



MORPHOTONICS

Nanoimprint technologies

Large-area nanoimprinting for
automotive applications

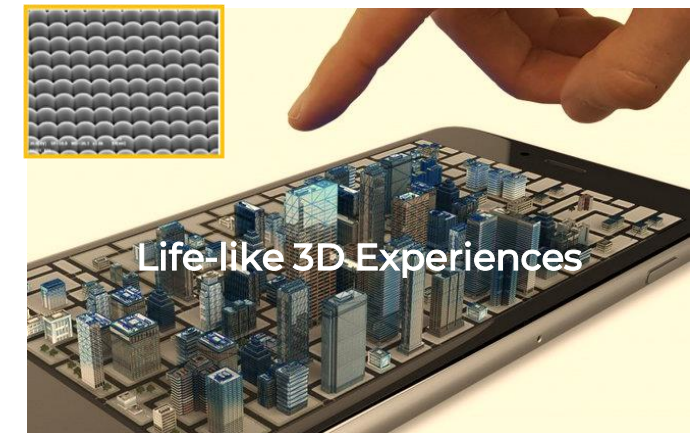
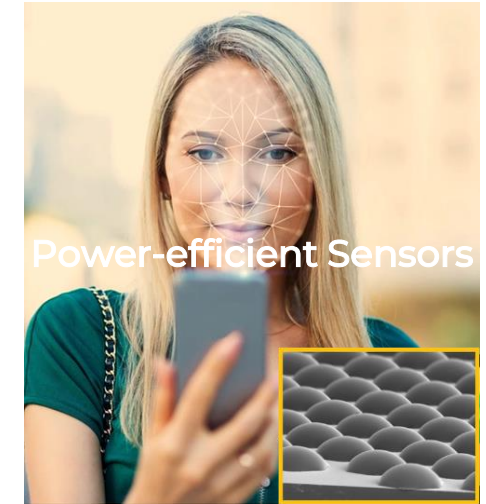
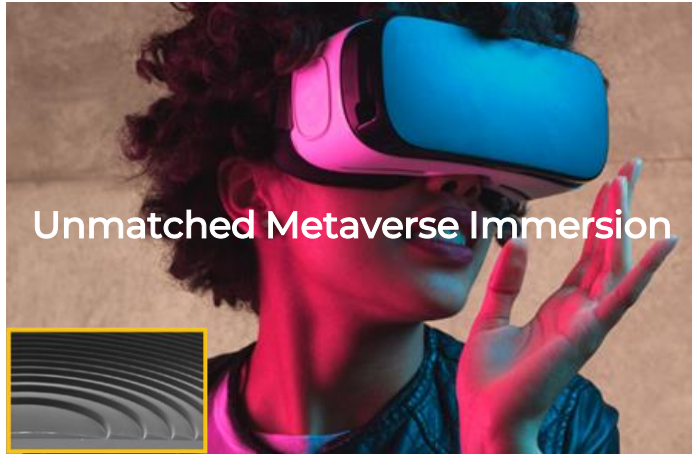
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Any Optics, Any Display, Any Size...



Design freedom to use any micron/nano structures for high-volume products
Key enabler is the Morphotonics large-area nanoimprinting technology!



Nanoimprinting Technology Solutions

Business Scope

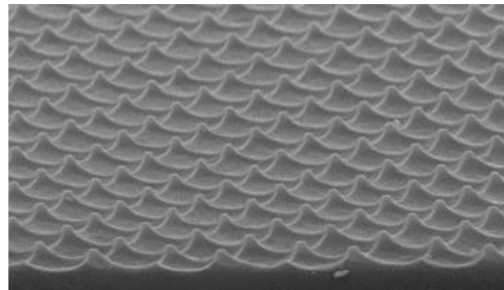
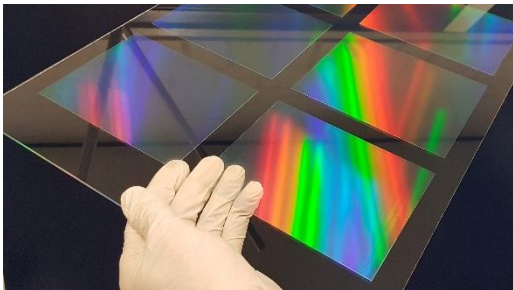
- **Problem:** Address the increasing demand of nanoscale surface customization for new visual experiences
- **Solution:** Deliver the only large-area nanoimprinting solution for micro-nano optics, that allows design freedom for displays + high volume manufacturing

