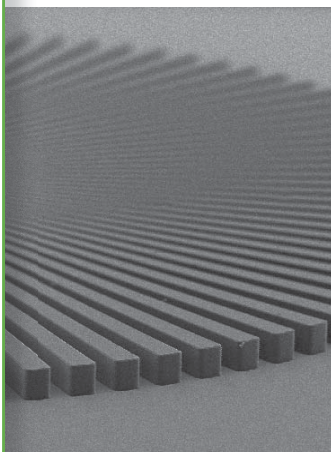


Negative Photoresists for UV & Electron Beam Lithography

micro resist technology

Gesellschaft für chemische Materialien spezieller Photoresistsysteme mbH

Negative Photoresists for UV & Electron Beam Lithography



- ma-N 400
- ma-N 1400
- ma-N 2400
- mr-EBL 6000 and mr-UVL 6000
- EpoCore and EpoClad

Unique features of the negative photoresists

- Different negative photoresists series designed for various applications:
 - conventional pattern transfer
 - lift-off process
 - use as permanent material
- Ready-to-use solutions in a variety of viscosities

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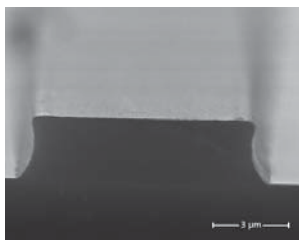


For Conventional Pattern Transfer and Single Layer Lift-Off

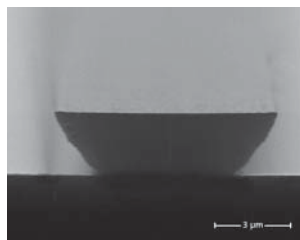
Resist	ma-N 400	ma-N 1400
Spectral sensitivity	300 – 380 nm	300 – 410 nm
Exposure dose @ 365 nm	350 – 1900 mJ/cm ²	300 – 700 mJ/cm ²
Ready-to-use solutions for various film thicknesses @ 3000 rpm	ma-N 405 → 0.5 μm (on request) ma-N 415 → 1.5 μm (on request) ma-N 420 → 2.0 μm (on request) ma-N 440 → 4.1 μm ma-N 490 → 7.5 μm	ma-N 1405 → 0.5 μm ma-N 1407 → 0.7 μm ma-N 1410 → 1.0 μm ma-N 1420 → 2.0 μm ma-N 1440 → 4.0 μm
Thermal stability	up to 110 °C for metal evaporation	up to 160 °C for metal evaporation and sputtering
Developer	ma-D 332/S and ma-D 331/S (NaOH based)	ma-D 533/S (TMAH based)

ma-N 400

Undercut patterns of 2 μm thick ma-N 400



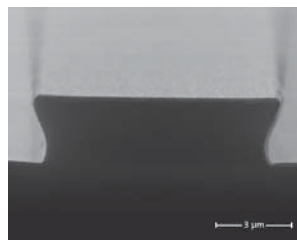
$t_b = 90 \text{ s} \rightarrow$
0 μm undercut



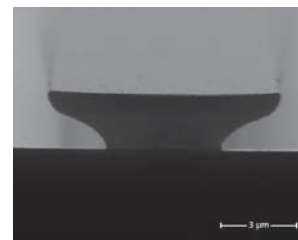
$t_b = 120 \text{ s} \rightarrow$
1.0 μm undercut

