Shin-Etsu can provide a number of products suitable for modification of various types of acrylic resins, including water-based, solvent-based and UV-cure products. These function in various ways and can be used to improve durability (by improving adhesion to substrates, light resistance and heat resistance), for surface modification (e.g. by imparting water repellency and increasing hardness), or for reducing viscosity or increasing fill factor (by improving dispersion of fillers).

**Inorganic – Organic Coupling Agent (Alkoxyl groups + Acrylic groups)**

**KBM-5103, KBM-503 Monomer Type**

- **Features & Benefits**
  - **Features**
    - High reactive activity (especially the acrylics)
  - **Benefits**
    - Higher strength and durability through improved adhesion

**KBM-5803 Long-chain Spacer Type**

- **Features & Benefits**
  - **Features**
    - Functionality and chain length (C8)
  - **Benefits**
    - Improved hydrophobicity
    - Improved flexibility

**X-12-1048, X-12-1050 Polymer type**

- **Features & Benefits**
  - **Features**
    - High number of functional groups, good reactivity
    - High number of functional groups
    - Low volatility
    - Film forming property
    - Main chain of organic group
  - **Benefits**
    - Improved durability
    - Improved surface hardness
    - Active ingredient functions even at high temp.
    - Also works well as a primer
    - Excellent compatibility

**KR-513 Siloxane type**

- **Features & Benefits**
  - **Features**
    - High number of functional groups, good reactivity
    - Low volatility
    - Main chain of siloxane skeleton
  - **Benefits**
    - Higher strength and durability through improved adhesion
    - Good reaction stability
    - Durable against heat & light

**Related materials (siloxane+acrylic groups)**

**X-12-2475 Siloxane Type**

- **Features & Benefits**
  - **Features**
    - High number of functional groups
    - Main chain of siloxane skeleton
  - **Benefits**
    - High hardness
    - Durable against heat & light

**X-12-2430C Fluorine Contained Type**

- **Features & Benefits**
  - **Features**
    - Main chain of siloxane skeleton
    - High number of functional groups
    - Fluorine content
  - **Benefits**
    - Durable against heat & light
    - High hardness
    - Imparting anti-stain properties
    - Imparting water and oil repellency

**Comparison with other radically reactive silane coupling agents**

<table>
<thead>
<tr>
<th>R (Functional groups)</th>
<th>Minimum curing dose (Mrad)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vinyl</td>
<td>&gt;10</td>
</tr>
<tr>
<td>Methacryloxy</td>
<td>5</td>
</tr>
<tr>
<td>Acrylic</td>
<td>2</td>
</tr>
</tbody>
</table>

*Silanes having alkoxyl groups require smaller doses to cure completely than those with vinyl or methacryloxy groups, which is an indication of their exceptionally high radical reactivity.

**Comparison of inorganic filler dispersion (compared with C3 type)**

<table>
<thead>
<tr>
<th>Product name</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>KBM-5803</td>
<td>[Image]</td>
</tr>
</tbody>
</table>

*Tuff KBM-5803 by improving dispersibility, transparency and improved Formulation: Same treated silica 15% (SWP:hydrophobic components 50%wt%)*

**Reaction mechanism of dual cure (UV cure / moisture cure) material**

- **Parameter**
  - Product name: X-12-1050
  - Pencil hardness: >3H
  - Taber abrasion test (Steel, 500g, 100 rotations): 2.7

**Comparison data of volatility with monomer type**

<table>
<thead>
<tr>
<th>Product name</th>
<th>Volatile content</th>
</tr>
</thead>
<tbody>
<tr>
<td>KR-513</td>
<td>105°C&lt;3h</td>
</tr>
<tr>
<td>KBM-5103</td>
<td>150°C&lt;3h</td>
</tr>
<tr>
<td>KBM-5103</td>
<td>180°C&lt;3h</td>
</tr>
</tbody>
</table>

