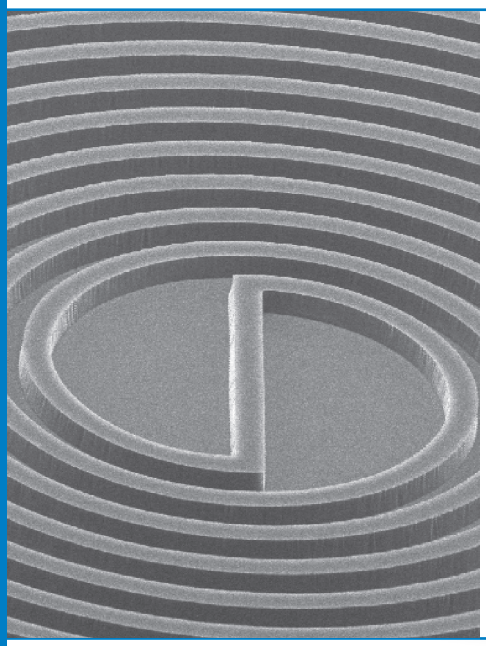
micro resist technology

Positive Photoresists for UV, Laser & Electron Beam Lithography



- **ma-P 1200 series, ma-P 1275HV** for standard UV lithography
- **ma-P 1200G series** for greyscale lithography
- **mr-PosEBR** for e-beam lithography
- **ma-P 1200LIL series** for laser interference lithography

Unique features of the positive photoresists

- Designed for - UV Lithography (mask aligner, laser grey-scale lithography, laser interference) & E-beam Lithography
- No post exposure bake
- Easy removal
- Ready-to-use resist solutions in a variety of viscosities

- Made in Germany -

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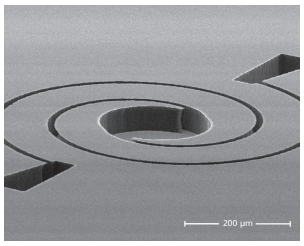
Positive Photoresist Series and Thick Film Photoresists for UV lithography

Resist		ma-P 1200 series	ma-P 1275	ma-P 1275HV
Spectral sensitivity	nm	330 - 450	350 - 450	350 - 450
Ready-to-use solutions for various film thicknesses	µm	ma-P 1205 → 0.5 ma-P 1210 → 1.0 ma-P 1215 → 1.5 ma-P 1225 → 2.5 ma-P 1240 → 4.0 ma-P 1275 → 7.5 @ 3000 rpm	6 - 40 in one spin-coating step	10 - 60 in one spin-coating step
Exposure dose @ 365 nm*	mJ cm^{-2}	35 - 150	150 - 3000	300 - 4000
Developer		ma-D 331 & ma-D 331/S (NaOH based); mr-D 526/S (TMAH based)		

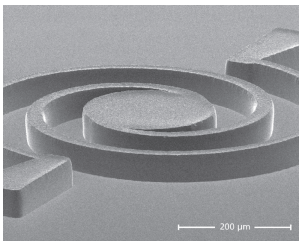
* Mask aligner broadband exposure

Resist patterning with mask aligner broadband exposure and pattern transfer

Resist mould for electroplating

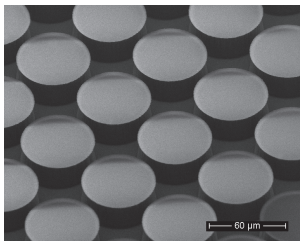


50 µm ma-P 1275HV mould

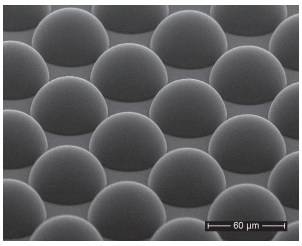


40 µm electroplated Ni

Resist pattern reflow



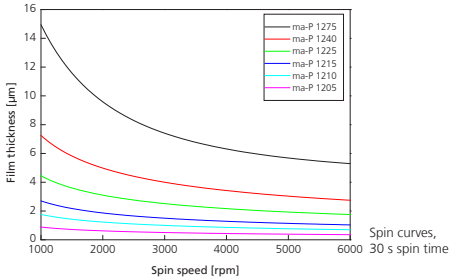
20 µm ma-P 1275, 60 µm diameter pillar



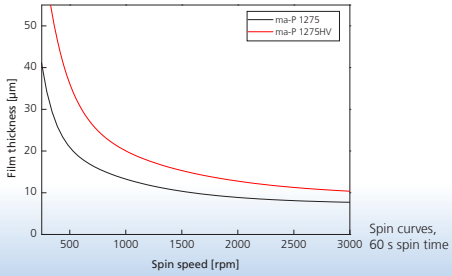
30 µm reflowed ma-P 1275, 60 µm diameter

ma-P 1200 series and ma-P 1275 & ma-P 1275HV
for microsystems technology and microelectronics

