PFAS-free products -
we pay attention

micro resist technology

Positive Photoresists

Ready-to-use high performance photoresists for standard UV, greyscale, and laser interference lithography

- Excellent process compatibility
- Variety of viscosities
- No post exposure bake required
- Easy removal
- RoHS compliance
- Production according to ISO 9001 and ISO 14001
- PFAS-free

- Made in Germany -

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Positive Photoresists

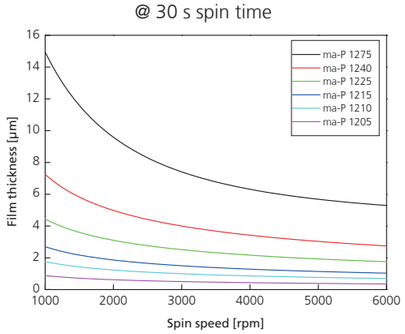
High perfomance materials for the most versatile applications

Properties and key parameters

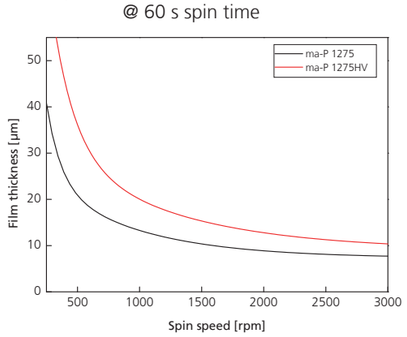
Resist	Patterning method					Spectral sensitivity	Typical film thickness			Developer			Pattern transfer methods
	Standard UV lithography	+ subsequent reflow	Grey scale lithography: Direct write lithography (DWL)	Grey scale lithography: Mask	Laser interference lithography (LIL)	[nm]	Spin coating @3000rpm [µm]	max. film thickness [µm]	Available types[1]	TMAH based	NaOH based	Silicate / phosphate based	
ma-P 1200 series	x	x				330 - 450	0.5 1.0 1.5 2.5 4.0 7.5		ma-P 1205 ma-P 1210 ma-P 1215 ma-P 1225 ma-P 1240 ma-P 1275	mr-D 526/S	ma-D 331 ma-D 331/S		Dry and wet etching, Electroplating, Ion implantation, Master for thermal (e.g. PDMS) and UV moulding (e.g. OrmoStamp®FF) from reflowed patterns
ma-P 1275HV	x	x				350 - 450	11	60 - 70		mr-D 526/S	ma-D 331 ma-D 331/S		
mr-P 1200LIL series					x	330 - 450	0.1 0.2		mr-P 1201LIL mr-P 1202LIL			ma-D 374/S	Dry and wet etching
ma-P 1200G series	x	x	x	x	x	350 - 450	1.5 2.5 4.0 9.5	60[2] 120[3]	ma-P 1215G ma-P 1225G ma-P 1240G ma-P 1275G	mr-D 526/S[4]	ma-D 331[5]		Master for thermal (e.g. PDMS) and UV moulding (e.g. OrmoStamp®FF), Electroplating
mr-P 22G			x very deep	(x)	x	330 - 420	17	120 - 140[2] 170 - 200[3]		mr-D 526/S (ma-D 532/S)			

[1] Additional custom-specific types available upon request [2] single coating [3] double coating [4] for greyscale lithography [5] for binary lithography

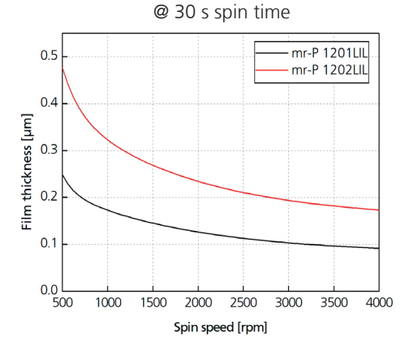
Spin curves ma-P 1200 series
@ 30 s spin time



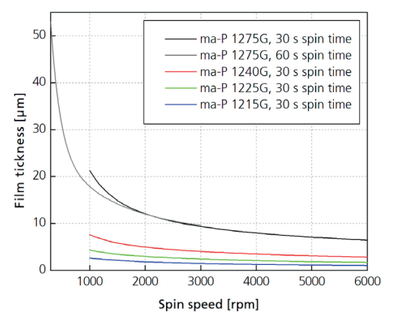
Spin curves ma-P 1275 / 1275HV
@ 60 s spin time