**Test result of higher hardness**

<table>
<thead>
<tr>
<th>Product name</th>
<th>Pencil hardness</th>
<th>Taber abrasion test (steel, 500g, 100 rotations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-12-2475</td>
<td>3H</td>
<td>2.5</td>
</tr>
<tr>
<td>X-12-2430C</td>
<td>2H</td>
<td>3.0</td>
</tr>
<tr>
<td>Blank</td>
<td>H</td>
<td>4.5</td>
</tr>
</tbody>
</table>
Shin-Etsu manufactures a range of products suitable for modification of epoxy resins used for coating, molding and other applications. These function in various ways and can be used to improve adhesion to substrates, improve durability (through improved light and heat resistance), and improve mechanical properties (e.g. by reducing cure shrinkage and relieving stress), and for reducing viscosity or increasing fill factor (by improving dispersion of fillers).

### Inorganic – Organic Coupling Agent (Alkox groups + Epoxy groups)

**KBM-303, KBM-403 Monomer Type**

- **Features & Benefits**
  - Higher strength and durability through improved adhesion

**KBM-4803 Long-chain Spacer Type**

- **Features & Benefits**
  - Improved dispersion of inorganic fillers (enables lower viscosity, higher fill factors)
  - Imparting water and alkali resistance
  - Imparting flexibility

**X-12-9815, X-12-9845 Polymer type**

- **Features & Benefits**
  - Excellent compatibility
  - Durable against heat & light

**KR-516, KR-517 Siloxane type**

- **Features & Benefits**
  - Good reaction stability

**KR-480 High phenyl resin**

- **Features & Benefits**
  - Excellent compatibility
  - Durable against heat & light
  - Imparting flame retardancy
  - Imparting stress relaxation

**KR-480 + epoxy modification**

- **Features & Benefits**
  - Silicone skeleton is incorporated into the epoxy as it reacts with KR-480.

Contact to: Sales and Marketing Department. II Phone: +81-(0)3-3246-5131
Silicones for Resin Modification

Silicones for improving crack & abrasion resistance of UV-cure acrylic resins (Under development)

- **Chemical structure**
  - Special structure is imparted.

- **Features and benefits**
  - **Features** | **Benefits**
    - Special structure | Excellent bend resistance without sacrificing hardness
    - Siloxane structure | Excellent heat and light resistance Excellent transparency
    - Acrylic x Siloxane structure | Excellent compatibility with organic resin and silicone resin

- **Comparison of physical properties mixed with DPHA (0.6mm film)**
  - Blend ratio on new modifier
  - 0% 20% 30% 40% 50% 60%
  - DPHA=Di-Pentaerythritol Hexa Acrylate

Silicones Containing Alicyclic Epoxy Groups

- **X-40-2669**
  - **Chemical structure**
  - **Features and benefits**
    - **Features** | **Benefits**
      - Alicyclic epoxy groups | High reactivity, high Tg
      - Siloxane structure | Heat and light resistance
      - Straight chain siloxane structure | With low surface tension, excellent leveling property and wettability
      - Low viscosity | Can be used as a reactive diluent.
      - Oligomer structure | Low out gas
  - **Viscosity when used to dilute hydrogenated epoxy (Santol ST-3000°)**
    - Mix ratio wt% | 100 | 50 | 20 | Turbidity (scattering)
    - X-40-2669 | 45 | 230 | 980 | 33
    - Alicyclic epoxy | 260 | 650 | 1,500 | 47
  - *Made by Toto Kasei Co., Ltd.*
  - (Not specified values)

- **KR-470**
  - **Chemical structure**
  - **Features and benefits**
    - **Features** | **Benefits**
      - Alicyclic epoxy groups | High reactivity, high Tg
      - Siloxane skeleton | Heat and light resistance
      - Cyclic siloxane structure | Low cure shrinkage
      - Single structure | Excellent compatibility, reactions are easy to control.

