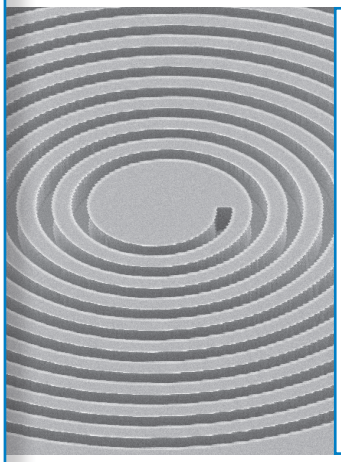
Positive Photoresists

micro resist technology

Gesellschaft für chemische Materialien spezieller Photoresistsysteme mbH

Positive Photoresists



- **ma-P 1200 series**
- **Thick resists ma-P 1275, ma-P 1275 HV**
- **Microlens Manufacture - ma-P 1200**

Unique features of the positive photoresists

- Sensitivity to g-line, i-line or broadband exposure
- No post exposure bake
- Easy removal
- Ready-to-use resist solutions in a variety of viscosities
- Broad process window and easy to handle

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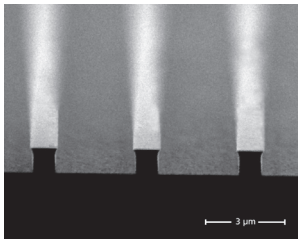
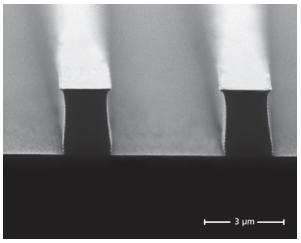
Positive Photoresist Series

Resist		ma-P 1205	ma-P 1210	ma-P 1215	ma-P 1225	ma-P 1240	ma-P 1275
Film thickness	µm	0.5	1.0	1.5	2.5	4.0	7.5
Spin coating	rpm s	3000 30					
Dose @ 365 nm (broadband exposure)	mJ cm^{-2}	35	35	45	55	110	210

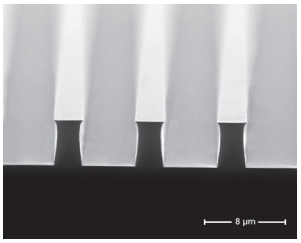
Resist patterning with mask aligner broadband exposure



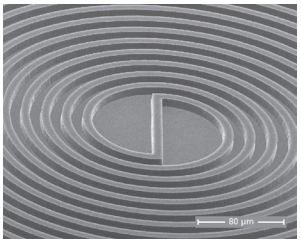
1 µm ma-P 1210,
1 µm lines/ 3 µm spaces



2.5 µm ma-P 1225,
2 µm lines/ 4 µm spaces



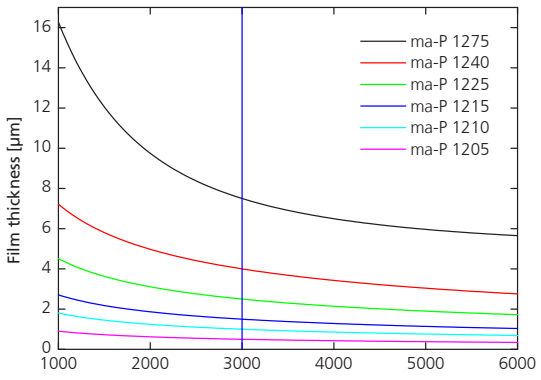
4 µm ma-P 1240,
3 µm lines/ 5 µm spaces



7.5 µm ma-P 1275,
coil, 10 µm trace with

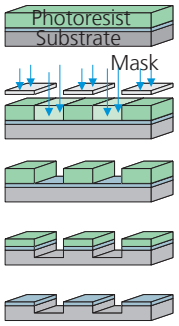
ma-P 1200 series
for microelectronics and microsystems technology

ma-P 1200 is a positive tone photoresist series designed for the use in microelectronics and microsystems technology.
The resists are available in a variety of viscosities for film thicknesses of 0.3 – 40 µm in one spin-coating step.

