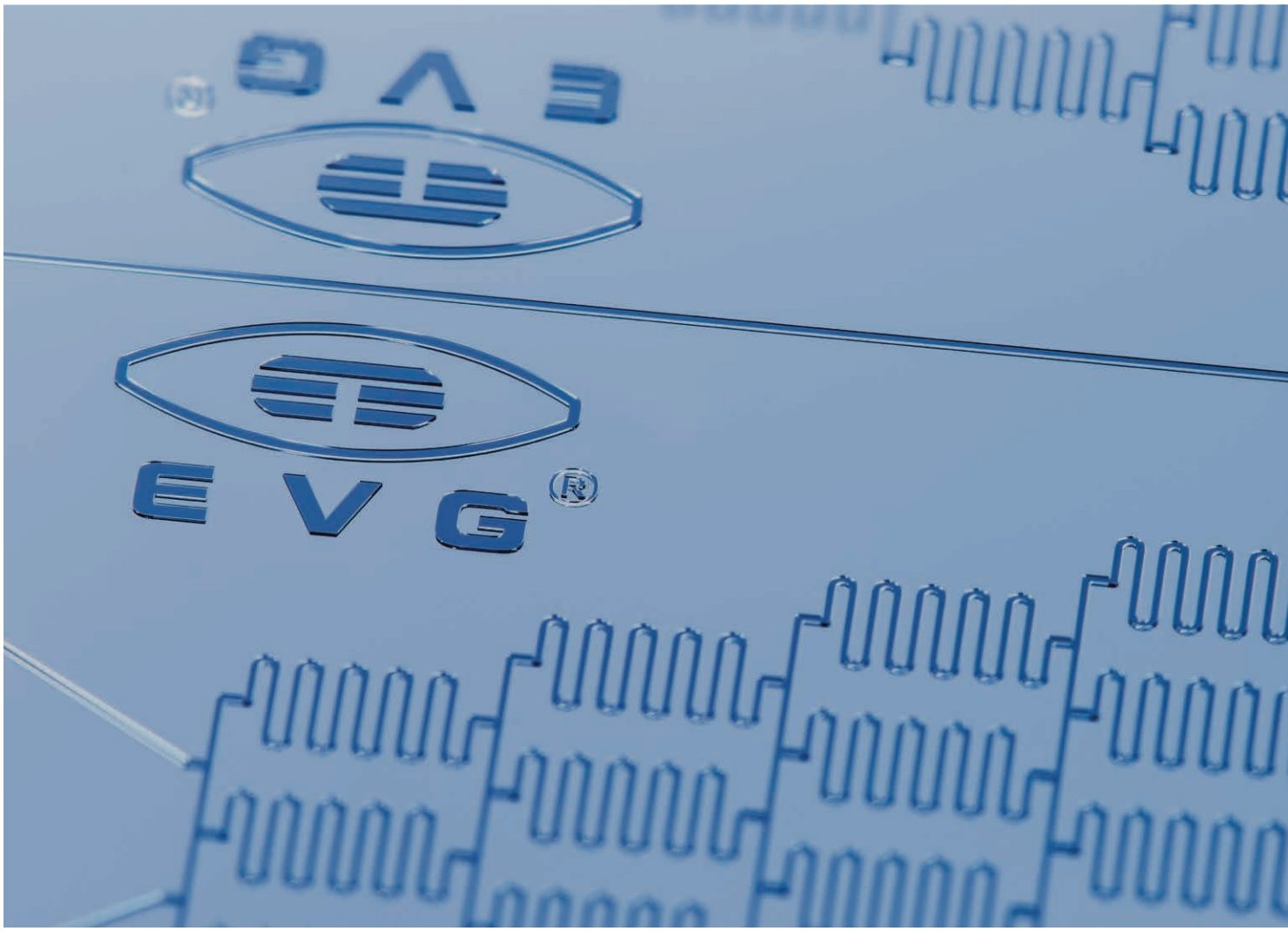
EV GROUP® | Technologies

Solutions for
Bio- & Medical Technology



Introduction

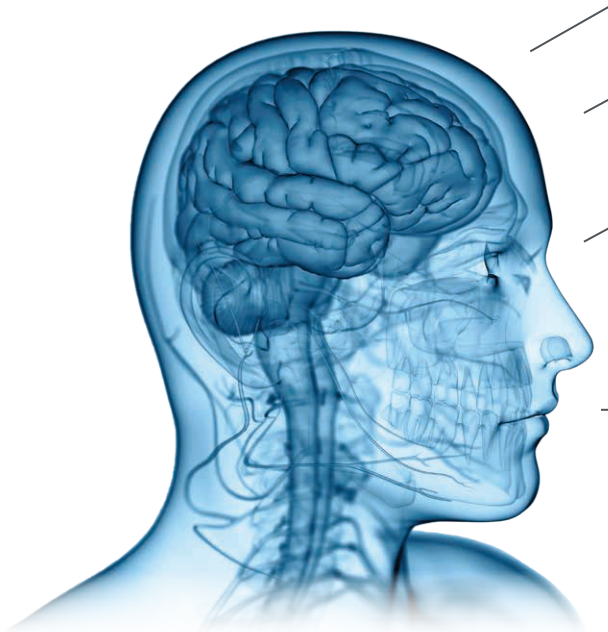
Today's miniaturized biotechnology devices can be found in numerous applications, including fields related to human health as well as environmental and industrial sciences. To successfully commercialize such products in a fast growing market with stringent requirements and high regulatory hurdles, precise and cost-effective micro-structuring technologies are essential.

Nanoimprint lithography (NIL) has evolved from a niche technology to a powerful high-volume manufacturing method that is able to serve today's needs and overcome the challenges of increasing complexity of microfluidic devices in particular, and biotechnology devices in general. NIL can be distinguished between three types of imprint technologies: hot-embossing or thermal NIL, UV-NIL, and micro-contact printing (µ-CP).

In addition to structuring technologies, sealing is a central process. Thus, bonding of different device layers, capping layers or interconnection layers is a key process that can be implemented together with NIL in an efficient large-area batch process. A variety of different bonding options are available, ranging from advanced room temperature bonding techniques for bio-material encapsulation to plasma activated bonding as well as high-quality hermetic sealing and vacuum encapsulation.