For improving adhesiveness & shelf life of urethane adhesives

- **X-12-1056ES, X-12-1172ES**
  - **Chemical structure**
    - X-12-1056ES
      - (MeO)3Si
    - X-12-1172ES
      - (EtO)3Si
  - **Features and benefits**
    - **Features** | **Benefits**
      - Functional groups are protected. | Improves stability of compositions (epoxy, acrylic and isocyanate)
      - Hydrolyzable silyl groups | Improved adhesion
      - Mercapto groups are protected (X-12-1056ES) | Reduced odor
  - **Lap-shear strength test result**
    - **Chemical structure**
      - X-12-1056ES
        - (MeO)3Si
      - X-12-1172ES
        - (EtO)3Si
    - **Compounds**
      - Urethane polymer containing NCO--------100part
      - Plasticizer---------------40part
      - Fillers-------------------100part
      - Catalysts-------------------0.1part
      - Silane coupling agents-----1.0part
    - **Curing conditions**
      - 23°C/50%RH × 3days
    - **Substrate**
      - Glass

Contact to Sales and Marketing Department II Phone: +81-(0)3-3246-6131
Shin-Etsu has developed a unique line of silicone powders which fall into three categories: Hybrid Silicone Powder, Silicone Resin Powder and Silicone Rubber Powder.

**Enhanced Properties**

**Stress Relaxation • Impact Resistance**
- No additive
- Silicone rubber & hybrid silicone powder added

- Broken
- Silicone rubber & hybrid silicone powder absorbs the pressure of impact and reduces the noise.

**Lubricity • Wear Resistance**
- Silicone resin powder
- Hybrid silicone powder
- Resin powder
- Rubber powder

**Soft-feel Property**
- Silicone rubber powder
- Hybrid silicone powder
- Resin powder
- Rubber powder

**Light Diffusion Property**
- Silicone resin powder
- Hybrid silicone powder
- Resin powder
- Rubber powder

*There are also aqueous dispersion of silicone rubber power.

**General Properties**

<table>
<thead>
<tr>
<th>Type</th>
<th>Parameter</th>
<th>Product name</th>
<th>Shape</th>
<th>Average particle size μm</th>
<th>Particle size distribution μm</th>
<th>True specific gravity</th>
<th>Moisture content %</th>
<th>Rubber hardness</th>
<th>Refractive index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid silicone powder</td>
<td>KMP-600</td>
<td>Spherical</td>
<td>5</td>
<td>1–15</td>
<td>0.99</td>
<td>0.1</td>
<td>30</td>
<td>3.0</td>
<td>1.41</td>
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<tr>
<td></td>
<td>KMP-601</td>
<td>Spherical</td>
<td>12</td>
<td>2–22</td>
<td>0.98</td>
<td>0.1</td>
<td>30</td>
<td>1.41</td>
<td>1.43</td>
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<tr>
<td></td>
<td>KMP-602</td>
<td>Spherical</td>
<td>30</td>
<td>4–60</td>
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<td>0.1</td>
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<td>1.43</td>
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<tr>
<td></td>
<td>KMP-605</td>
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<td>0.37–5</td>
<td>0.99</td>
<td>0.1</td>
<td>75</td>
<td>1.42</td>
<td>1.43</td>
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<tr>
<td></td>
<td>KMP-706</td>
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<td>0.2–2</td>
<td>1.01</td>
<td>1</td>
<td>75</td>
<td>1.42</td>
<td>1.43</td>
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<td></td>
<td>KMP-707</td>
<td>Spherical</td>
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<td>1–4</td>
<td>1.3</td>
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<td></td>
<td></td>
<td>1.43</td>
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<tr>
<td></td>
<td>KMP-708</td>
<td>Spherical</td>
<td>4.5</td>
<td>1–6</td>
<td>1.3</td>
<td>1</td>
<td></td>
<td></td>
<td>1.43</td>
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<tr>
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<td>KMP-709</td>
<td>Spherical</td>
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<tr>
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<td>Spherical</td>
<td>0.7</td>
<td>0.2–5</td>
<td>1.3</td>
<td>1</td>
<td></td>
<td></td>
<td>1.43</td>
</tr>
<tr>
<td></td>
<td>KMP-597</td>
<td>Spherical</td>
<td>5</td>
<td>1–10</td>
<td>0.97</td>
<td>0.1</td>
<td>30</td>
<td>1.41</td>
<td>1.43</td>
</tr>
<tr>
<td></td>
<td>KMP-598</td>
<td>Spherical</td>
<td>13</td>
<td>2–30</td>
<td>0.97</td>
<td>0.1</td>
<td>30</td>
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<td>1.43</td>
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<tr>
<td></td>
<td>KMP-875</td>
<td>Association</td>
<td>30</td>
<td>1–100</td>
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<td>1.41</td>
<td>1.43</td>
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<td>KMP-979</td>
<td>Emulsification</td>
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<tr>
<td></td>
<td>KMP-1133</td>
<td>Emulsification</td>
<td>5</td>
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<td>Not specified</td>
<td>0</td>
<td></td>
<td></td>
<td>1.43</td>
</tr>
</tbody>
</table>