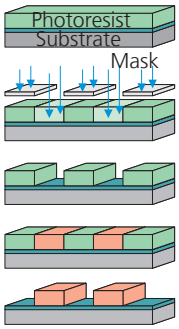


Spin curves, 30 s spin time

Process flow RIE



Process flow Electroplating



- Outstanding pattern stability in wet etch processes and acid and alkaline plating baths
- Highly stable in dry etch processes e.g. CHF_3, CF_4, SF
- Aqueous alkaline development
- Resists available in a variety of viscosities

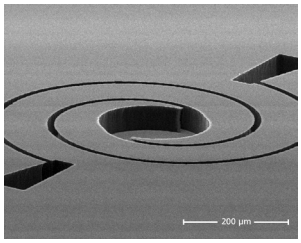
Main applications

- Mask for etching e.g.Si, SiO_2, Other semiconductors, Metals
- Mask for ion implantation
- Mould for electroplating

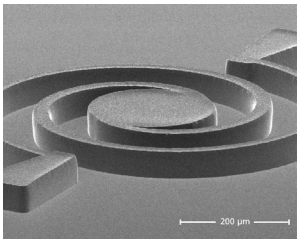
Thick Positive Photoresists

Film thickness		7.5 µm	11 µm	20 µm	30 µm	40 µm	50 µm
ma-P 1275	rpm s	3000 30	-	500 60	350 60	250 60	-
ma-P 1275 HV	rpm s	-	3000 30	1100 60	700 60	500 60	400 60

Electroplating

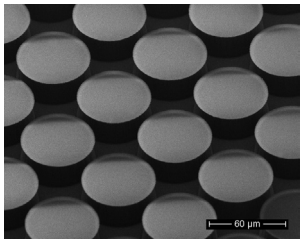


50 µm ma-P 1275 HV mould

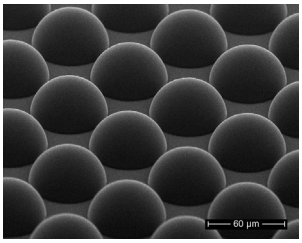


40 µm electroplated Ni

Resist pattern reflow (see page 4)



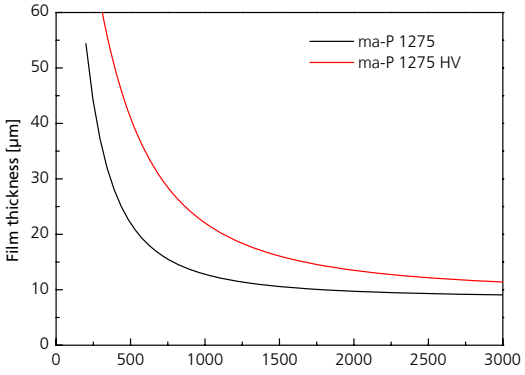
20 µm ma-P 1275, 60 µm diameter pillar



30 µm reflowed ma-P 1275, 60 µm diameter

ma-P 1275 & ma-P 1275 HV
for microsystems technology

ma-P 1275 & ma-P 1275 HV are high viscosity positive tone photoresists for film thicknesses of up to 60 µm designed for electroplating structures in microsystems technology and excellently suited for the use as etch mask.



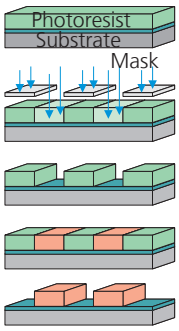
Spin curves, 60 s spin time

- Specifically designed for electroplating of structures in microsystems technology
- High stability in acid and alkaline plating baths
- Very well suitable also for the use as an etch mask exhibiting 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

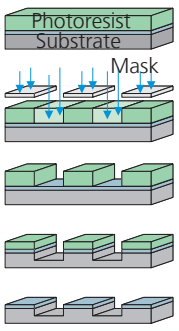
Main applications

- Mould for electroplating – e.g. for micro coils, micro springs, micro optical components
- Etch mask for metal and semiconductor substrates – e.g. microlenses from reflowed patterns
- Mask for ion implantation