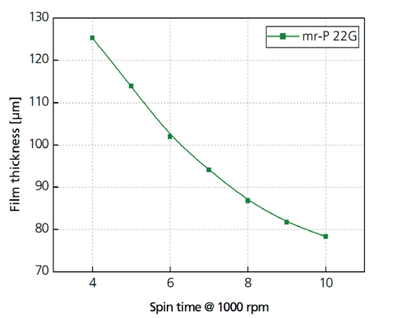
Spin curves mr-P 1200LIL series
@ 30 s spin time



Spin curves ma-P 1200G series



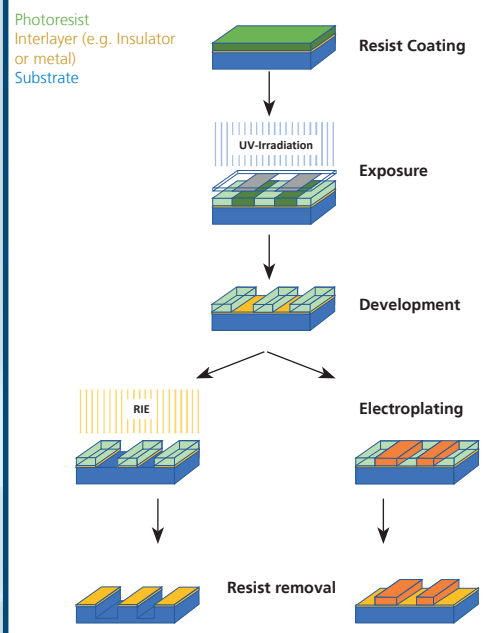
Thinkness vs. spin time mr-P 22G



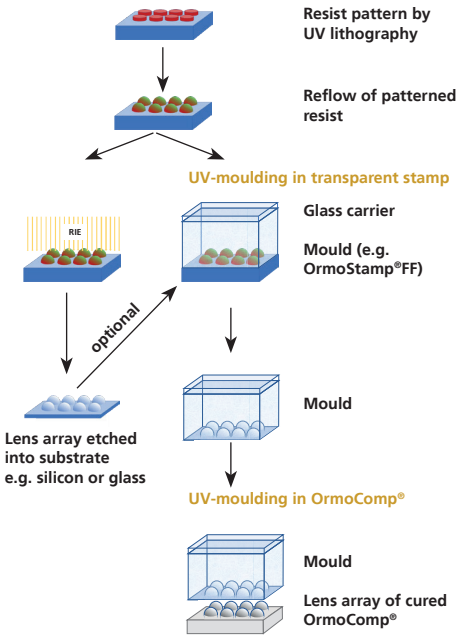
Manufactured in Berlin, Germany

enabled by ready-to-use formulations

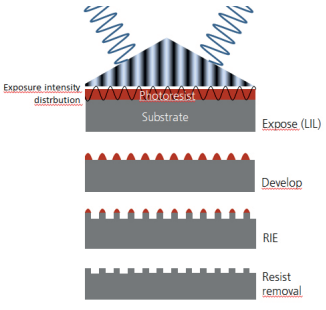
Process flow RIE / Electroplating

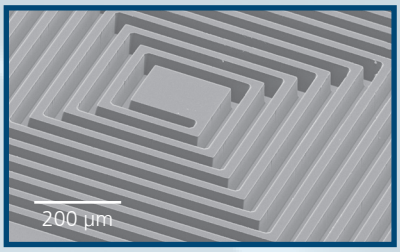


Process flow Reflow of ma-P 1200 / ma-P 1200G and pattern transfer

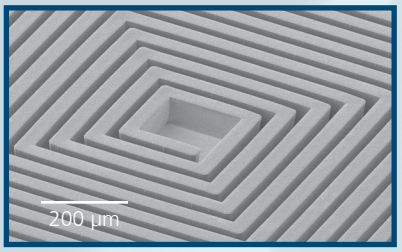


Process flow Laser Interference Lithography and etching

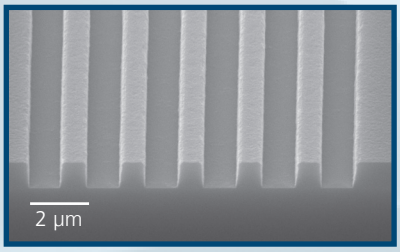




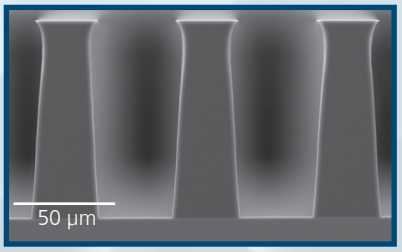
56 µm thick ma-P 1275HV mould



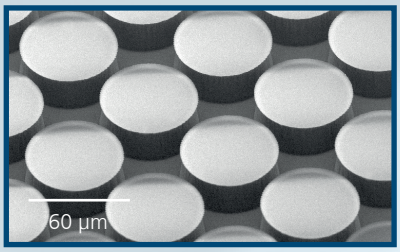
48 µm thick electroplated Ni



