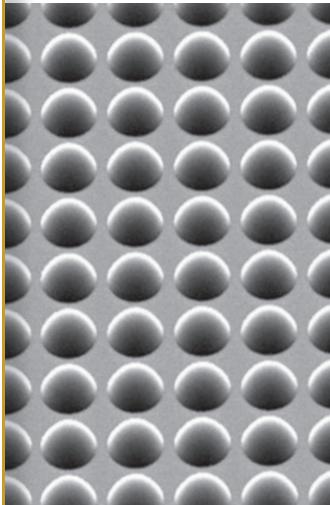


UV-Curable Hybrid Polymers for Micro Optics



Gesellschaft für chemische Materialien spezieller Photoresistsysteme mbH

UV-Curable Hybrid Polymers for Micro Optics



- OrmoComp
- OrmoClear
- OrmoClear10
- OrmoClear30
- OrmoStamp
- OrmoCore
- OrmoClad

Unique features

- Excellent transparency
- Excellent mechanical properties
- High chemical and physical stability
- Excellent pattern transfer fidelity
- Ready-to-use solutions
- Solvent-free

micro resist technology GmbH
Köpenicker Str. 325
12555 Berlin
GERMANY

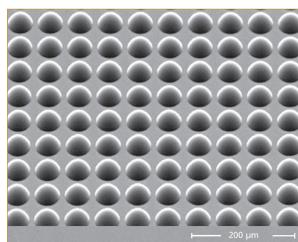
phone +49 30 64 16 70 100
fax +49 30 64 16 70 200
mail sales@microresist.de
info www.microresist.com



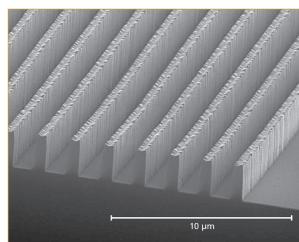
www.microresist.com

OrmoComp and OrmoClear for Micro-Optical Components

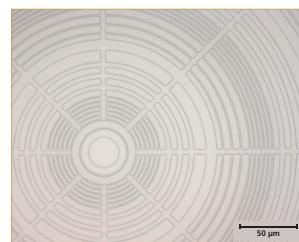
| Properties of cured material | OrmoComp | OrmoClear | OrmoClear10 | OrmoClear30 |
|--|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Thermal behaviour | Duromeric | | | |
| Shrinkage (during curing) by volume | 5 – 7 % | 3 – 5 % | < 2 % | < 2 % |
| CTE (20 – 100 °C) [ppm K ⁻¹] | 60 | 100 – 130 | 130 | 130 |
| Refractive index @ 635 nm @ 810 nm | 1.518 – 1.520 1.512 – 1.513 | 1.553 – 1.554 1.545 – 1.546 | 1.553 – 1.554 1.545 – 1.546 | 1.554 – 1.555 1.546 – 1.547 |
| Layer thickness (3000 rpm 30s) [μm] | | | | |
| Ambient atmosph. UV-exposure | 20 | 15 | 31 | 75 |
| Oxygen free UV-exposure | 20 | 25 | 41 | 85 |



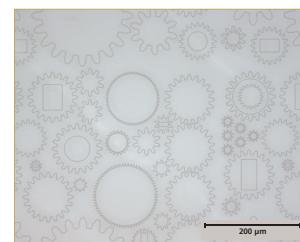
Replicated OrmoComp 10x10 microlens arrays



OrmoComp optical grating
(Courtesy of FSU Jena)



OrmoClear10 circular structures width 1 μm - 10 μm, length up to 120 μm



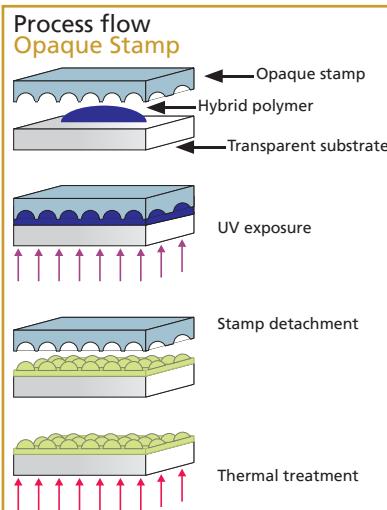
OrmoClear30 gear wheel structures up to 200 μm diameter