ma-N 1400

Undercut patterns of 2 μm thick ma-N 1400



$t_b = 65 \text{ s} \rightarrow$
0.6 μm undercut



$t_b = 100 \text{ s} \rightarrow$
1.7 μm undercut

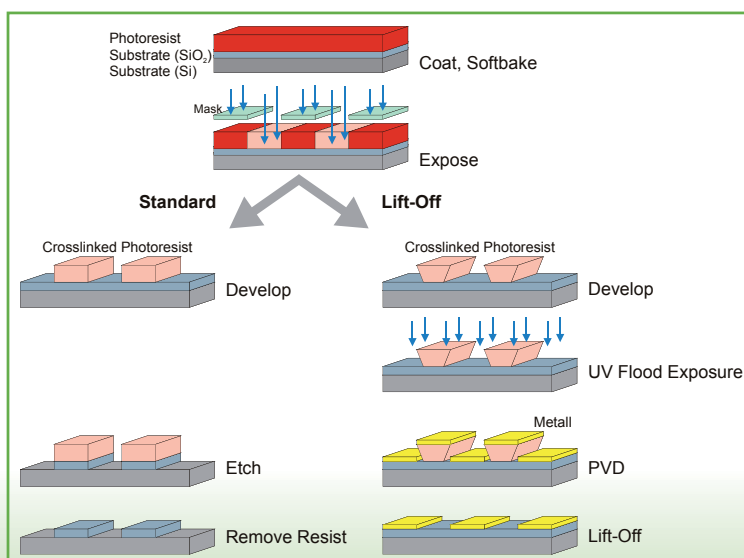
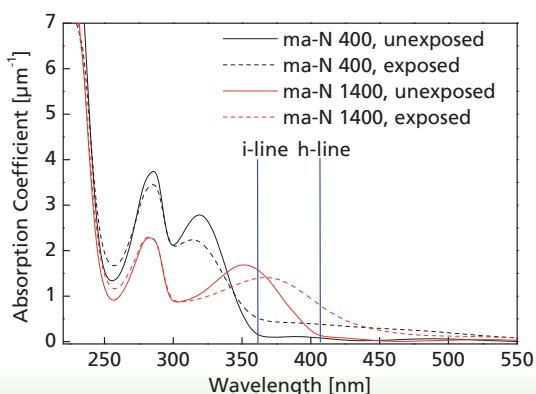
ma-N 400 and ma-N 1400 for conventional pattern transfer, physical vapour deposition (PVD), metal sputtering and lift-off

These two series are mainly used as single layer resist for pattern transfer by PVD and lift-off.

- Tunable pattern profile: vertical to undercut
- Aqueous alkaline development
- Good - excellent thermal pattern stability
- High wet and dry etch resistance
- Easy to remove

Main applications

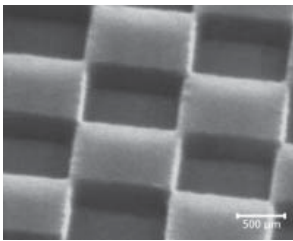
- Microelectronics and micro system technology
- Mask for lift-off processes
- Etch mask for semiconductors and metals



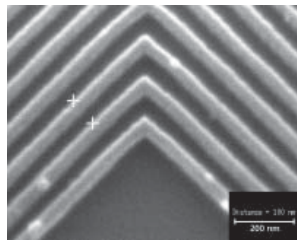
For Thin Film E-Beam, Deep UV or UV Lithography

Resist	ma-N 2400	mr-EBL 6000	mr-UVL 6000
Sensitivity @ 10 keV @ 20 keV @ 50 keV	- 120 – 250 $\mu\text{C}/\text{cm}^2$ 100 – 350 $\mu\text{C}/\text{cm}^2$	2 – 5 $\mu\text{C}/\text{cm}^2$ 4 – 6 $\mu\text{C}/\text{cm}^2$ 20 – 40 $\mu\text{C}/\text{cm}^2$	- - -
Deep UV [248 nm/ 254 nm] UV [300 – 365 nm]	210 – 420 mJ/cm^2 -	- -	400 – 550 mJ/cm^2
Ready-to-use solutions for various film thicknesses @ 3000 rpm	ma-N 2401 → 0.1 μm ma-N 2403 → 0.3 μm ma-N 2405 → 0.5 μm ma-N 2410 → 1.0 μm	mr-EBL 6000.1 → 0.1 μm mr-EBL 6000.3 → 0.3 μm mr-EBL 6000.5 → 0.5 μm	mr-UVL 6000.1 → 0.1 μm mr-UVL 6000.3 → 0.3 μm mr-UVL 6000.5 → 0.5 μm
Developer	ma-D 525 (TMAH based) ma-D 332/ ma-D 331 (NaOH based)	mr-Dev 600 (solvent based)	

ma-N 2400

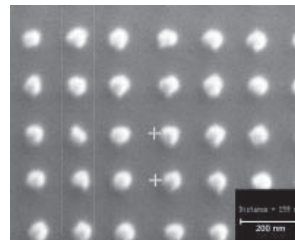


300 nm thick,
chess pattern

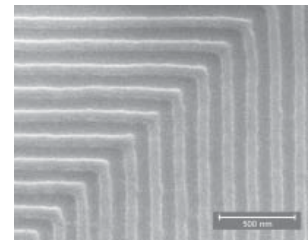


100 nm thick,
50 nm L/S

mr-EBL 6000



100 nm thick,
80 nm dots



100 nm thick,
80 nm L/S

(All pictures - Courtesy of IPMT/Jena and HMI Berlin)

ma-N 2400 and mr-EBL 6000 for pattern transfer

These two series are mainly used for electron beam lithography.

ma-N 2400 e-beam & Deep UV sensitive

- High resolution capability
- Aqueous alkaline development
- Lift-off
- Easy to remove
- Good thermal stability of the resist patterns
- High wet and dry etch resistance

