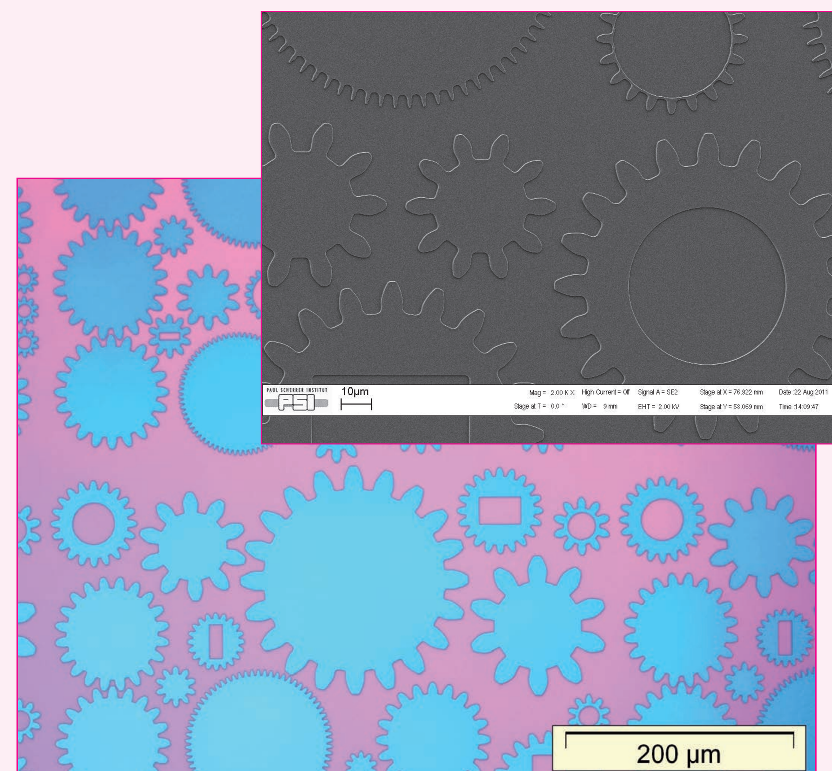
micro resist technology GmbH
Köpenicker Straße 325
12555 Berlin
Germany
Tel. +49 (0) 30 641670100
Fax +49 (0) 30 641670200
info@microresist.de
www.microresist.com

micro resist technology

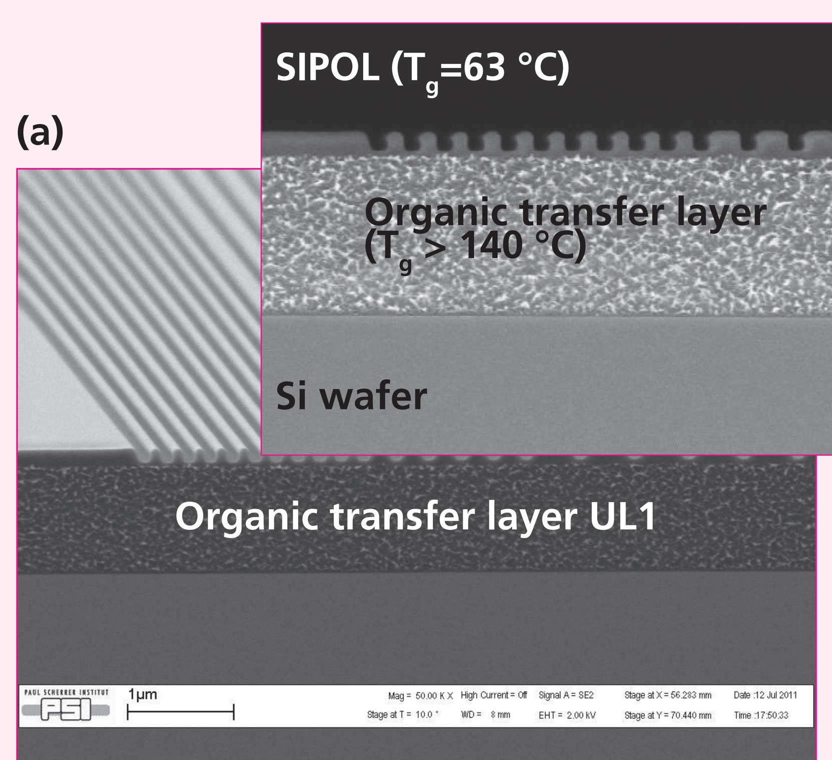
SIPOL – A new Si-containing thermal nanoimprint resist series for the fabrication of high aspect ratio patterns

SIPOL is typically applied in a bilayer system, i.e. in combination with an underlying organic transfer layer like UL1 for example. This approach renders the fabrication of high aspect ratio patters by an amplification of the imprinted relief of the SIPOL layer into the underlying organic transfer layer and in the substrate material by applying a sequence of consecutive plasma etch processes. In special cases or if required, SIPOL can also be applied as a single resist layer.