OrmoComp - processed by imprinting or UV moulding

- Exposure: i-line, h-line, broadband
- Fast curing
- Highly transparent for near UV and visible light down to 350 nm
- High resolution to sub-100 nm line width
- Water absorption < 0.5 %
- Roughness 2 – 4 nm
- High mechanical and thermal stability
- 6 months shelf life
- Solvent-free

Main applications

- Moulded gratings
- Micro lenses
- Micro lens arrays
- Optical couplers and connectors
- Prism

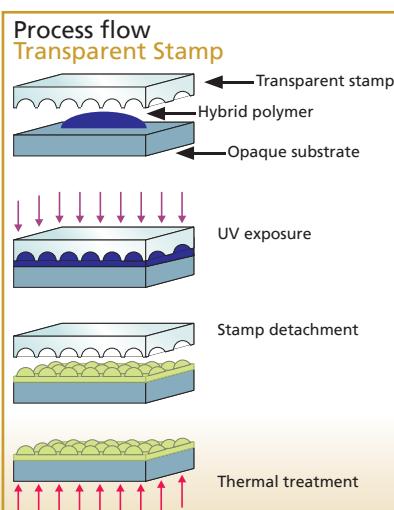


OrmoClear (series) - processed by imprinting or UV moulding

- Exposure: i-line, h-line, broadband
- Fast curing
- Highly transparent for near UV and visible light down to 350 nm and at the datacom and telecom wavelengths
- High mechanical and thermal stability
- The material family covers a structure size range from 1 to 1000 μm
- 6 months shelf life
- Solvent free

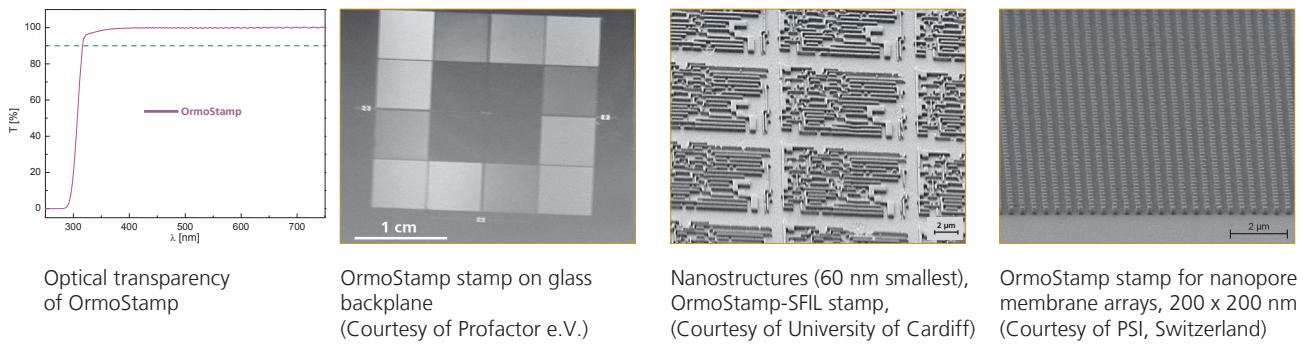
Main applications

- Positioning and mechanical alignment features in one mould
- Single elements or wafer scale
- Micro optical devices