- Film thickness up to 60 µm in one spin-coating step
- Broadband-, g- and i-line exposure
- High stability in acid and alkaline plating baths
- High dry and wet etch resistance
- Good thermal stability of the resist patterns attainable
- Aqueous alkaline development
- Side wall angle up to 87° with mask aligner broadband exposure
- Suitable for pattern reflow

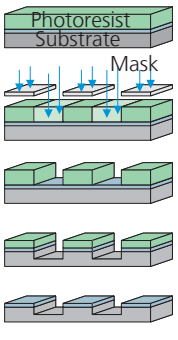


Spin curves, 30 s spin time

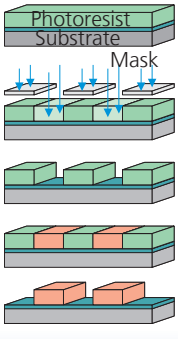


Spin curves, 60 s spin time

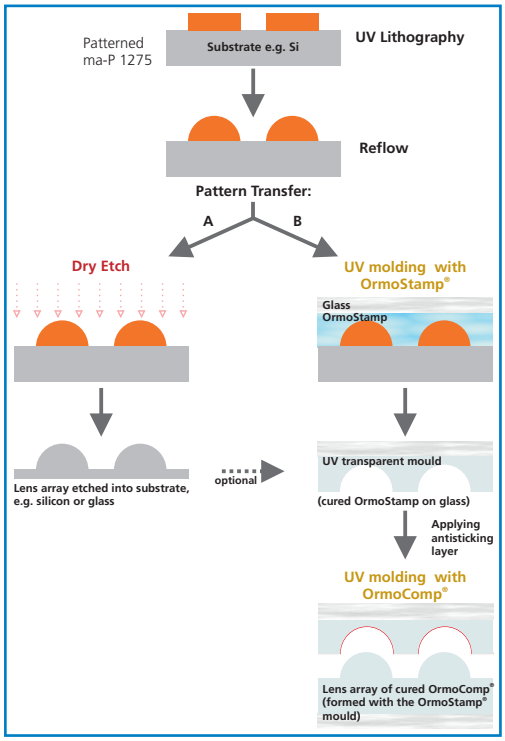
Process flow RIE



Process flow Electroplating



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



Main applications

- Etch mask - metals and semiconductors
- Mould for electroplating
- Fabrication of micro optical components, e.g. micro lenses by pattern transfer from reflowed resist patterns
- Mask for ion implantation

OrmoComp®: DE 30 210 075 433; IR 1 091 982 ; TW 100030626 (application), OrmoStamp®: DE 30 210 075 435; IR 1 092 621; TW 100030629 (application)

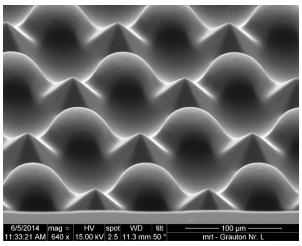
Positive Photoresist Series for Greyscale Lithography

Resist		ma-P 1215G	ma-P 1225G	ma-P 1275G			
Film thickness *	µm	1.5	2.5	9.5	15	30	60
Spin-coating	rpm s	3000 30	3000 30	3000 30	1500 30	500 60	1000 4
Spectral sensitivity	nm	350 - 450					
Exposure dose @ 365 nm**	mJ cm^{-2}	35 - 150	150 - 3000	300 - 4000			
Developer		ma-D 532/S, mr-D 526/S (TMAH based) for greyscale lithography ma-D 331 (NaOH based) for standard lithography					