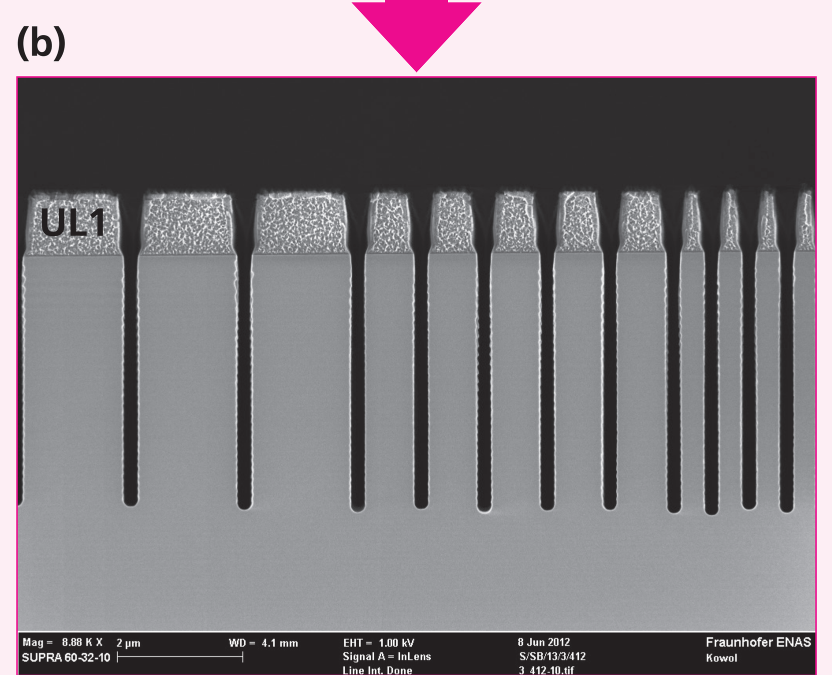


Fast imprint of large microstructures
(T = 123 °C, t = 60 s, p = 30 bar)

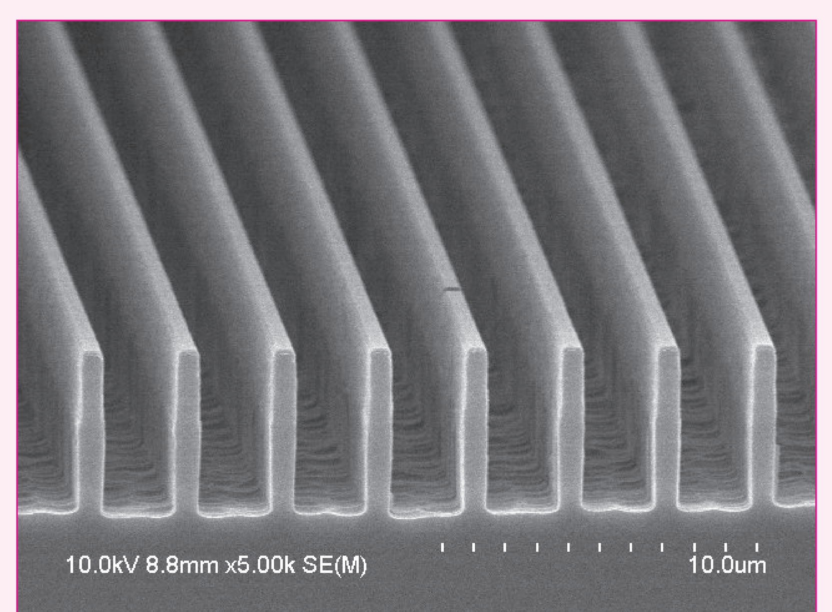
(a)



(b)



(a) Imprinted line-space patterns in SIPOL onto an organic transfer layer (UL1),
(courtesy of Paul-Scherrer Institute (PSI), Switzerland)
(b) Transfer and amplification of the imprinted SIPOL relief depicted in (a) into the Si wafer applying consecutive etch processes.
The obtained 200 nm trenches feature an aspect ratio of 20.



