



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 -

micro resist technology GmbH

Gesellschaft für chemische Materialien spezieller Photoresistsysteme mbH

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Properties and key parameters

Resist	Patterning method					Spectral sensitivity [nm]	Typical film thickness		Developer			Pattern transfer methods	
	Standard UV lithography	Pattern reflow	Grey scale lithography		Laser interference lithography (LIL)		Spin coating @3000rpm [μm]	max. film thickness [μm]	TMAH based	NaOH based	Silicate / phosphate based		
			Direct write lithography (DWL)	Mask									
ma-P 1200 series ¹⁾	x	x				330 - 450	0.5 - 7.5		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 ²⁾					x	330 - 450	0.1 - 0.2				ma-D 374/S		Dry and wet etching
ma-P 1200G series ³⁾	x	x	x	x	x	350 - 450	1.5 - 9.5	60 ⁴⁾ 120 ⁵⁾		mr-D 526/S ⁶⁾	ma-D 331 ⁷⁾		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 ⁴⁾ 170 - 200 ⁵⁾		mr-D 526/S (ma-D 532/S)			

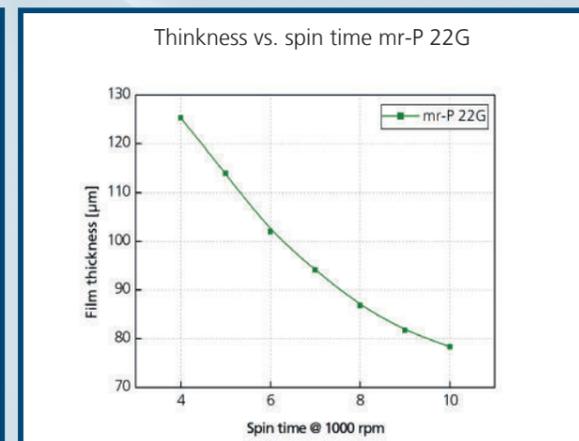
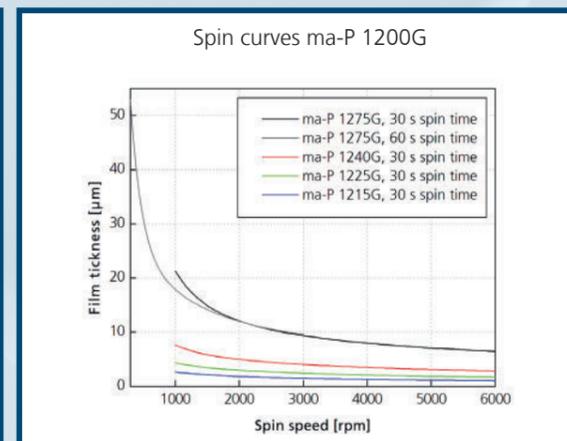
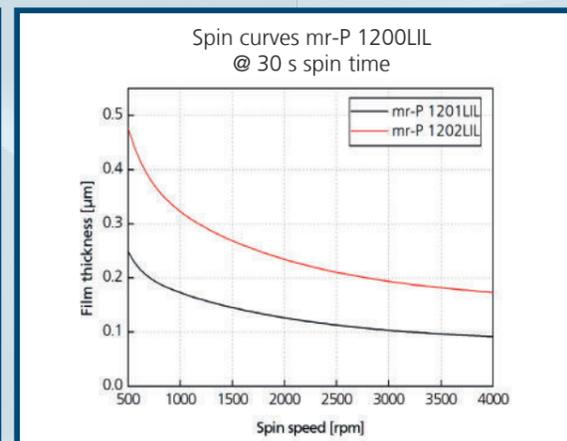
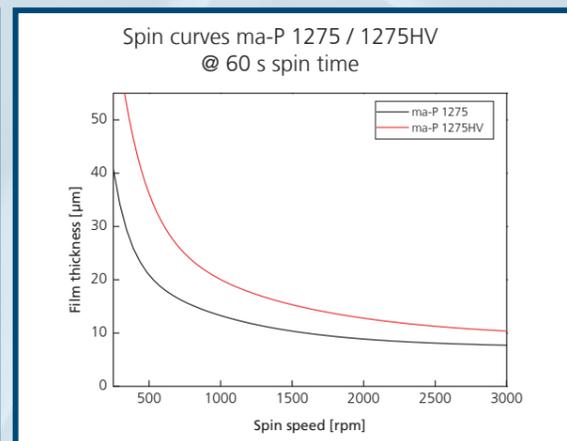
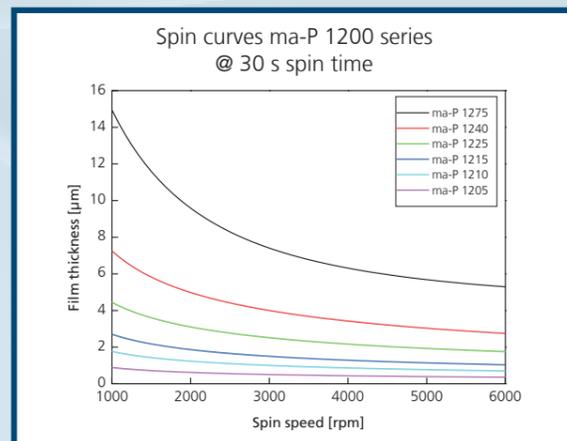
Available types: ¹⁾ ma-P 1205 / ma-P 1210 / ma-P 1215 / ma-P 1225 / ma-P 1240 / ma-P 1275