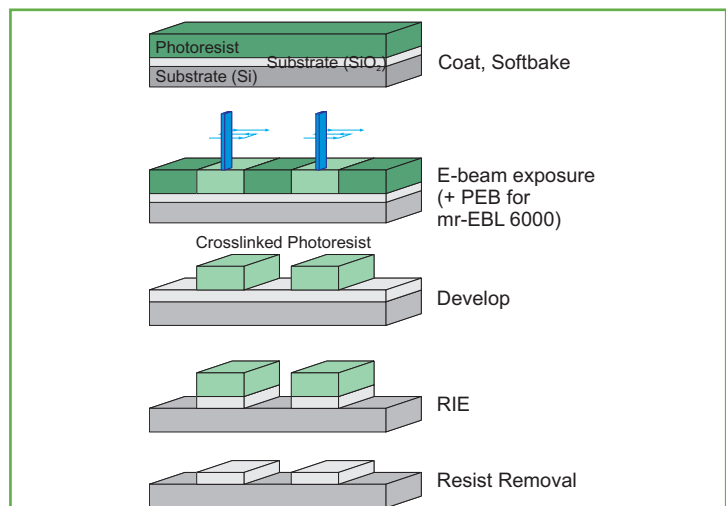
mr-EBL 6000 high e-beam sensitivity

- Excellent thermal stability of the resist patterns
- High dry and wet etch resistance
- High resolution capability
- Post exposure bake (PEB)
- Development in organic solvents

mr-UVL 6000 for pattern transfer

Mainly used for thin layer UV lithography.

- High dry and wet etch resistance
- Excellent thermal stability of the resist patterns
- High resolution capability
- Post exposure bake (PEB)
- Development in organic solvents



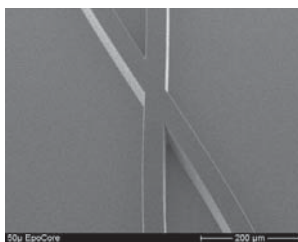
Main applications

- Use in micro- and nanoelectronics
- Manufacturing of semiconductor devices
- Mask for etching, e.g. of Si, SiO₂, Si₃N₄ or metals
- Generation of sub 100 nm pattern
- Generation of stamps with nanopatterns

For Low Optical Loss Standard Application

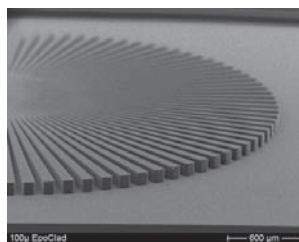
Material	EpoCore	EpoClad
Spectral sensitivity	365 nm	365 nm
Characteristics	optically highly transparent material high viscosity material	flexibilized material, lower refractive index than EpoCore, high viscosity material
Ready-to-use solutions for various film thicknesses	20 – 80 µm	20 – 140 µm
Developer	mr-Dev 600 (solvent based)	
Thermal stability	up to 230 °C	
Shrinkage	< 3 %	

EpoCore

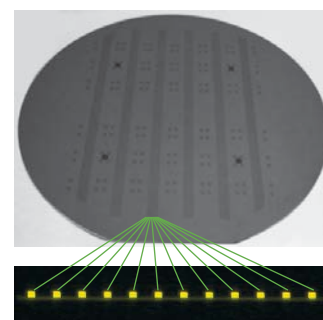


50 µm thick

EpoClad



100 µm thick



EpoCore and EpoClad

for conventional pattern transfer and preparation of polymer waveguides

- UV sensitive negative resist
- Highly transparent to visible light
- Excellent thermal and pressure stability
- High wet and dry etch resistance
- Development in organic solvents

Main applications

- Specifically designed for optical applications in micro system technology
- Optical waveguides: EpoCore as core and EpoClad as cladding material
- Standard FR4 substrates (10 x 10 cm², 8 inch)
- Etch mask

EpoClad, flood exposed
Substrate



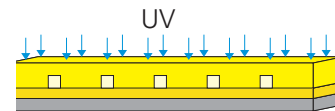
EpoCore



Patterning of EpoCore



EpoClad, flood exposure



Lamination



Properties of prepared polymer waveguides	EpoCore	EpoClad
Refractive index @ 830 nm	1.58	1.57
Optical loss	~0.2 dB/cm @ 850 nm	-
High glass transition temperature	> 180°C	
Excellent stability after lamination	T > 185 °C, pressure 23 kp/cm ² and reflow tests 3 x 15 s @ 230°C, TCT: 240 x -40°C to 120 °C	