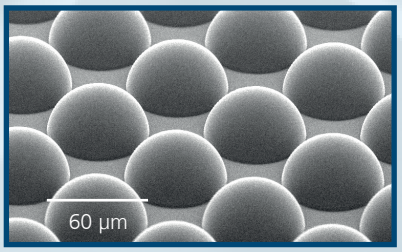
0.8 µm lines in 1.0 µm thick ma-P 1210



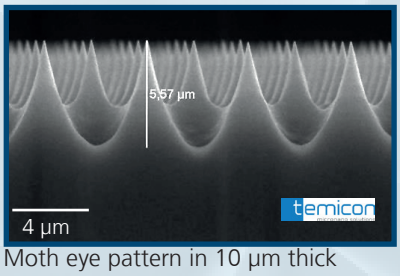
30 µm lines in 100 µm thick ma-P 1275G



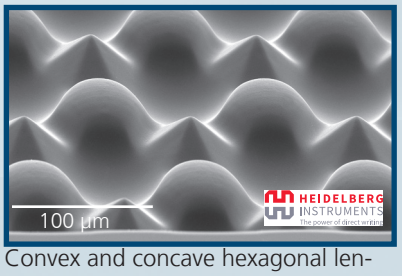
20 µm high ma-P 1275, 60 µm diameter pillars



30 µm high reflowed ma-P 1275, 60 µm diameter

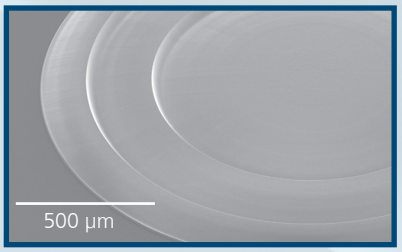


Moth eye pattern in 10 µm thick ma-P 1275G patterned by LIL @ 351 nm

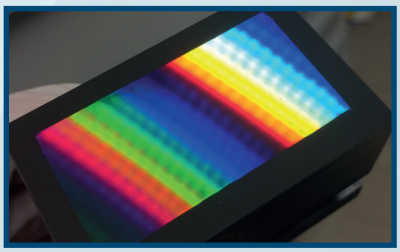


Convex and concave hexagonal lenses, 60 µm diameter in ma-P 1275G

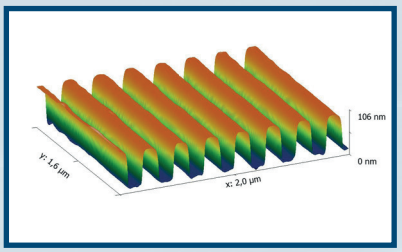
63 µm deep pattern in ma-P 1275G, patterned by Heidelberg Instruments



Fresnel lens, 2 mm diameter, 42 µm depth, patterned in ma-P 1275G



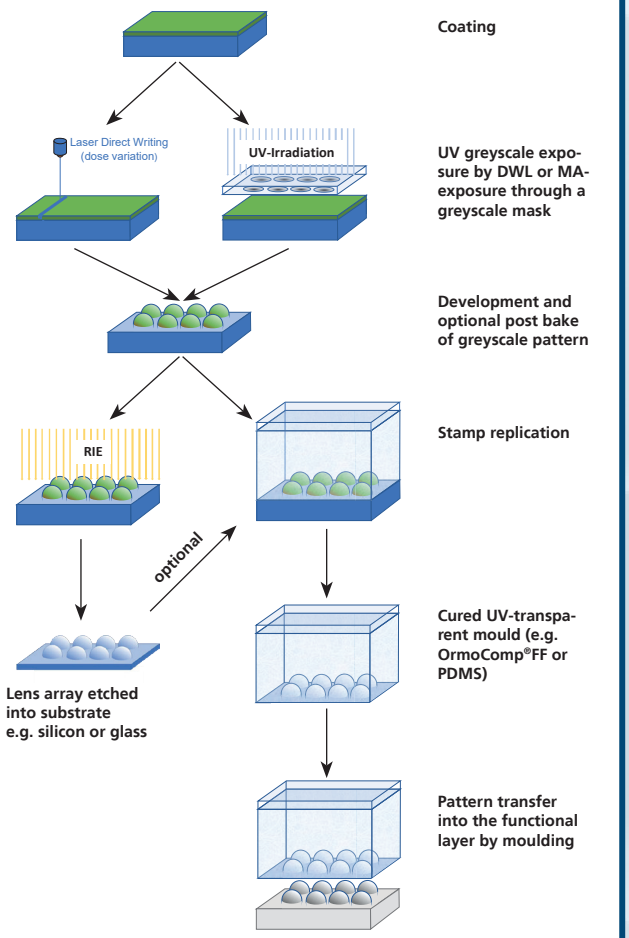
Diffractive optic: laminar grating (50 x 30 mm²) in mr-P 1202LIL