EVG's NIL equipment offers a well-suited solution, where complexity in design does not necessarily add manufacturing cost. Together with bonding processes that are well aligned with these structuring techniques, limitations of current fabrication methods can be overcome to enable the production of next-generation biotechnology devices.

Bio- and Medical Devices



Microsurgical Tools

Neural Electrodes
- Stimulation
- Monitoring

Prosthetic Devices
- Artificial retina
- Cochlear implants
- Pacemakers

Drug Delivery *
Micro- and Nano-
- Needles
- Pumps
- Valves

DNA, RNA and Protein Chips *
- Extraction / Purification
- PCR
- Electrophoresis
- Sequencing
- Protein Analysis

Cell and Tissue Chips *
- Cell Culture
- Organ-on-a-Chip
- Cell Sorting
- Drug Discovery

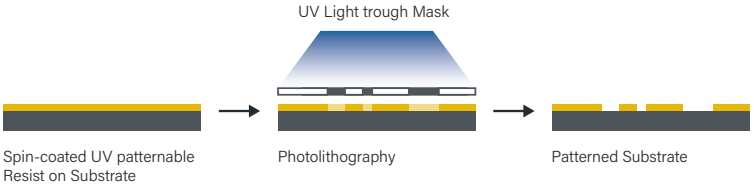
Chemical Sensors and Biosensors *
- Clinical Chemistry
- Environmental & Industrial Analysis

*Microfluidic-based

UV Lithography

Direct structuring of microfluidics
Master fabrication for UV-NIL or Hot Embossing

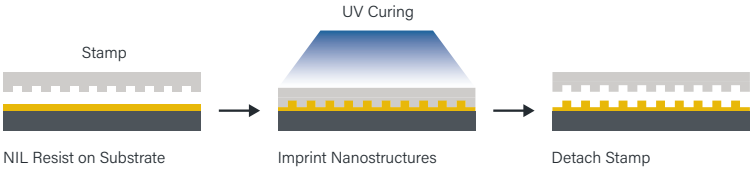
- State-of-the-art thick and thin resist processing
- Easy design change for R&D and HVM
- Multilayer processing for 3D devices
- SU-8 mastering



UV Nanoimprint Lithography (UV-NIL)

