UV-Curable Hybrid Polymers for Micro Optical Components

- OrmoComp®
- InkOrmo
- OrmoClear®
- OrmoClear®30
- OrmoClear®FX
- OrmoCore
- OrmoClad
- OrmoStamp®

Unique features
- Excellent transparency
- Excellent mechanical properties
- High chemical and physical stability
- Excellent replication fidelity
- Ready-to-use solutions

- Made in Germany -

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**Product Overview**

- **Material Specifications**

<table>
<thead>
<tr>
<th>OrmoComp®</th>
<th>InkOrmo</th>
<th>OrmoClear®</th>
<th>OrmoClear®30</th>
<th>OrmoClear®FX</th>
<th>OrmoStamp®</th>
<th>OrmoCore</th>
<th>OrmoClad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid material before patterning process</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Solvent-free</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Viscosity [Pa·s]</td>
<td>2.0 ± 0.5</td>
<td>*</td>
<td>2.9 ± 0.3</td>
<td>30 ± 3</td>
<td>1.5 ± 0.3</td>
<td>0.4 ± 0.2</td>
<td>2.9 ± 0.4</td>
</tr>
<tr>
<td>Film thickness upon spin coating [µm]</td>
<td>3000 rpm</td>
<td>10-60</td>
<td>**</td>
<td>30</td>
<td>20 - 95</td>
<td>100</td>
<td>50 - 270</td>
</tr>
<tr>
<td>Spectral sensitivity photo-curing [nm]</td>
<td>300 - 410</td>
<td>* *</td>
<td>300 - 410</td>
<td>300 - 410</td>
<td>300 - 410</td>
<td>300 - 390</td>
<td>300 - 410</td>
</tr>
</tbody>
</table>

- **Hybridpolymer after photo-curing (λ = 365 nm) and hardbake (140 - 160°C)**

| Volume shrinkage [%] | 5 - 7 | 3 - 5 | << 2 | 3 - 5 | 4 - 6 | 2 - 5 | 2 - 5 |
| Refractive Index (589 nm) | 1.520 | 1.555 | 1.561 | 1.555 | 1.516 | 1.555 | 1.537 |
| Abbe number | 47 | 34 | 34 | 34 | 51 | 34 | 33 |
| dn/dT (10-4/K) | -2.0 | -2.1 | -2.3 | -2.7 | -1.5 | -2.2 | -2.7 |
| CTE (20-150 °C) [ppm/K] | 150 | 150 | 150 | 150 | 140 | 150 | 150 |
| Young’s modulus [GPa] | ~1 | ~1.2 | n.d. | ~0.8 | n.d. | ~0.6 | ~1 | ~0.5 |
| Hardness (by indentation) [MPa] | ~68 | ~60 | ~90 | n.d. | ~36 | ~53 | ~24 |

- **Applications**

<table>
<thead>
<tr>
<th>Selection Guide</th>
<th>OrmoComp®</th>
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<th>OrmoCore</th>
<th>OrmoClad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Compatibility</td>
<td>Photolithography (mask-lithography)</td>
<td>UV molding</td>
<td>Nano-imprinting</td>
<td>Direct laser writing, TPA</td>
<td>Ink-jet dispensing</td>
<td>Roll-to-roll / Roll-to-plate processing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preferred Applications</td>
<td>Microarrays, gratings, prisms, DOEs</td>
<td>Waveguiding</td>
<td>Bio applications, lab-on-chip, microfluidics</td>
<td>Replication with hard molds (quartz, Ni etc.)</td>
<td>Replication with PDMS molds (no oxygen sensitivity)</td>
<td>Working stamp fabrication (e.g. for NIL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material Compatibility</td>
<td>Si and SiO₂ substrates</td>
<td>Plastic substrates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Main Features and Optical Properties**

  - UV lithography and UV molding
  - Two-photon absorption (TPA) fabrication (OrmoComp® only)
  - High resolution down to 100 nm feature size
  - Highly transparent for VIS and near UV down to 350 nm
  - High thermal stability up to 300 °C (short term), 270 °C (long term)
  - High mechanical stability
OrmoStamp® for Transparent Polymer Working Stamps

Main Applications - Stamp Fabrication
- Transparent working stamp fabrication
- (Nano)Imprint processes
- Cost efficient alternative to quartz stamps

Main Features - Stamp Fabrication
- For UV-based and thermal imprinting
- Highly transparent for near UV and visible light
- Excellent pattern replication
- High mechanical stability
- Thermal stability up to 270 °C (short term)
- Enhanced anti-adhesive properties for low release forces

OrmoCore and OrmoClad for Optical Waveguide Fabrication

Main Applications - Optical Waveguides
- Single-mode waveguides
- Multi-mode waveguides
- Beam splitters
- Thermo-optical switches
- Microring resonators

Main Features - Optical Waveguides
- UV lithography and UV moulding
- Low optical loss at datacom wavelengths
- Tunable refractive index (Core/Clad ratios)
- High resolution down to 100 nm feature size
- Thermal stability up to 270 °C (short term)
- High mechanical stability

Ancillaries

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Ancillary</th>
<th>Features</th>
</tr>
</thead>
</table>
| Adhesion Promoter | OrmoPrime08 | - Recommended for various substrates like Si, glass, and quartz
| | | - Ready-to-use solution for spin coating
| | | - Film thickness 130 nm
| Dilution of Hybrid Polymers * | OrmoThin ma-T 1050 | Dilution for d > 0.5 µm (product-dependent) *
| | | Dilution for d < 0.5 µm (product-dependent) *
| Developer | OrmoDev | - Removal of uncured material (e.g. after mask lithography was applied)
| | | - Immersion development

* For details of dilution ratios see corresponding processing guidelines