²⁾ mr-P 1201LIL / mr-P 1202LIL

³⁾ ma-P 1215G / ma-P 1225G / ma-P 1240G / ma-P 1275G

⁴⁾ single coating ⁶⁾ for greyscale lithography

⁵⁾ double coating ⁷⁾ for binary lithography

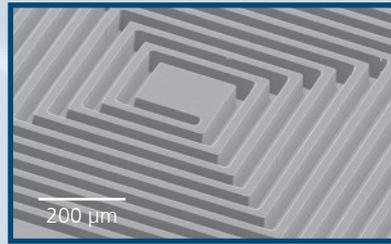
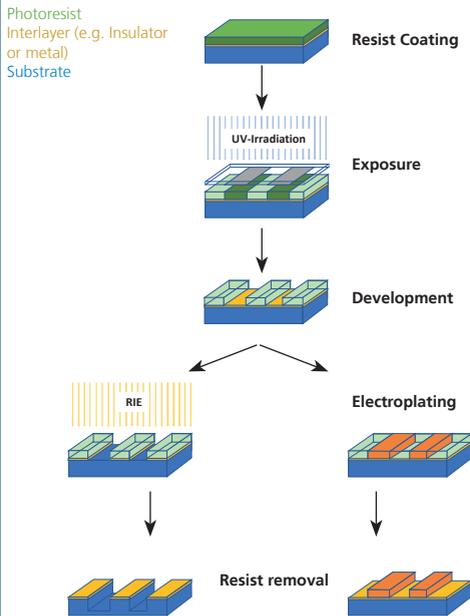


