATION OF LARGE SUBSTRATES

Robot-based inkjet printing enables digital, maskless decoration and fuctionalization of products

Lot size 1 is an important topic for many industries and is strongly related with flexible production and individual product design. The application of graphical or functional elements to curved surfaces excludes individual solutions in conventional methods like screen-printing.

Robot-based inkjet printing offers the possibility to print digitally onto curved surfaces ("direct-to-shape printing") over a large area and with high throughput.

The individual sports shoe is a reality
Printing on heavily used objects such as sports shoes places high demands on inks and on the printing process, especially when it comes to moisture and abrasion resistance.

For the printing process, the path of the robot around the athletic shoe is created using a 3D model . The technological focus is on the further development of the robot-based inkjet printing technology with integration of a pinning unit for fixing drops on curved surfaces, automatic path planning and the printing of multiple swaths and materials.

Your advantages
- Digital, contactless printing
- Flexible design
- Large objects with free-form surfaces
- Decoration and functionalization of finished products

Application areas
- Small and large bent glasses
- Cars, airplanes
- Shoes and textiles
- Consumer goods
- Plastic veneers

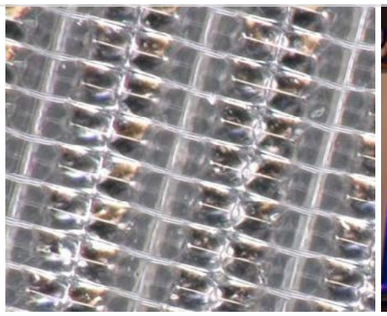
References
- Automotive
- Consumer products
- Textile industry

Robot-based inkjet printing

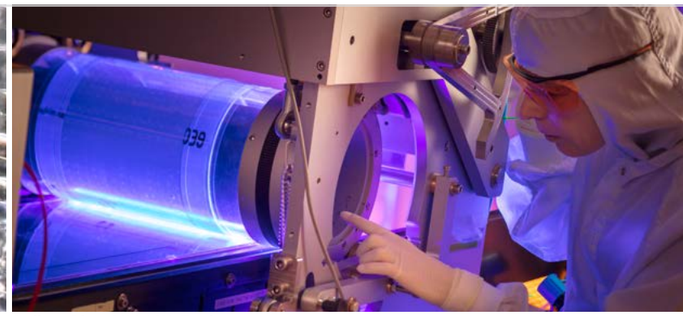
Printing conductive inks on curved glass

Technical data:
- 6-axes robot arms
- Industrial inkjet printheads
- UV-curable inkjet inks
- Software-based path planning and simulation
- Max. printing speed: approx. 100 mm/s
- Max. object size: unlimited (depending on robot)
- Max. object size in our lab: approx. 80 x 80 x 80 m
- Resolution: 300 dpi x ≤ 2400 dpi

Micro-/Nanostructures on glasses and planar surfaces



Functionalization of glass



Roll-to-Plate UV-NIL-Tool

Micro- or Nanostructuring of large areas is often very time and cost-intensive. Roll-to-Plate UV-NIL now offers the possibility of providing surfaces with micro- or nanostructures over a large area and at high throughput. The technology is particularly suitable for the functionalization of rigid surfaces such as glass plates, plastic plates but also for thick films or very sensitive substrates.

The roll-to-plate NIL tool for micro- and nanostructuring in the clean room in the technology house of PROFACTOR is one of the first of its kind and was set up together with Stensborg A / S. It can be used for a broad range of structures ranging from sub-100 nanometers up to several 100 microns - and therefore for a broad variety of applications. For example: safety elements, microlenses, photovoltaic cells and even haptic or bactericidal structures for surfaces.
It is also possible to print microfluidic structures, which are then filled with functional inkjet inks, for example for invisible switches on glass panels.