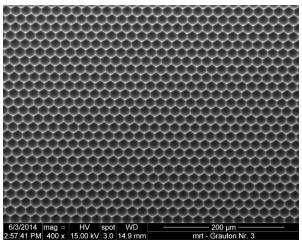
* Resists with different viscosities available as custom-made products
** Mask aligner broadband exposure

Resist patterning with Laser Direct Writing

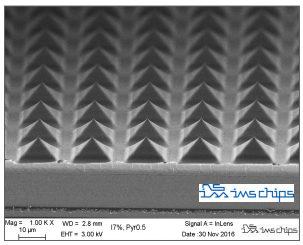
* Patterned at Heidelberg Instruments
** by courtesy of IMS CHIPS



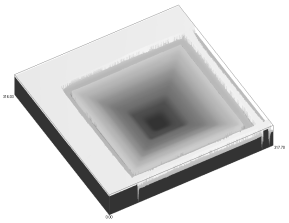
Convex and concave hexagonal lenses, 60 µm diameter*



Hexagonal concave lenses, ~ 17 µm width*



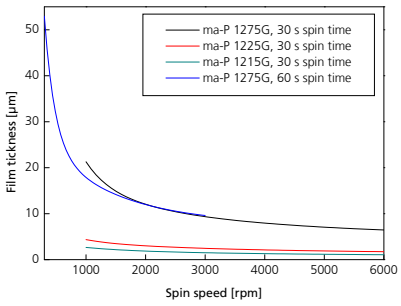
Pyramids, 10 µm base width, 5 µm height, 45 °angle**



53 µm pattern depth in 58 µm thick resist*

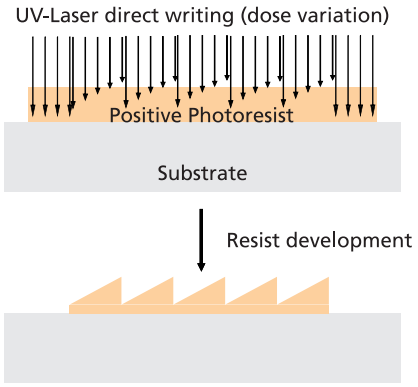
ma-P 1200G
for greyscale lithography

Specifically designed for the requirements of greyscale lithography, application in standard binary lithography also possible.

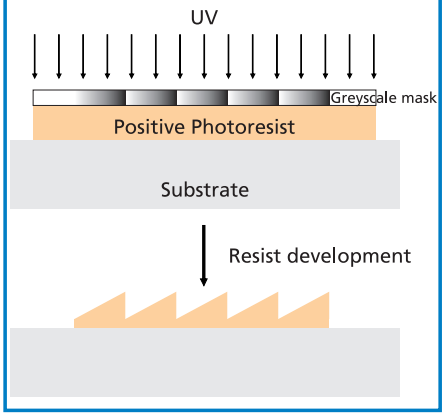


Spin curves

Process flow
Laser Direct Writing



Process flow
Exposure through a greyscale mask



- Reduced contrast
- Film thickness 1 - 60 µm and higher
- High intensity laser exposure possible, no outgassing
- 50-60 µm greyscale pattern depth possible
- Aqueous alkaline development
- High dry etch resistance
- Suitable for pattern reflow after standard binary lithography

Main applications

Use of manufactured 3D patterns in microoptics, MEMS and MOEMS and displays

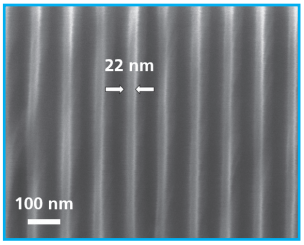
Pattern transfer by

- Electroplating
- Etching
- UV moulding

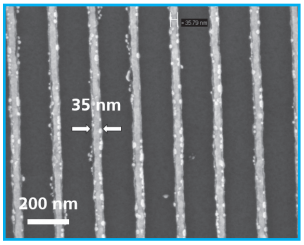
Positive Electron-Beam Resist Series

Resist		mr-PosEBR 0.05	mr-PosEBR 0.1	mr-PosEBR 0.3
Film thickness (@ 3000 rpm)	nm	50	100	300
Exposure dose @ 30 keV @ 100 keV	$\mu C\ cm^{-2}$ $\mu C\ cm^{-2}$	75 - 200 340 - 500	75 - 200 340 - 500	75 - 200 340 - 500
Developer		mr-Dev 800 (solvent based)		
Dry etch selectivity vs. Si (SF_6/CF_4 process)		~2.5		