Manufactured in Berlin, Germany

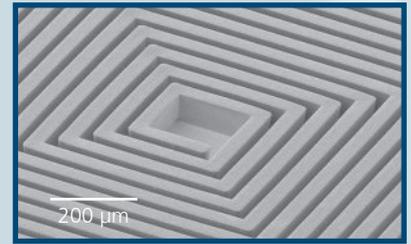


enabled by ready-to-use formulations

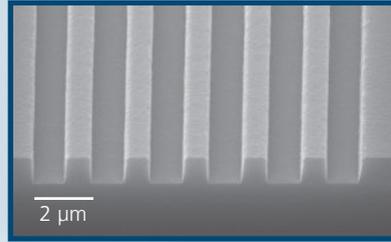
Process flow RIE / Electroplating



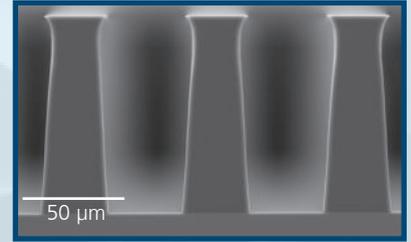
56 µm thick ma-P 1275HV mould



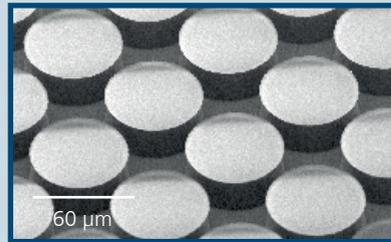
48 µm thick electroplated Ni



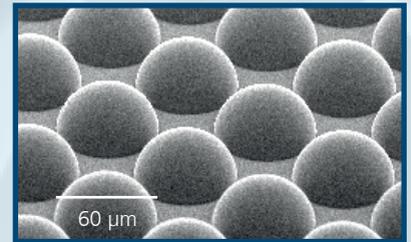
0.8 µm lines in 1.0 µm thick ma-P 1210



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

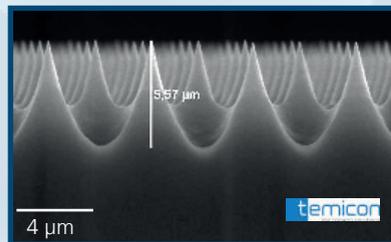
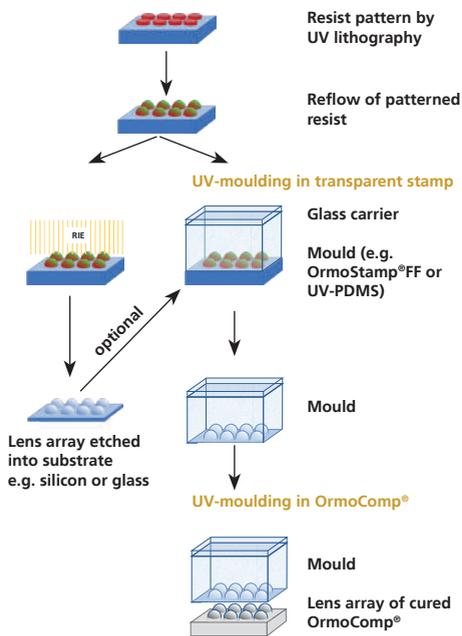


20 µm high ma-P 1275, 60 µm diameter pillars

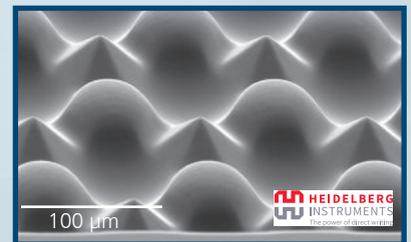


30 µm high reflowed ma-P 1275, 60 µm diameter

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



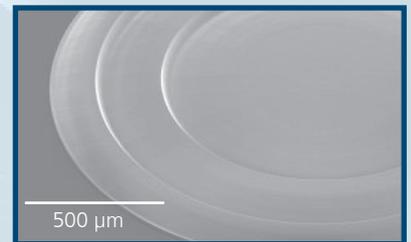
Moth eye pattern in 10 µm thick ma-P 1275G patterned by LIL @ 351 nm



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

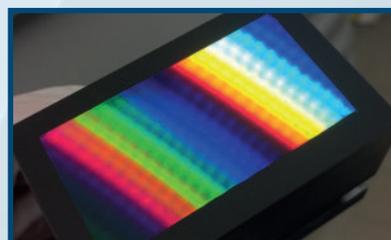
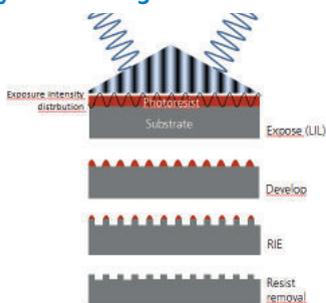