Nanostructured surfaces with highest resolution

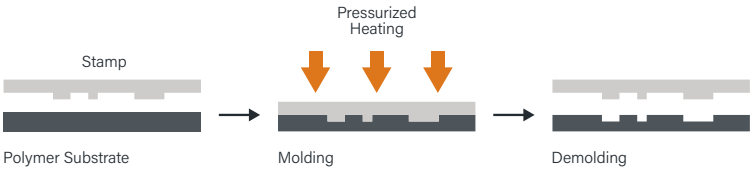
- Volume–proven imprinting technology with superior replication fidelity with resolution down to 20 nm
- Proprietary SmartNIL® technology
- Room-temperature process
- Imprinted UV-NIL resist directly suitable as functional layer
- Highly uniform residual layers for optimum pattern transfer by etching



Hot Embossing

Replication of microfluidic patterns into polymer materials

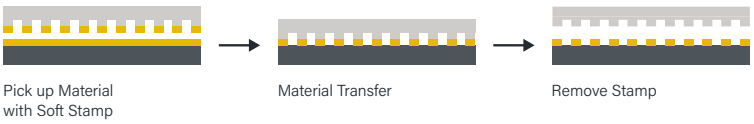
- Simultaneous replication of micro- and nanostructures
- Imprinting into bulk polymer or spin-on thermoplastics
- Low residual stress
- High replication accuracy down to 50 nm
- High aspect ratio features



µ-contact Printing

Transfer of bio-molecules onto substrates in a distinct pattern

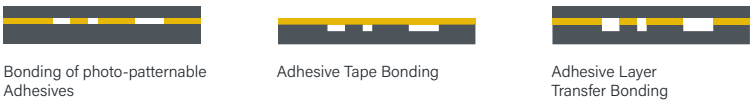
- Local modification of surface chemistry
- Precise placement of capture molecules for bio-sensing applications
- Applicable on all common surfaces
- Micro- and nanometer resolution



Adhesive Bonding

Biocompatible device sealing with adhesives

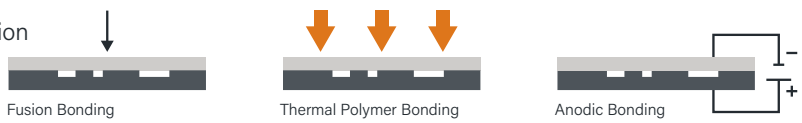
- Room-temperature encapsulation of biological materials
- Ultra-thin adhesive transfer technology with excellent uniformity over large areas
- Compatible with a wide range of substrate materials
- Hybrid microfluidic integration



Interlayer-free Bonding

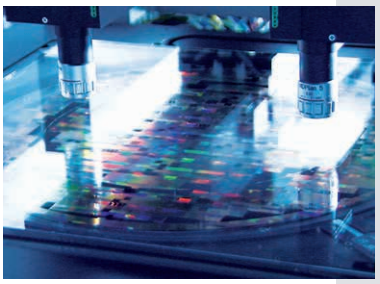
Homogenous device sealing

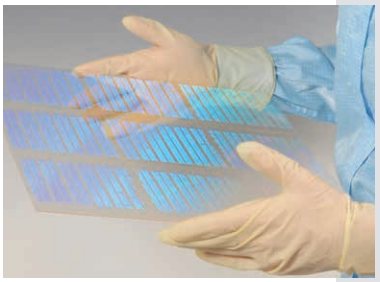
- High pressure and temperature uniformity
- High-quality hermetic sealing and vacuum encapsulation
- Plasma-activated bonding
- Precise bond alignment capabilities



Key Features

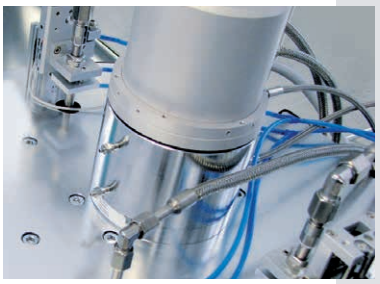
Nanoimprint Lithography Hot Embossing, UV-NIL, Micro Contact Printing	Device Sealing Thermal, Plasma-activated, Adhesive, Anodic, Metal
■ Innovative lithography for bio- and medical applications ■ Market-leading nanoimprint lithography equipment ■ Robust and field-proven proprietary SmartNIL® technology	■ Bio-compatible bonding on industry-leading wafer processing equipment ■ Room-temperature bonding technologies for bio-material encapsulation ■ Processing of all common substrates, including polymers, glass and silicon