Application areas
- Foils
- Displays
- Micro lenses
- Microfluidics

Your advantages
- Large area nanostructuring on rigid and also non-transparent substrates
- Combination of multiple material systems
- Digital material dispensing possible
- Multilayer nanoimprinting

References
- Consumer products
- Life-sciences

Technical data;
- Max. substrate size: 30 x 60cm²
- Substrate thickness up to 17 mm
- Slot-die coating, inkjet printing, droplet dispensing for material deposition alignment capabilities for multilayer NIL

INTEGRATION AND FABRICATION OF ELECTRONICS AND OPTICAL COMPONENTS

Digital printing of electronics and 3D printed electronics as well as optics

So far, customers have applied electrical / electronic elements (antennas, coils, conductors, electrical contacts, sensors) only on flat surfaces and with conventional analogue methods (optical lithography, screen printing, manual fabrication, soldering). Many future applications and trends, however, require digital production methods in which the function is integrated directly on the 3D part.

The solution „InkjeTronics“ offers the possibility of integrating digitally printed electrics / electronics on flat, curved surfaces or even within the part. Our processes for example allow the fabrication of free-form optical lenses with integrated electrical circuitry in one single printing process.

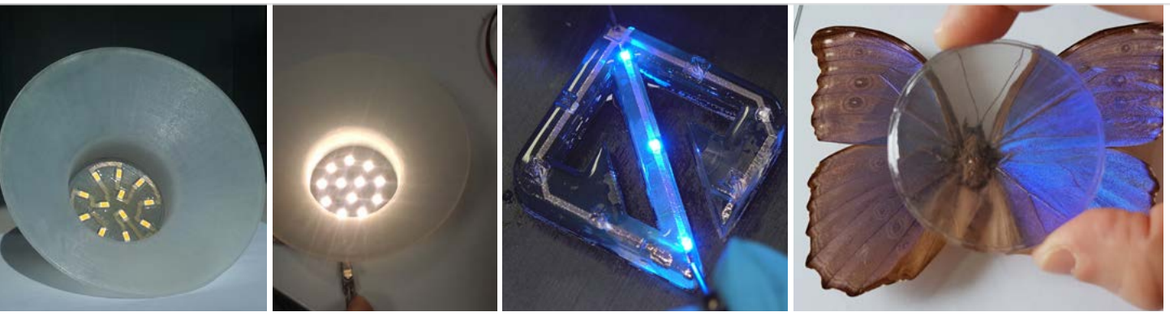
PROFACTOR focuses on the development of digital manufacturing processes (inkjet printing, inkjet-based 3D printing) for the fabrication of free-form optics and printed electronics within 3D parts or on curved surfaces and the fabrication of high-resolution electrical structures like antennas or electrodes.

We provide rapid prototyping services of surface finished free-form optical components like lenses and prototyping of polymer parts with integrated electronics.

Your advantages
- Digital, contactless printing
- Flexible design and fabrication process
- fast time to market
- precise deposition of multiple materials in one fabrication process
- high resolution features in 3D

Application areas
- Printed Sensors, RFID, NFC
- Antennas
- Optical Elements (free-form lenses)
- Electrodes
- Electrical Contacts
- 3D printed jointed robot arm
- 3D printed luminaires

References
- Electronics
- Photonics, Optics
- Automotive
- Life-sciences
- Smart Packaging
- Smart Textiles
- Wearables

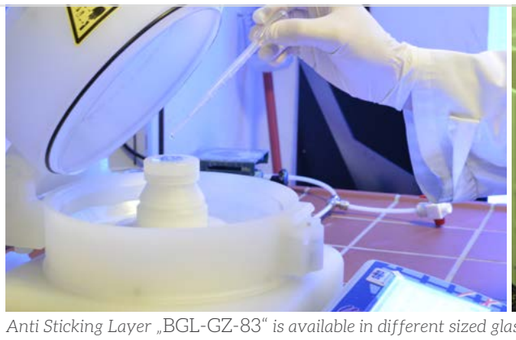


„InkjeTronics“: Integration of conductive inks in 3D printed parts with PolyJet, a inkjet-based 3D-printing technology