Test pattern, 63 µm pattern depth, patterned by Heidelberg Instruments

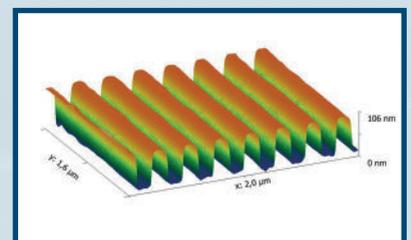


Fresnel lens, 2 mm diameter, 42 µm depth, patterned in ma-P 1275G

Process flow Laser Interference Lithography and etching



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

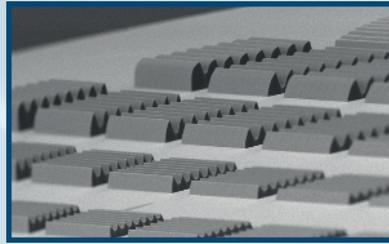
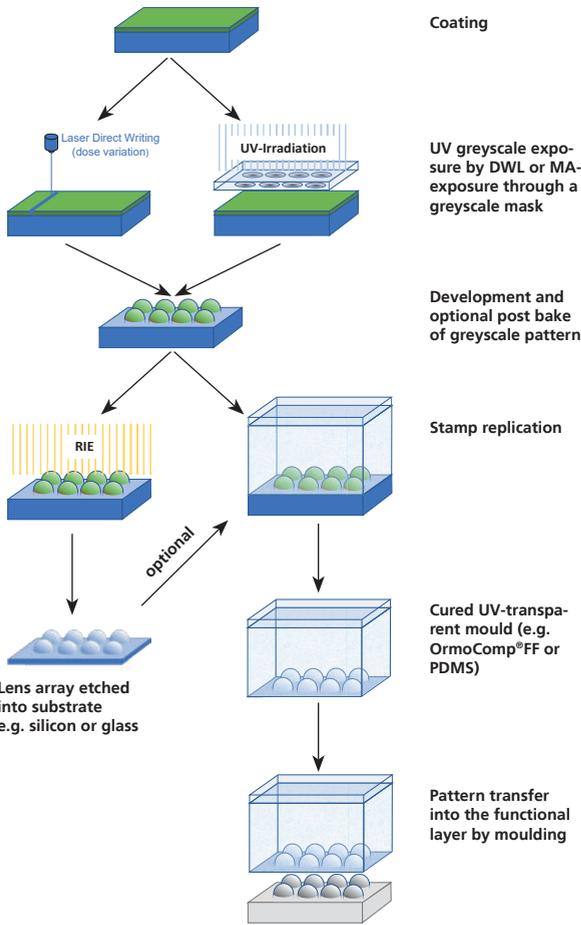


100 nm thick mr P 1201LIL, 125 nm pattern width

Positive Photoresists

e.g. for 2.5 D applications

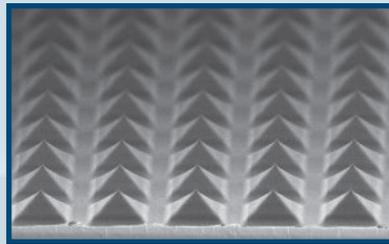
Process flow Greyscale Lithography and pattern transfer



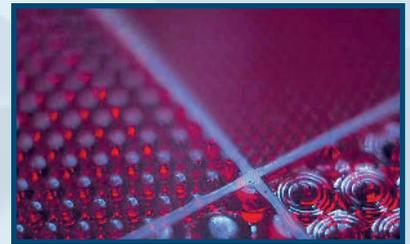
MA exposure with 405 nm filter, HEBS glass greyscale mask (by Canyon Materials Inc.): max. 70 μm high saw tooth patterns in different heights and pitches



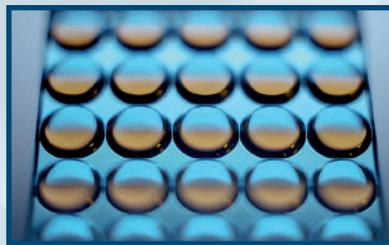
103 μm high, 2 mm diameter Fresnel lens¹⁾ (DWL66+)



DWL @ $\lambda = 355 \text{ nm}$
Pyramids, 10 μm base width, 5 μm height, 45° angle²⁾



DWL @ $\lambda = 405 \text{ nm}$ with PICOMASTER XF 200: 125 μm high lenses, and Fresnel lenses 125-500 μm diameter³⁾



DWL @ $\lambda = 405 \text{ nm}$ with DWL 66+: 70 μm high, 500 μm diameter lenses¹⁾