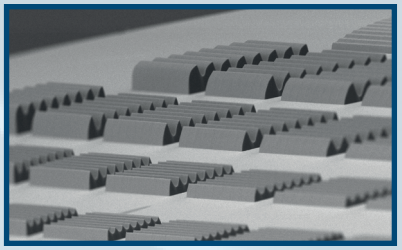
100 nm thick mr P 1201LIL, 125 nm pattern width

Positive Photoresists
e.g. for 2.5D applications

Process flow **Greyscale Lithography and pattern transfer**

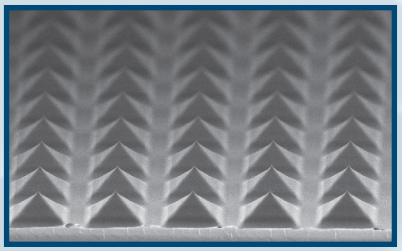


patterning and pictures by courtesy of
[1] Heidelberg Instruments Miktrotechnik GmbH
[2] IMS CHIPS
[3] RAITH laser systems

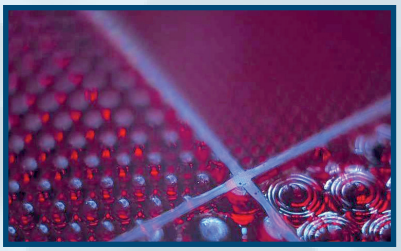


MA exposure with 405 nm filter, HEBS glass greyscale mask (by Canyon Materials Inc.): max. 70 µm high saw tooth patterns in different heights and pitches

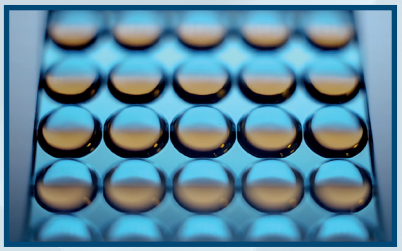
103 µm high, 2 mm diameter Fresnel lens[1] (DWL66+)



DWL @λ = 355 nm
Pyramids, 10 µm base width, 5 µm height, 45° angle[2]



DWL @λ = 405 nm
with PICOMASTER XF 200: 125 µm high lenses, and Fresnel lenses 125-500 µm diameter[3]

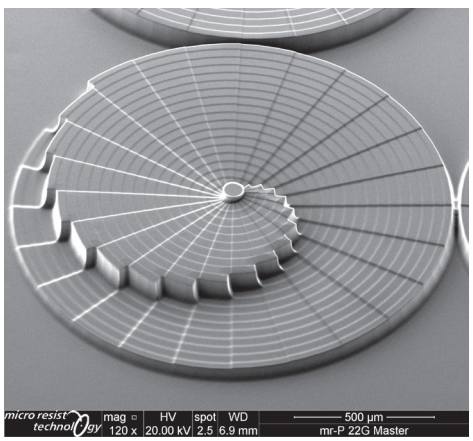


DWL @λ = 405 nm (DWL 66+):
70 µm high, 500 µm diameter lenses[1]

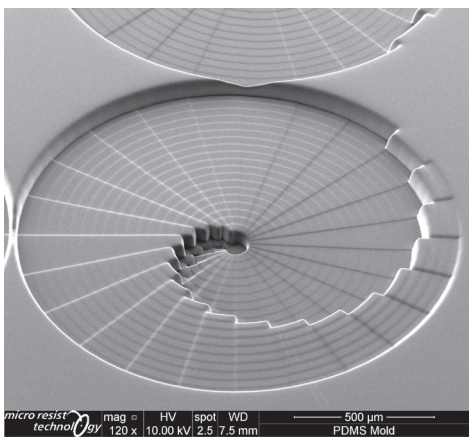
Greyscale pattern by DWL @λ = 405 nm (DWL 66+)[1]