Fabrication of free-standing Si lines applying consecutive plasma etch processes and a SIPOL / UL1 bilayer stack
(Courtesy of Korean Institute of Machinery & Materials)

Resist characteristics

- Excellent flowability characteristics render short imprint cycle times and enable a fast filling of even large patterns with microscale dimensions
- High oxygen plasma resistance due to a Si content of 10 %
- Good mould release characteristics give rise to a low defectivity rate

Exemplary application fields

- Fabrication of micro/nano-scale patterns with high aspect ratios >> 3
- Patterned sapphire substrates (PSS) for fabrication of high brightness LEDs
- Micro/nanopillars for nanofluidic devices, e.g. DNA electrophoresis
- Fabrication of photonic crystals

Availability

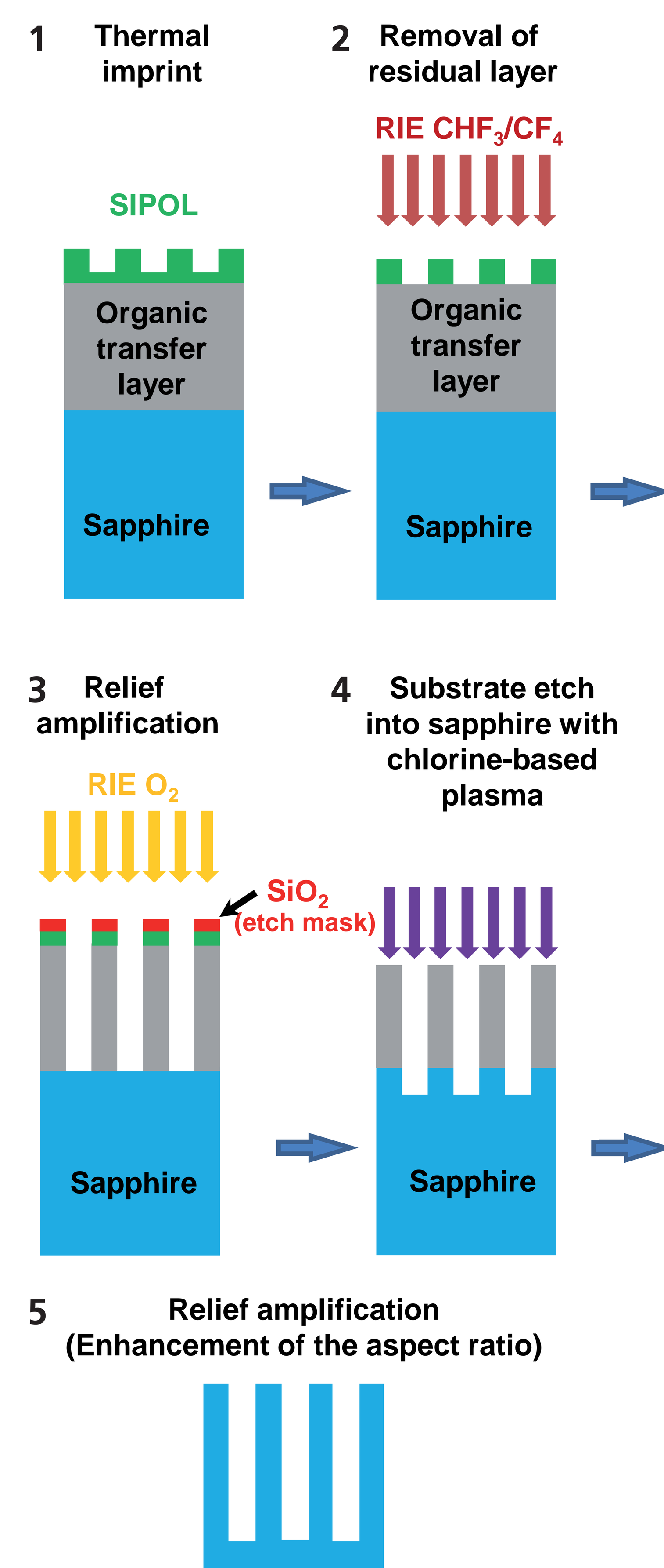
SIPOL version	SIPOL film thickness [a)]
SIPOL-100nm	100 nm
SIPOL-200nm	200 nm

[a)] Layer preparation by spin-coating @ 3000 rpm

Recommended processing parameters

Process step	Process parameter
Spin-coating	3000 rpm for 30 s
Softbake conditions	100 °C for 2 min
Imprint temperature	100-130 °C
Imprint pressure	10-30 bar
Imprint time	1-5 min
Mould release temperature	20-50 °C
Resist thinner	ma-T 1050
Resist stripping	ma-T 1050

Plasma etching steps for the generation of high aspect ratio nanopatterns



Applicable etch parameters for SIPOL and UL1

Removal of residual layer (SIPOL) [a)]				
Gas type	Flow rate [mTorr]	Power Bias [W]	Power Source [W]	Temperature [°C]
CHF_3/CF_4	7	50	1300	8 - 10
Transfer etch through organic layer UL1 [a)]				
Oxygen	5	80	500	8 - 10

[a)] Etcher: Oxford Instruments Plasmalab System 100 ICP

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