Technical data:
- Functional conductive and dielectric inks
- Large substrate flexibility
- Large material flexibility
- Structure size resolution: µm-nm
- Flat and free-form substrates
- 3D free-form optical elements
- 3D electronic structures

ANTI STICKING LAYER FOR STAMPS AND ADHESION PROMOTER

High quality NIL processes and stamps



Anti Sticking Layer „BGL-GZ-83“ is available in different sized glass bottles, standard size is 100 ml

Adhesion Layer for working stamp materials

There are different types of working stamp materials like Ormoceres or Perfluorinated Polyether (PFPE). For all those materials an adhesion promoter is needed to improve the adhesion of the working stamp material to the backplane of Silicon, Quartz or Glass.

Drop and spin

Our adhesion promoter is spin-coated onto the glass or silicon backplane. Just put your backplane in your coating equipment, dispense HMNP-12 and turn on your spin coater. After softbake the backplane is ready for working stamp replication. Low viscosity, less water sensitivity HMNP-12 provides an adhesion layer of few nm on your glass or silicon substrate. It is in comparison to other products less sensitive to water film on your substrates and humidity in air.

The easiest anti sticking layer for your stamps

A critical step in a replication or Nanoimprint process is the separation of stamp and substrate after resist curing. To avoid sticking of the resist and stamp, the total surface energy of the stamp has to be minimized.

Sticky stamps?

BGL-GZ-83 provides a fast and easy anti-coating of your stamp. It has been tested for a broad range of applications, like the replication of microoptic devices.

Drop and spin

BGL-GZ-83 is spin-coated in one minute onto a stamp, which is ready to use after 8 hours. Just put your stamp in your coating equipment, dispense BGL-GZ-83 and turn on your spin coater.

Application areas
- Anti Sticking Layer: Versions for quartz, nickel and Ormostamp
- Adhesion Layer: works on silicon, quartz and glass

Your advantages
- Fast and easy to apply
- Cost efficient
- Only a spin coater is needed
- Anti Sticking Layer: Decreased stamp surface energy; minimal sticking of resist to stamp
- Adhesion Layer: Low viscosity, no special care needed regarding humidity in air, no special treatment of backplane before applying HMNP-12

References
- Nanotechnology
- Life-sciences
- Research & development
- Security features
- Chemical industry
- Consumer products

Product data
- Available in glass bottles (100 ml, 250 ml)
- Anti Sticking Layer: Process at room temperature; process can be performed in air; µm-nm applications
- Adhesion Layer: Few nanometer thin layer; adhesion promoter for PFPE materials as well as Ormoceres
- For questions and orders: BGL-GZ-83@profactor.at

OUR INFRASTRUCTURE

... for characterisation and analysis, prototyping and printing services

Inkjet Lab:
Inkjet printer for material deposition and further processing and tests of 3D printable suspensions; spectrometry and gas chromatography for the analysis and detection of material components; digital pad printing tool, robot-based inkjet printing prototype, 5-axis inkjet printing prototype for digital printing on free-form substrates, atmospheric pressure plasma jet, PiXDRO LP 50, lab prototype for digital pad printing, access to atmospheric plasma plotter for coating deposition

3D Printing Lab:
Stratasys Objet500 Connex2, HAGE3D 72l, Micro Solid Creator, formlabs Form 2 und Ultimaker 2+, MakerBot Replicator, access to Nanoscribe

Nano Lab:
Atomic force microscopy (AFM), ellipsometer, viscosimeter, surface tension measurements, climate chamber, profilometer, digital optical microscope, etc.

Nanoimprint Lab:
Roll-to-Plate UV-NIL tool, and NIL equipment for imprinting on flat and curved substrates, low pressure plasma

IMPRESSUM
Herausgeber, Medieninhaber und Hersteller
PROFACTOR GmbH
Im Stadtgut A2 | 4407 Steyr-Gleink | Austria
Tel. +43 (0)7252-885-0 | Fax: +43 (0)7252-885-101
office@profactor.at | www.profactor.at
Firmenbuchnummer: FN 129658z
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