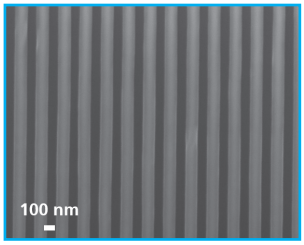
Resist patterning with e-beam lithography and pattern transfer



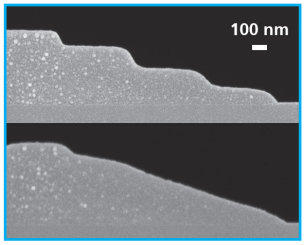
Resist grating pattern, period 100 nm[1]



Ti/Au lines via lift-off[2]



L&S pattern, period 200 nm, etched into Si via RIE (SF_6/CF_4)[1]



multistep grayscale pattern before and after thermal reflow[2]

[1] Exposure: RAITH150 Two (30 kV), Courtesy of MPI Erlangen, Germany

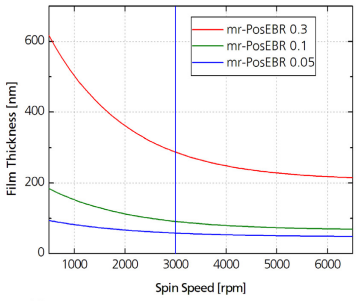
[2] Exposure: Vistec EBPG 5000+ (100 kV), Courtesy of PSI Villigen, Switzerland

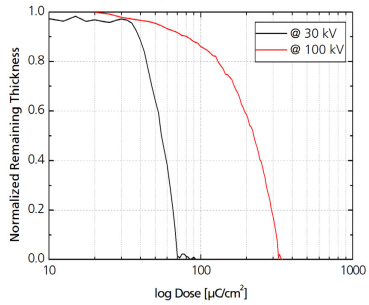
mr-PosEBR for high resolution electron-beam lithography

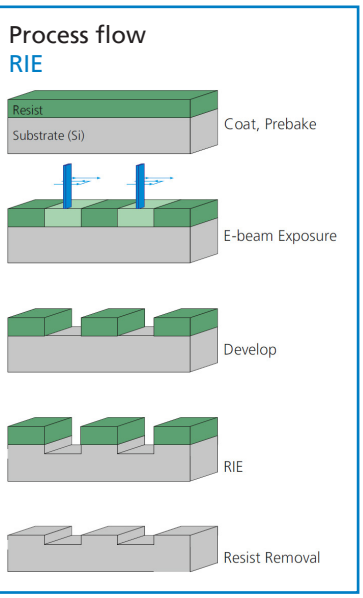
- Highly sensitive
- High resolution capability
- Generation of sub 50 nm patterns
- Excellent dry etch stability
- Good pattern transfer fidelity
- Development in organic solvents
- Resist solvent anisole

Main applications

- Use in micro- and nanoelectronics
- Manufacture of semiconductor devices
- Etch mask for pattern transfer, e.g. into Si, SiO_2, Si_3N_4 or metals
- Mask for lift-off patterning
- Suitable for 3D surface patterning







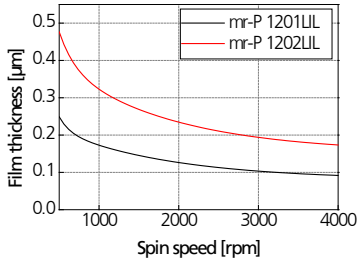
Thin Film Positive Photoresists in Laser Interference Lithography

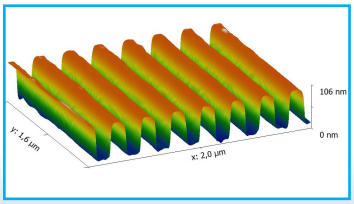
mr-P 1200LIL for high resolution laser interference lithography

- Steep sidewalls due to high contrast enable high quality etched pattern
- Good etch resistance
- Film thickness 100…500 nm

Main applications

- Masking of substrate surfaces during fabrication of steep-edged nano structures for diffractive optics:
- Laminary gratings
- VLS gratings





AFN scan of 100 nm thick mr-P 1201LIL, 4000 lines/ mm on 4´´ Si wafer