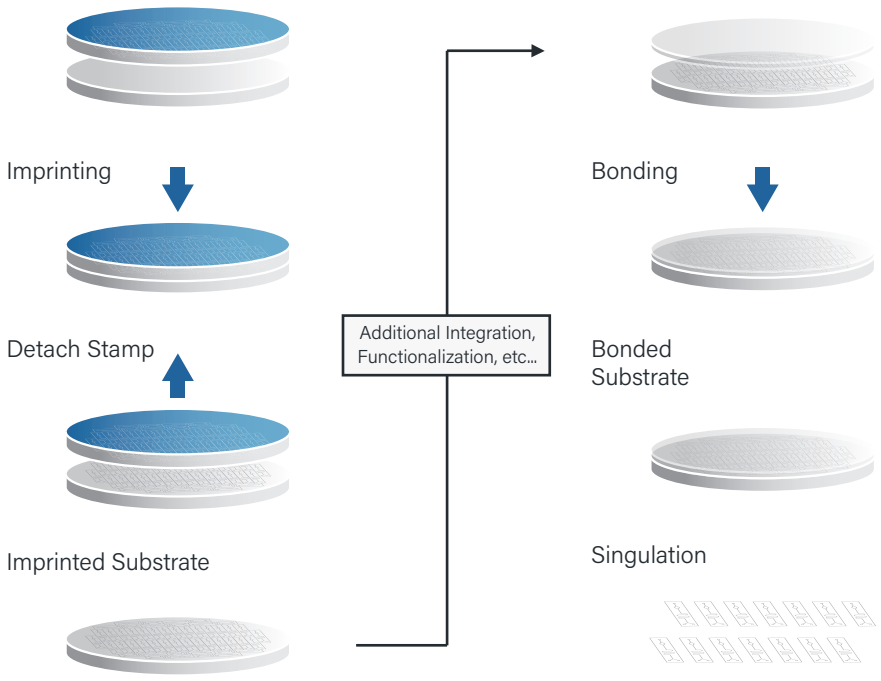




High-Throughput Parallel Processing

- Fully automated equipment solutions up to 300 mm
- Flexible low-cost production technology
- Large area processing





Support and Development

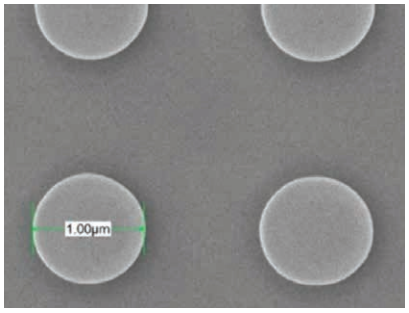
- Customer demonstrations
- Process development
- Small-volume pilot-line production
- Joint R&D with partners
- Funded projects

- → World class cleanroom infrastructure
- → State-of-the-art equipment
- → Process know-how
- → Applications know-how
- → Technology experts

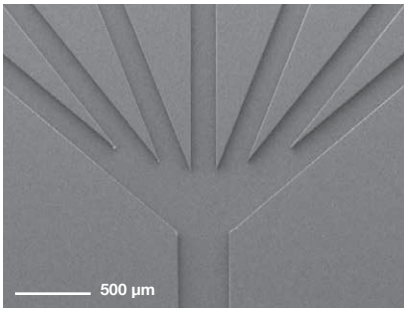
Process Results

EVG's NIL solutions are able to produce a multitude of different sized and shaped patterns with resolution down to 20 nm. A variety of different bonding options are also available, ranging from advanced room temperature bonding techniques to plasma activated bonding as well as high-quality hermetic sealing and vacuum encapsulation.

