Positive Photoresists for UV, Laser & Greyscale Lithography

• **ma-P 1200 series, ma-P 1275HV**
  for standard UV lithography
• **ma-P 1200G series** for greyscale lithography
• **ma-P 1200LIL series**
  for laser interference lithography

**Unique features of the positive photoresists**

• Designed for - UV Lithography (mask aligner, laser greyscale lithography, laser interference 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

<table>
<thead>
<tr>
<th>Resist</th>
<th>ma-P 1200 series</th>
<th>ma-P 1275</th>
<th>ma-P 1275HV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectral sensitivity</td>
<td>nm</td>
<td>330 - 450</td>
<td>350 - 450</td>
</tr>
<tr>
<td>Ready-to-use solutions for various film thicknesses</td>
<td>µm</td>
<td>ma-P 1205 → 0.5</td>
<td>ma-P 1210 → 1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ma-P 1225 → 2.5</td>
<td>ma-P 1240 → 4.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>@ 3000 rpm</td>
<td>6 - 40 in one spin-coating step</td>
</tr>
<tr>
<td>Exposure dose @ 365 nm*</td>
<td>mJ cm⁻²</td>
<td>35 - 150</td>
<td>150 - 3000</td>
</tr>
<tr>
<td>Developer</td>
<td></td>
<td>ma-D 331 &amp; ma-D 331/S (NaOH based); mr-D 526/S (TMAH based)</td>
<td></td>
</tr>
</tbody>
</table>

* Mask aligner broadband exposure

Resist patterning with mask aligner broadband exposure and pattern transfer

Resist mould for electroplating

Resist pattern reflow

56 µm ma-P 1275HV mould
48 µm electroplated Ni
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

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
Positive Photoresist Series for Greyscale Lithography

<table>
<thead>
<tr>
<th>Resist</th>
<th>ma-P 1215G</th>
<th>ma-P 1225G</th>
<th>ma-P 1275G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Film thickness *</td>
<td>µm</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Spin-coating</td>
<td>rpm</td>
<td>s</td>
<td>3000</td>
</tr>
<tr>
<td>Spectral sensitivity</td>
<td>nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure dose @ 365 nm**</td>
<td>mJ cm⁻²</td>
<td>50 - 70</td>
<td>70 - 110</td>
</tr>
<tr>
<td>Developer</td>
<td>ma-D 532/S, mr-D 526/S (TMAH based) for greyscale lithography ma-D 331 (NaOH based) for standard lithography</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Resist patterning with Laser Direct Writing

Convex and concave hexagonal lenses, 60 µm diameter*
Test pattern, 63 µm pattern depth*
Pyramids, 10 µm base width, 5 µm height, 45 ° angle**
Fresnel lens, 2 mm diameter, patterned in ma-P 1275G

ma-P 1200G
for greyscale lithography

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

Process flow
Laser Direct Writing
UV-Laser direct writing (dose variation)

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
Thin Film Positive Photoresists in Laser Interference Lithography

<table>
<thead>
<tr>
<th>Resist</th>
<th>mr-P 1201LIL</th>
<th>mr-P 1202LIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Film thickness @ 3000 rpm</td>
<td>µm</td>
<td>0.1</td>
</tr>
<tr>
<td>Spin coating</td>
<td>rpm</td>
<td>3000</td>
</tr>
<tr>
<td>Spectral sensitivity</td>
<td>nm</td>
<td>330 – 450</td>
</tr>
<tr>
<td>Exposure dose @ 405 nm</td>
<td>mJ cm⁻²</td>
<td>15 – 50</td>
</tr>
<tr>
<td>Developer</td>
<td></td>
<td>mr-D 374/S (metal ion bearing, silicate/ phosphate based)</td>
</tr>
</tbody>
</table>

Resist patterning with 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 surface during fabrication of steep-edged nanostructures for diffractive optics:
  - Laminary gratings
  - VLS gratings

Greyscale photoresists in special applications

- mr-P 1200G
  - in laser interference lithography
    - Moth eye patterns for pattern transfer; 10 µm thick ma-P 1275G patterned by Laser Interference Lithography @ 351 nm; 5.6 µm pattern depth
  - mr-P 1200G
    - for very high vertical pattern resolution
      - Si staircase structure for Fabry-Perot µ-interferometers array; 500 nm thick ma-P 1200G resist patterned by Laser Direct Writing @ 405 nm

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