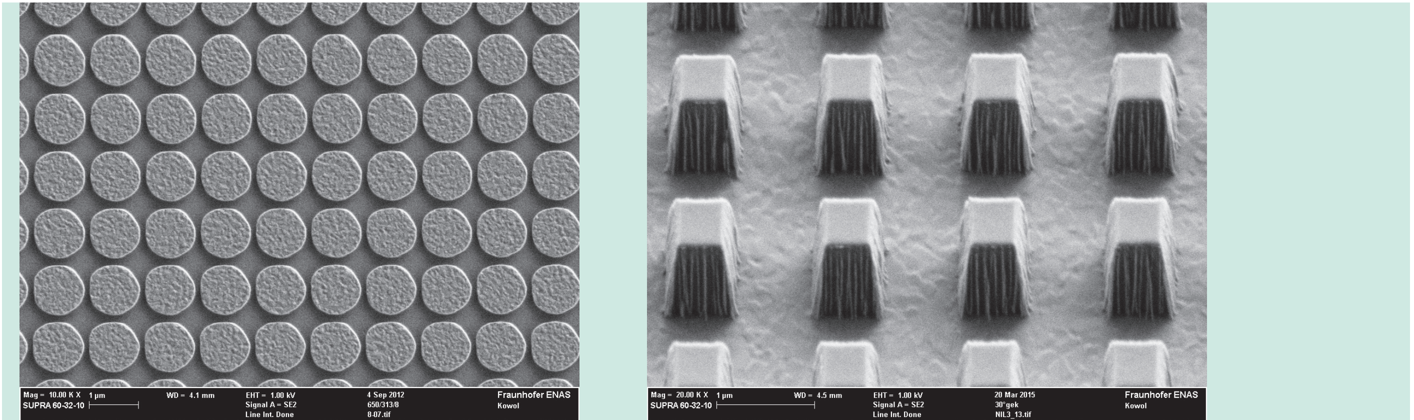
NANOIMPRINT LITHOGRAPHY



Contact

Fraunhofer Institute for Electronic Nano Systems ENAS
Technologie-Campus 3
09126 Chemnitz | Germany

Contact person
Dr. Maik Wiemer
Phone: +49 371 45001-233
E-mail: maik.wiemer@enas.fraunhofer.de

Christian Hofmann
Phone: +49 371 45001-496
E-mail: christian.hofmann@enas.fraunhofer.de

Figures:
SEM image: optical active, nanoscale Al-structure of a MEMS-interferometer fabricated by NIL. (left);
SEM image: Nanoscale structures on aluminum fabricated by NIL with a 2-layer resist system. (right).

Description

For the integration of new functionalities in optical/photonic, biotechnological/biological as well as microsystem-technological applications nanoscale structures are necessary. The structures can be fabricated using sequential exposure techniques like the electron beam lithography. However, these fabrication techniques are associated with high cost of ownership. In order to minimize the costs to a suitable level, there will be a large degree of development in the area of parallel lithography techniques (batch processing) like the Nanoimprint Lithography (NIL) in recent years. The NIL is used to transfer structures in the range of micrometer to nanometer from a master template in a substrate with support of a specially developed resist. The high-cost master template can be reproduced to working stamps by using polymers. Thus, the nanoimprint lithography is an interesting process for fabricating large-area nanostructures on wafer level for microsystem and microelectronic technologies to drastically reduce the costs per nanostructured wafer.

At the Fraunhofer Institute for Electronic Nano Systems ENAS exists a process flow for the adjusted UV nanoimprint lithography (NIL) for the fabrication of nanostructures. Finally the pattern can be transferred in the underlying material via dry etching techniques.

Advantages of the technology

- Parallel working method
- Nanostructuring of up to 6 inch round substrates
- Lateral dimensions: < 50 nm
- Higher throughput and lower costs than E-Beam lithography

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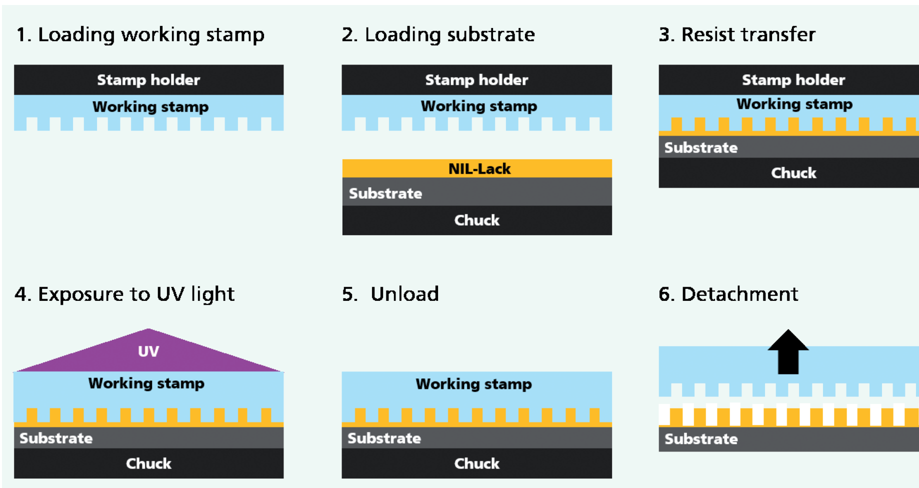
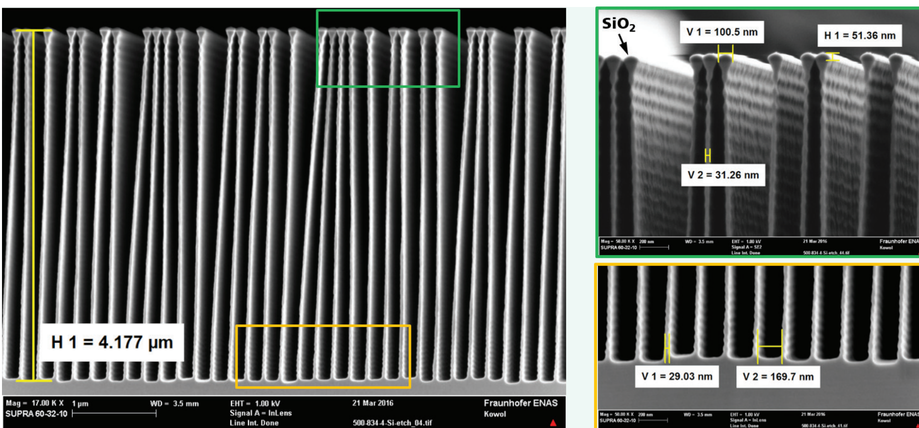


Schematically process flow of NIL.



SEM images: Nanoscale silicon combs with very high aspect ratios fabricated by NIL.

Parameter

Description	Value	Unit
Master material	Silicon, Resist	-
Master size	4, 6	inch
Working stamp material	Polymer	-
Working stamp size	6	inch
Min. lateral dimension	< 50	nm
Layer materials	Si, SiO_2, Al, PMMA	-
Layer thickness	< 100	nm
Alignment accuracy (incl. contact alignment)	< 0,5	µm

Photo acknowledgments: Fraunhofer ENAS

All information contained in this datasheet is preliminary and subject to change. Furthermore, the described systems, materials and processes are not commercial products.

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