Pattern transfer by UV moulding

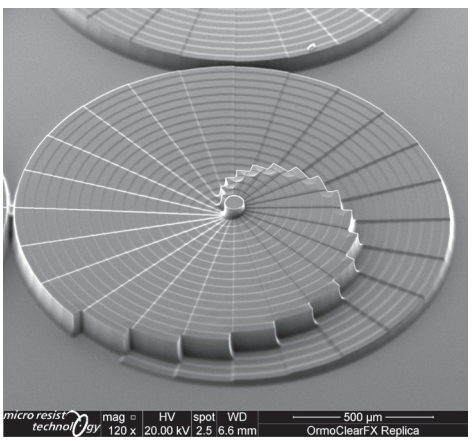
Process flow **Pattern transfer (example)**



130 µm deep mr-P 22G pattern



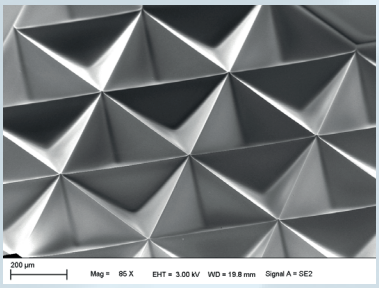
Thermal moulding with PDMS



UV moulding with OrmoClear®FX

Positve Photoresists
Highlights and inspirations

Highlight: Thick Film Positive Photoresist for Greyscale Lithography - mr-P 22G



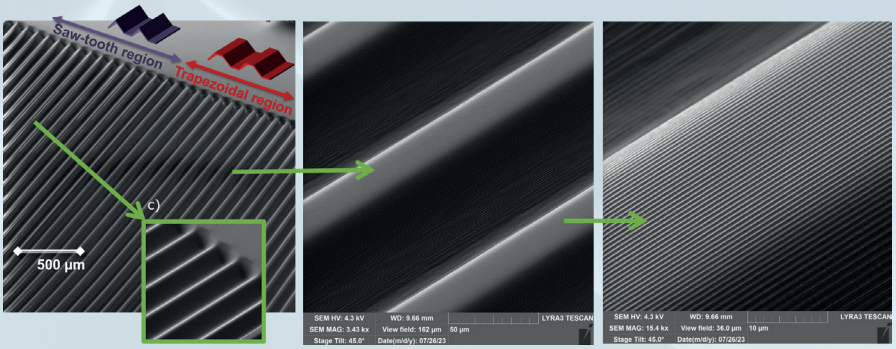
DWL @λ = 405 nm with DWL 66⁺:
155 µm deep tetrahedrons
patterning and pictures by courtesy of
Heidelberg Instruments Mikrotechnik GmbH

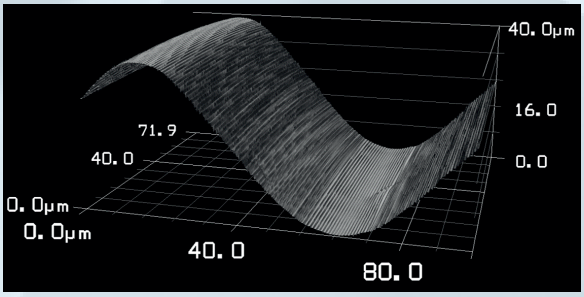
Main features

- ⇨ Specifically designed for the requirements of greyscale lithography in up to 200 µm thick films for up to 140–160 µm deep greyscale patterns
- ⇨ Very low residual absorption after exposure enables up to 140–160 µm pattern depth in greyscale lithography
- ⇨ Suitable exposure wavelengths: λ = 330–420 nm (λ = 405 nm and higher suited for deep patterns)
- ⇨ Aqueous alkaline development with TMAH based developers

Experimental approaches:

ma-P 1275G for hierarchical patterns by mix&match (combining DWL & LIL)





- ⇨ Large structure (405 nm - DWL manufactured); 100 µm grating period, 40 µm depth
- ⇨ Small structure (405 nm - LIL manufactured); 690 nm grating period, ~ 400 nm depth

- ⇨ Optical pattern assessment: 405 nm - LIL manufactured surface gratings on different parts of the 405 nm - DWL fabricated wave pattern in ma-P 1275G

patterning and pictures by courtesy of Joanneum Research and University of Žilina

JOANNEUM RESEARCH MATERIALS | UNIVERSITY OF ŽILINA | OPTIMAL AutOmated Maskless Laser Lithography Platform for First TIme Right Mixed ScALe Patterning

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