**DOWSIL™ Silicone NIL (Nano-Imprinting Lithography) mold materials**

**The unique properties of silicones**

![Silicone molecule diagram](image)

- Molecular characteristics
  - Highly open, flexible and mobile backbone
  - High bond strength: 435 kJmol⁻¹ Si-O, cf. 350 kJmol⁻¹ C-C

- Physico-chemical properties
  - Low surface tension and energy
  - High spreading and wetting capabilities
  - Permeable to gas and water vapour
  - Heat stability
  - Degradability
  - Compatibility with organics
  - Weather resistance
  - Low glass transition temp.

- Applications
  - Lubricant
  - Antifoam agent
  - Release agent
  - Aesthetic feel (softness)
  - Comfort
  - High temperature processing
  - Can be sterilized
  - Hydrophobic / hydrophilic
  - Breathable

**Nanoimprint process (heat or UV cure)**

1. Spin coat
2. Imprint
3. Cure (heat or UV)
4. Demoulding
5. Pattern replicated
Silicone-Based NIL Mold: s-PDMS

**Soft-PDMS (s-PDMS)**
- Sylgard 184: control
- High modulus SG184: 5, 10, 15 MPa
- Viscosity range: 1,000 to 5,000 cP
- Two-part solution (shelf-life: > 2 year at RT)
- One-part solution (shelf-life: > 6month/ 3-5°C)
- Low-temperature heat cure: 70 – 80°C

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Hardness (Shore A)</th>
<th>Young modulus (MPa)</th>
<th>Tensile (psi)</th>
<th>Elongation% Average</th>
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<td>SG184</td>
<td>50</td>
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Silicone-Based NIL Mold: h-PDMS

**UV-curable h-PDMS (hard-PDMS)**
- Fluro-silicone composition for facile demolding
- High modulus (> 30MPa) / hardness (> 3H)
- Solvent-free composition
- Viscosity: 50-500 cP
- Fast UV-cure at RT (< 5 seconds)
- Uniform liquid film by spin-coating, or spray coating

UV-cure low-viscosity silicone for NIL

Enabling large patterning at low pressure

<table>
<thead>
<tr>
<th>UV-cure</th>
<th>Cured resin</th>
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<tbody>
<tr>
<td>UV-broadband at RT</td>
<td>Modulus*: 0.3-2.18 GPa</td>
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<td>UV dosage: &lt;0.5 J/cm²</td>
<td>Hardness*: 0.05-0.15 GPa</td>
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<td>Cure time: &lt;3 second</td>
<td>Shrinkage &lt; 3%</td>
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<td>UV transmittance &gt; 90%</td>
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Dow offering

**NIL mold material solutions**
- S-PDMS
  - Low-T heat cure
- H-PDMS
  - UV-cure
- Other Silicone materials

**Customized solution**