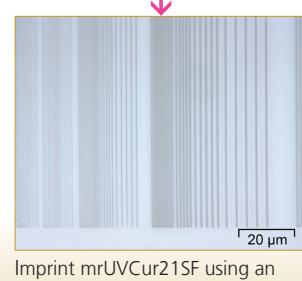
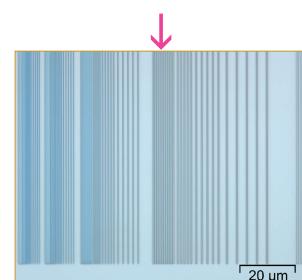
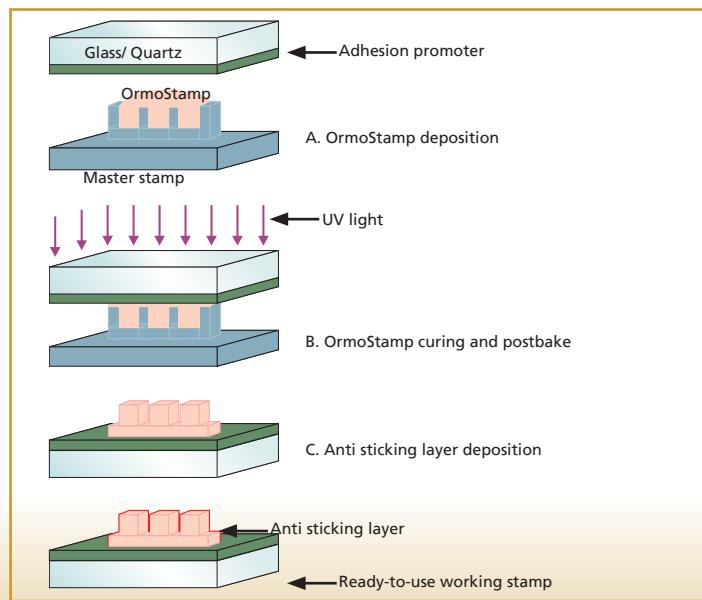
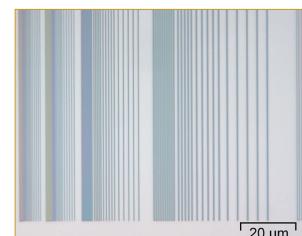
OrmoStamp for Transparent Stamp Fabrication

| Properties of cured material | OrmoStamp |
|--|--------------------------------|
| CTE (20 – 100 °C) [ppm K ⁻¹] | 105 |
| Elasticity modulus | 650 MPa |
| Hardness | 35 MPa |
| Refractive index @ 635 nm @ 810 nm | 1.504 – 1.508 1.500 – 1.503 |



OrmoStamp - processed by UV moulding

- Cost-efficient alternative to quartz stamps
- Excellent fidelity to the master stamp
- Highly transparent for visible light down to 350 nm
- High resolution to sub-100 nm linewidth
- Convenient processing with standard lithography equipment
- High mechanical and thermal stability
- One-step or two-step stamp fabrication



OrmoCore and OrmoClad for Optical Wave Guide Fabrication

| Properties of cured polymer | OrmoCore | OrmoClad |
|--|--------------------------------|--------------------------------|
| Film quality | | Good planarisation properties |
| Water absorption | | < 0.5 % |
| CTE (20 – 100 °C) [ppm K ⁻¹] | | 100 – 130 |
| Rms roughness | | 10 – 15 nm |
| Shrinkage (during curing) | | 2 – 5 % by volume |
| Refractive index @ 635 nm @ 810 nm | 1.552 – 1.553 1.545 – 1.546 | 1.533 – 1.534 1.524 – 1.526 |