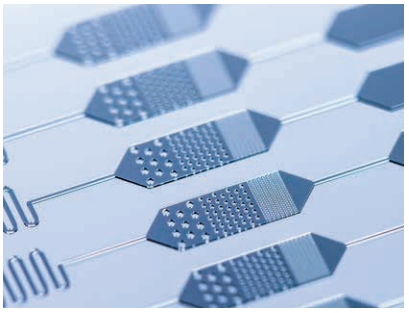
UV Lithography



SEM Image of 1 µm pillars in SU-8 resist
Source: EVG

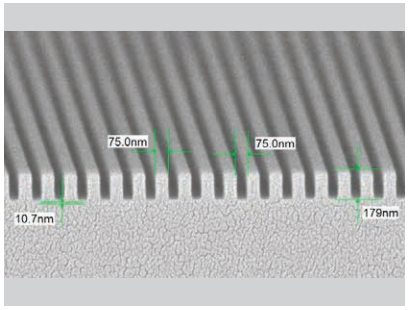


SEM image of microfluidic network in SU-8 resist
Source: EVG

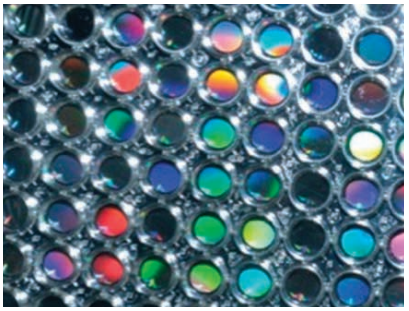


Master with microfluidic structures for hot embossing
Source: EVG

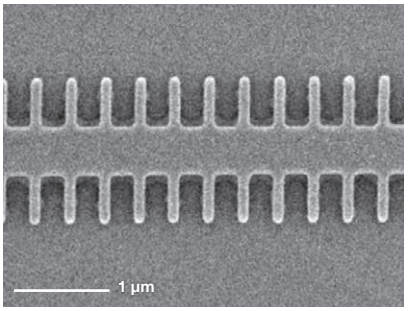
UV Nanoimprint Lithography (UV-NIL)



L/S grating with optimized residual layer with approximately 10 nm thickness
Source: EVG



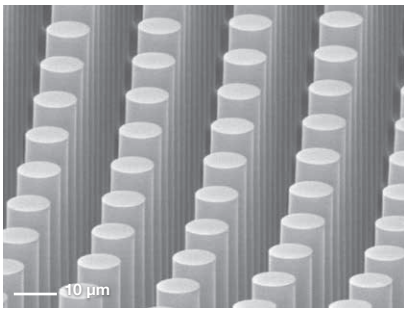
Nanostructured cell culture well plates
Source: EU Project R2R Biofluidics



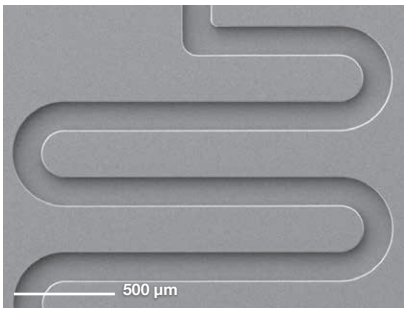
Photonic bandgap sensor grating
Source: EVG (EU Project Saphely)

Hot Embossing

Microfluidic chips replicated in PMMA by hot embossing
Source: EVG

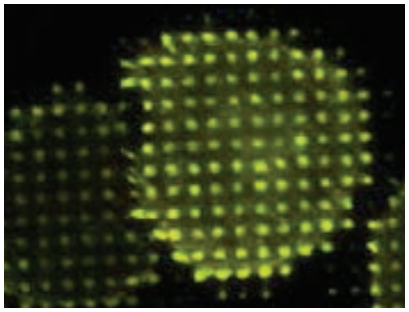


10 µm pillar arrays with high aspect ratio (7:1)
Courtesy of National Research Council Canada



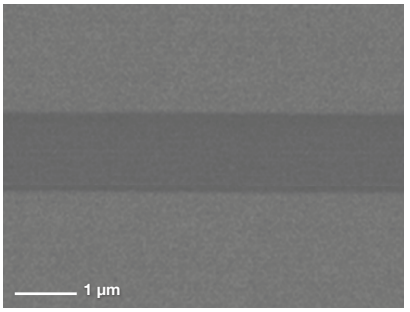
SEM image of hot embossed microfluidic channels
Source: EVG

µ-contact Printing



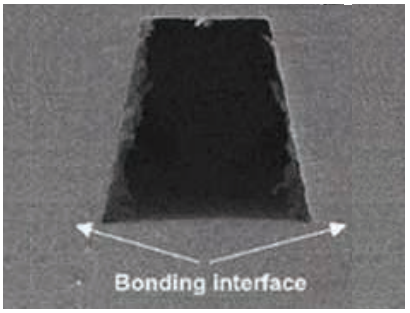
Biological sample interacting with directly imprinted functional array
Courtesy of FH Wels

Adhesive Bonding



Cross section of adhesive interface after adhesive transfer bonding
Source: EVG

Interlayer-free Bonding



Cross section of bonded PMMA substrates
Courtesy of Waseda University

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