Background

- Founded in 2014, 40 Employees and 1000 m² cleanroom.
- IP: > 25 patents worldwide (5 patent families), 14 pending
- >20 tools sold worldwide, Roll-to-Plate (R2P) technology proven in production

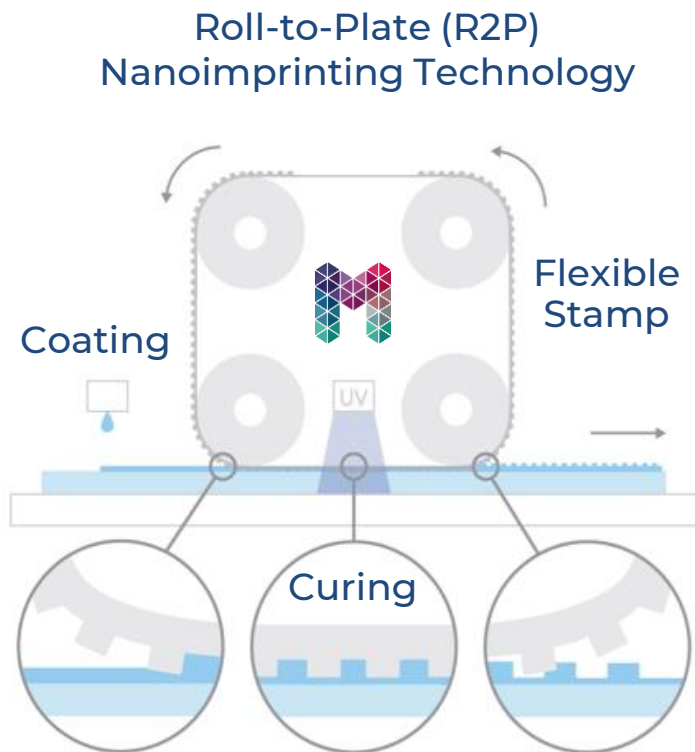
Products & Platform Technology

- Modular OEM platform approach from R&D to mass production;
- From sampling & master upscaling to turn-key production line
- Proprietary consumables: UV curable resins & flexible stamps





Large Area Nanoimprinting | Any Optics for Any Display



Any optics:

Precise structures w/ feature sizes from 500 μm to 50 nm
Design freedom – slanted, steep or high aspect ratio proven

Large-area NIL:

Large-area replication up to 1.1 x 1.5 m^2 , enabling high throughput for any display size

High throughput:

Imprint cycle times < 2 minutes in mass production

Materials:

Imprinting on rigid & flexible substrates, 100+ resin choices

Cost effective:

Stamp lifetime 1000x in commercial production;





Morphotonics | Automotive applications

Simultaneous imprinting of nano- and microtextures

SPIE 2023
270°AR waveguides on Gen5 size imprint

Freedom in optical design, from WGP and slanted gratings to MLA's and all in between.

Why need for large-area imprinting in automotive applications?

Using large-area NIL for larger displays:

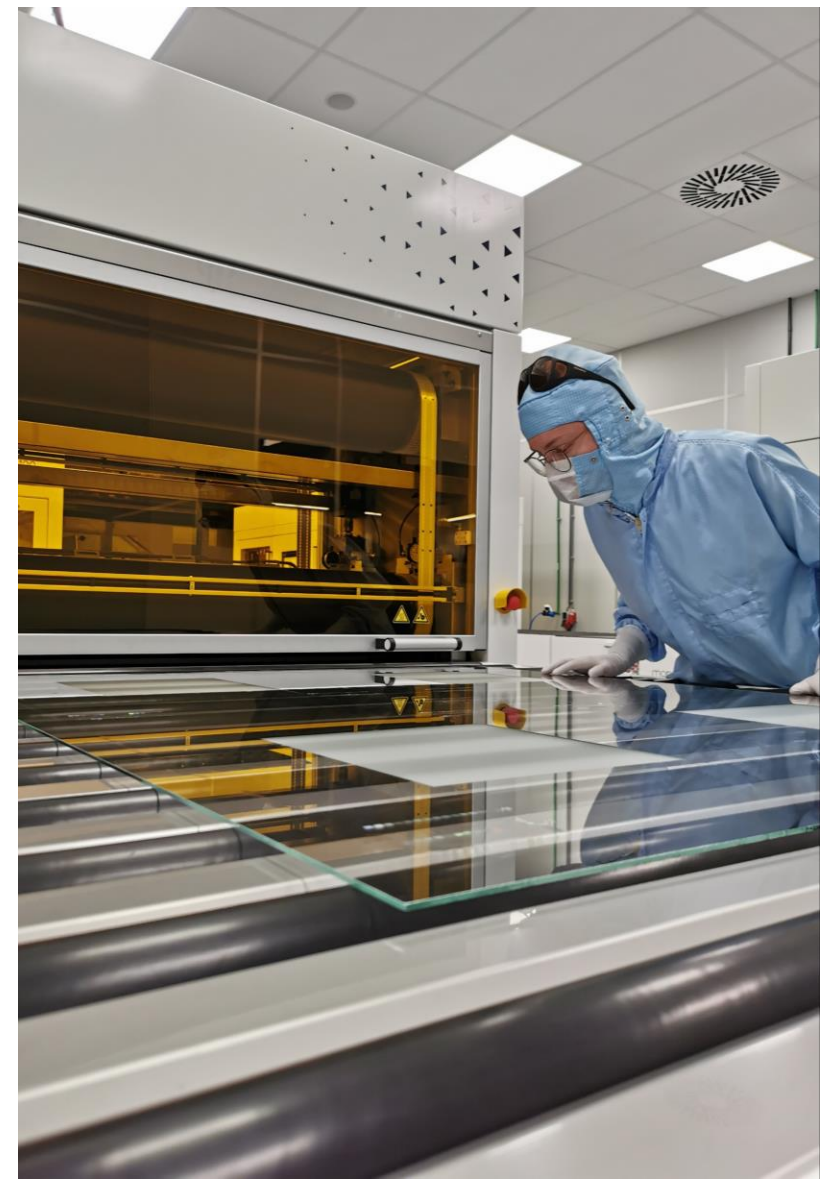
- 3D displays
- Anti-glare
- HUD

Display independent: LCD, OLED,...

Smaller optical products in high volumes

- Sensors
- Lighting/HUD projectors

Multiple products in 1 imprint cycle, resulting in high throughput





Optics mini/microLED applications

Wide application range

- More efficient interior lighting, using enhanced light management features
 - Uniform light distribution demonstrated with Seisenbacher in PHABULOuS project
- Pixel-level beam shaping/collimation
 - Interior projection for driver safety
 - Projections for decorative usage/entertainment
 - Brighter & more efficient displays

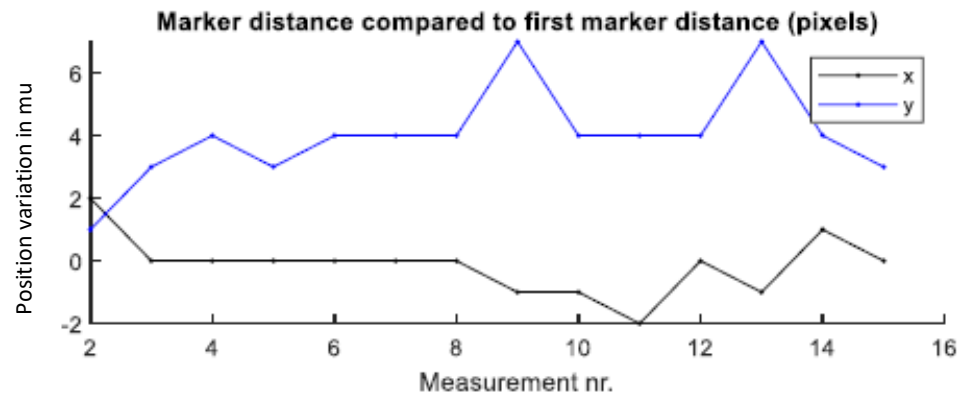
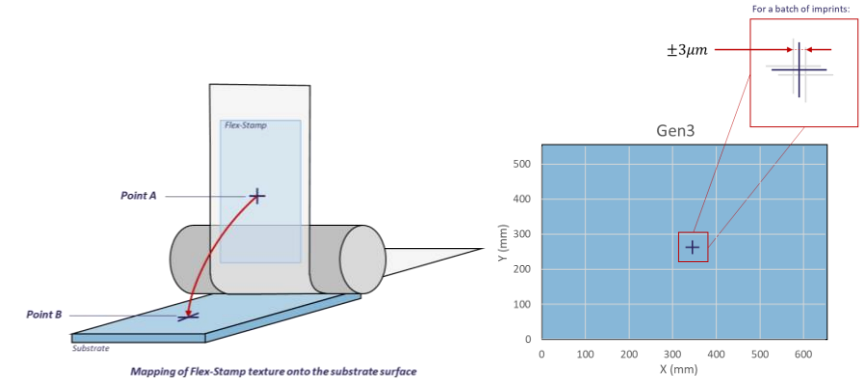