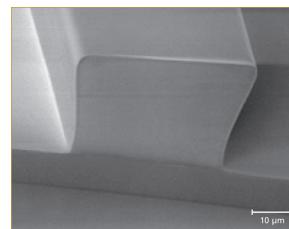
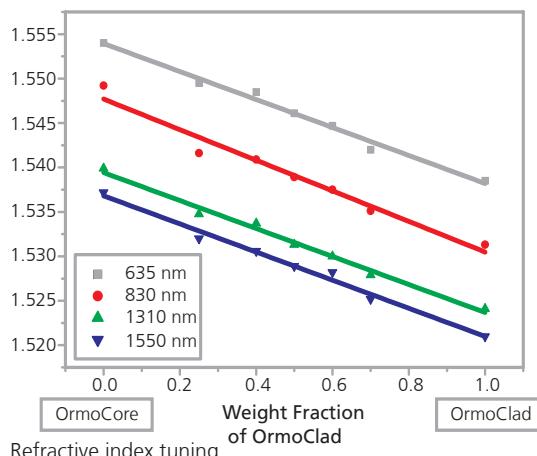
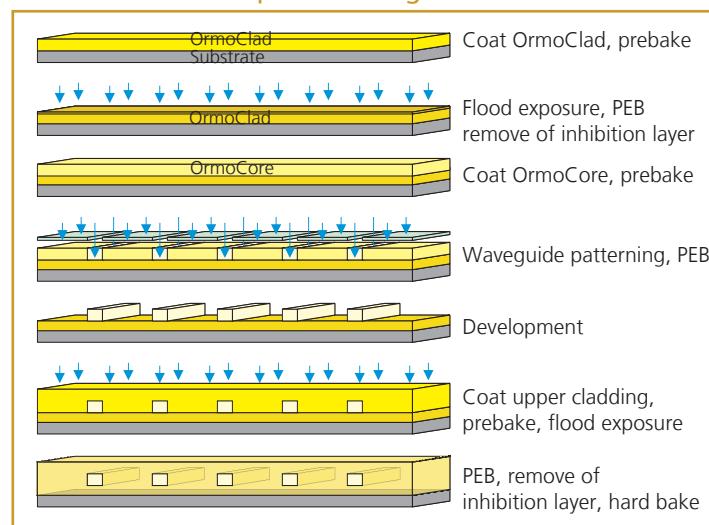
OrmoCore / OrmoClad - conventional lithography or UV moulding

- Exposure: i-line, broadband
- Tunable refractive index (Core/ Clad)
- Low optical loss at datacom wavelengths
- High mechanical and thermal stability
- 6 months shelf life

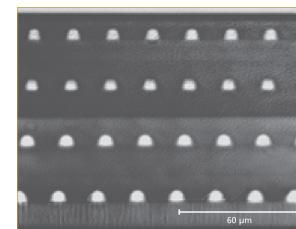
Main applications

- Single-mode wave guides
- Multi-mode wave guides
- Beam splitters
- Thermo-optical switches

Process flow for optical wave guides

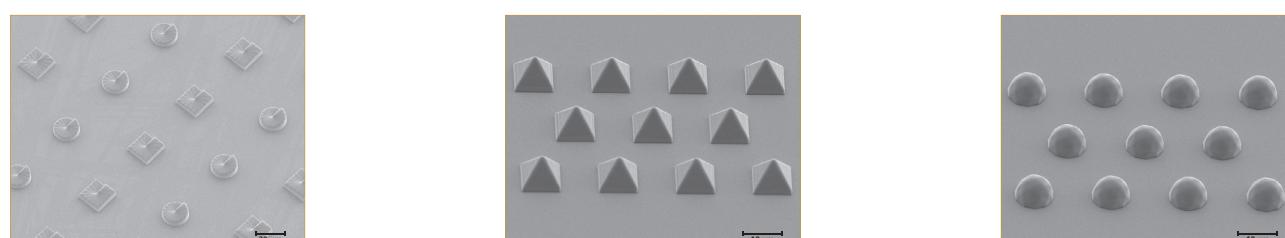


Undercladding/ core of a multimode wave guide on silicon (Courtesy of ACREO)



Multilayer optical fan-out (Courtesy of FHG - IOF/ Jena)

Direct laser writing as an alternative patterning method for OrmoComp



Microstructures made of OrmoComp: directly fabricated with Nanoscribe's 'Photonic Professional' 3D laser lithography system. Form and geometry of the structures can be chosen freely in the two-photon absorption fabrication process. Processing laser wavelength: 780 nm; substrate: glass

(Images courtesy of Nanoscribe GmbH)