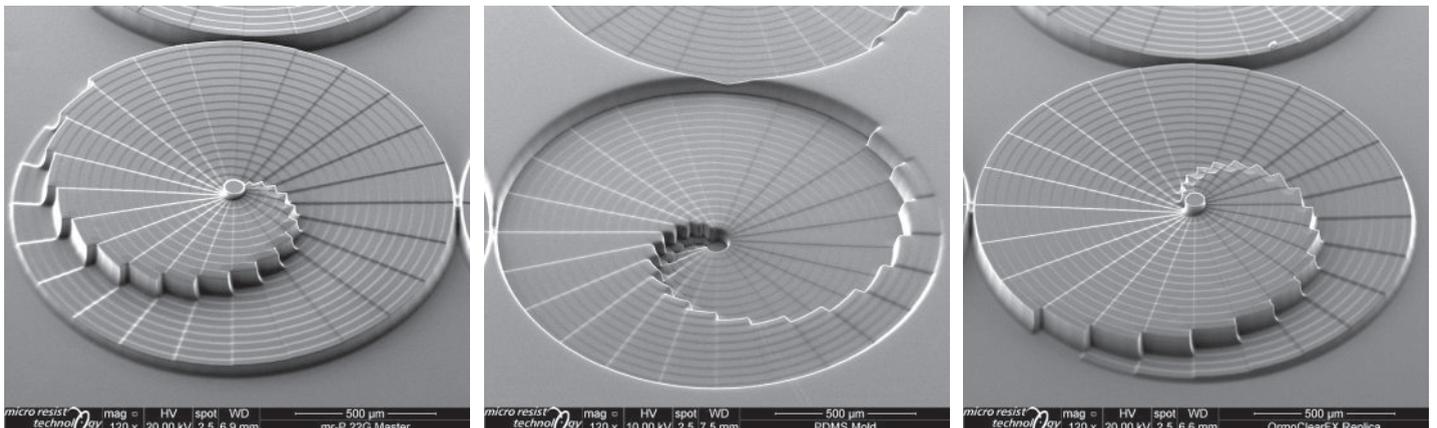


Greyscale pattern in mr-P 22G by DWL @ $\lambda = 405 \text{ nm}$ with DWL 66+¹⁾

patterning and pictures by courtesy of
¹⁾ Heidelberg Instruments Mikrotechnik GmbH
²⁾ IMS CHIPS
³⁾ RAITH laser systems

Pattern transfer by UV moulding

Process flow Pattern transfer (example)



Pattern transfer from 130 μm deep mr-P 22G pattern



Thermal moulding with PDMS

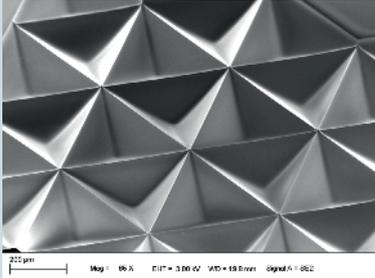


UV moulding with OrmoClear®FX

Positive Photoresists

Highlights and inspirations

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



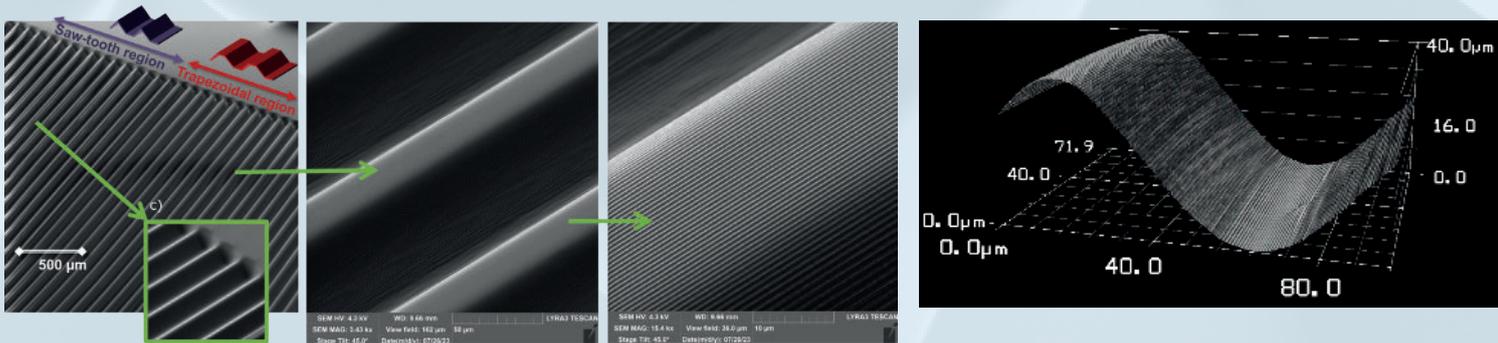
DWL @ $\lambda = 405$ nm with DWL 66+:
155 µm deep pyramid pattern¹⁾

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: $\lambda = 330\text{--}420$ nm ($\lambda = 405$ nm and higher suited for deep patterns)
- ⇒ Aqueous alkaline development with TMAH based developers

Experimental approaches:

ma-P 1275G 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-P1275G

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



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