Aligned large-area nanoimprinting

Morphotonics develops dedicated Portis X-NIL for aligned imprinting:

- Aligned imprinting at $\pm 3\mu\text{m}$ accuracy over full 600 x 600mm surface (incl. tilt)
- Ability to enhance lower pixel-pitch MicroLED based displays with precise MLA placement
- Enabling imprinting of dual sided imprinting (thinner, lighter, more efficient)



Position variation in run of 15 imprints (1pixel is 1 μm)

Effect of one direction prism imprint on laser light.



Resulting effect of the multi-layer imprint on laser light.





Morphotonics part of PHABULOUS

European pilot line for the manufacturing of free form micro-optical components

- From design to mastering & manufacturing
- Accelerating innovation

First projects successful finished.

- As example decorative lighting

Open call ongoing: funding opportunity to implement free-form micro optical components

www.phabulous.eu

FREE-FORM MICRO-OPTICS ONE STOP SHOP



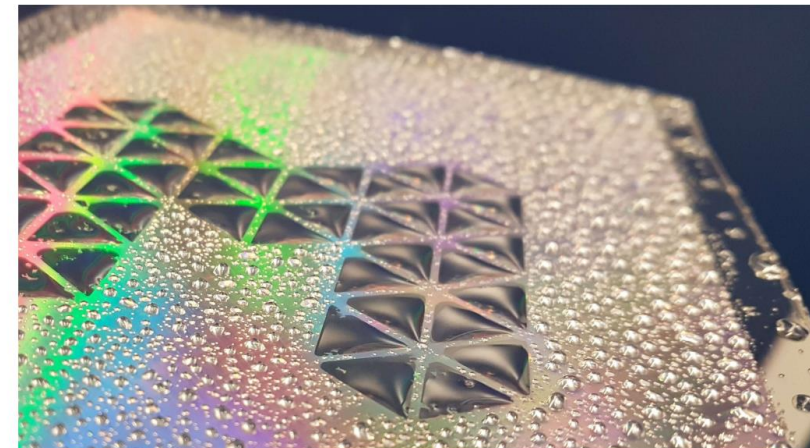
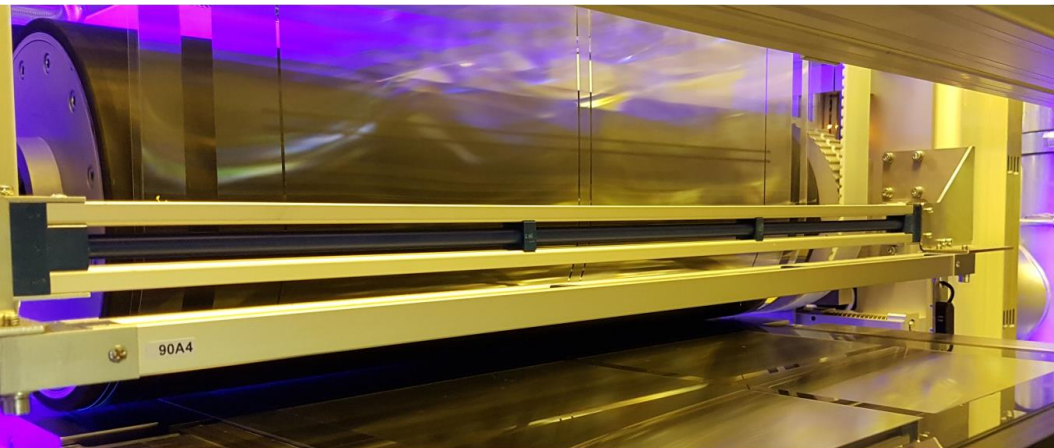


Summary

Large-area nanoimprinted can enhance the design, functionality, and affordability of automotive displays & lighting.

- Large-area nanoimprinting has flexibility to enhance optics of small or large displays in high volumes
- Performance of display can be enhanced strongly to create enhanced lighting, HUD, 3D or anti-glare functions
- Aligned large-area imprinting available in 2023
- Technology is already adopted & being used worldwide for different applications
- Open call in PHABULOuS program; unique opportunity to develop freeform microOptics applications

Morphotonics enables freedom in design & manufacturing of any micro or nano-optics for any display





MORPHOTONICS
Nanoimprint technologies