Process flow Electroplating



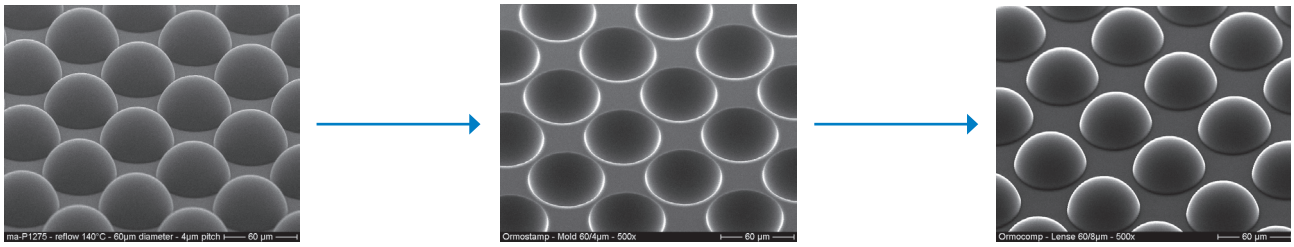
Process flow RIE



Special Application: ma-P 1200 in Microlens Manufacture

Formation of Photoresist Lens Template	Lens Manufacture by Pattern Transfer A	or	B
• Standard lithography of ma-P 1200 to form pillars • Reflow conditions (hotplate): temperature ramp from 100 °C to 140 °C (4-8 K / min), 5 min hold time at 140 °C • Lens shape controlled by height / diameter ratio of original ma-P 1200 pillars, e.g. half spheres obtained with ratio 1 : 3	• ma-P 1200 lenses transferred by **dry etching** e.g. into silicon or glass substrate • Optional: subsequent UV moulding into OrmoStamp® and OrmoComp® hybrid polymers* (see Pattern Transfer B) * see Product Flyer Hybrid Polymers		• **UV moulding** with UV curable OrmoStamp® (ma-P 1200 residues easily removed with acetone from cured OrmoStamp® patterns) • Application of antisticking layer • Use as mould for multiple replications by UV moulding of OrmoComp® micro lenses

UV Moulding

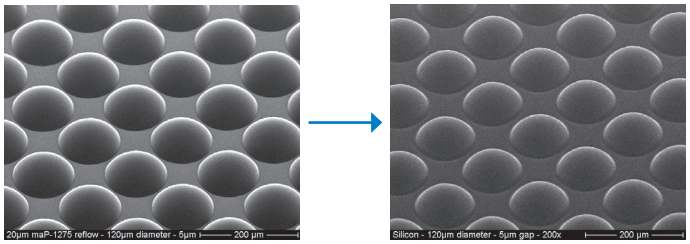


60 µm diameter ma-P 1200 pattern **after reflow** at 140 °C

Pattern transfered into Ormo-Stamp® by UV moulding

Lens array transfered into Ormo-Comp® by UV moulding

Dry Etching



120 µm diameter ma-P 1200 pattern **after reflow** at 140 °C

Pattern transfered into silicon by dry etching

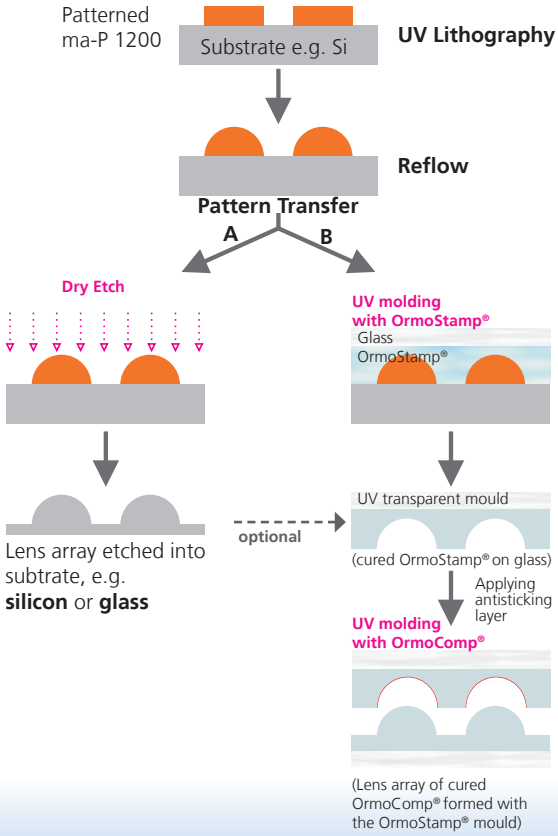
Method

- Pattern reflow of positive tone photoresist ma-P 1200 and subsequent pattern transfer by dry etching or UV moulding
- Cost-effective method for manufacturing micro lenses, since template manufacture only requires standard UV lithography tools
- Dimensions of photoresist lens templates (depending on original ma-P 1200 pattern size): 2 µm – 1 mm diameter, up to 90 µm height
- Increase of photoresist lens diameter up to merging of lens edges can be accomplished by elevated reflow temperatures

Main applications

- Microoptical components, e.g. in cameras, sensors (UV, IR), lasers
- Fiber Optics
- Anti-reflective coatings (moth eye)

Reflow of ma-P 1200 and pattern transfer



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)