*Hybrid silicone powder, Silicone resin powder, Silicone rubber powder

* + + : Excellent  + : Good  ± : Satisfactory  – : Poor

(A not specified values)

**Product Data**

<table>
<thead>
<tr>
<th>Hybrid silicone powder</th>
<th>KMP-600 Particle size distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Particle size distribution μm</td>
</tr>
<tr>
<td></td>
<td>(Weight changes vs. temperatures)</td>
</tr>
<tr>
<td></td>
<td>(Not specified values)</td>
</tr>
<tr>
<td></td>
<td>Temperature(℃)</td>
</tr>
<tr>
<td></td>
<td>Weight Change (%)</td>
</tr>
<tr>
<td></td>
<td>Relative change (%)</td>
</tr>
<tr>
<td></td>
<td>Data of temperature increase: 1℃/min, Atmosphere: Air</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Silicone resin powder</th>
<th>KMP-706 Particle size distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Particle size distribution μm</td>
</tr>
<tr>
<td></td>
<td>(Weight changes vs. temperatures)</td>
</tr>
<tr>
<td></td>
<td>(Not specified values)</td>
</tr>
<tr>
<td></td>
<td>Temperature(℃)</td>
</tr>
<tr>
<td></td>
<td>Weight Change (%)</td>
</tr>
<tr>
<td></td>
<td>Relative change (%)</td>
</tr>
<tr>
<td></td>
<td>Data of temperature increase: 1℃/min, Atmosphere: Air</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Silicone rubber powder</th>
<th>KMP-597 Particle size distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Particle size distribution μm</td>
</tr>
<tr>
<td></td>
<td>(Weight changes vs. temperatures)</td>
</tr>
<tr>
<td></td>
<td>(Not specified values)</td>
</tr>
<tr>
<td></td>
<td>Temperature(℃)</td>
</tr>
<tr>
<td></td>
<td>Weight Change (%)</td>
</tr>
<tr>
<td></td>
<td>Relative change (%)</td>
</tr>
<tr>
<td></td>
<td>Data of temperature increase: 1℃/min, Atmosphere: Air</td>
</tr>
</tbody>
</table>

**Dispersibility**

Dispersibility in liquid epoxy resin

**Contact to:** Sales and Marketing Department | Phone: +81-(0)3-3246-5132

5
Modified Silicone Fluids which bind various reactive groups exhibit a variety of properties by reacting with organic resin.

### Enhanced properties
- Heat resistant
- Cold resistant
- Weather resistant
- Impact resistant
- Flexibility

### Reactive groups

<table>
<thead>
<tr>
<th>Types of resins</th>
<th>Thermoset resin</th>
<th>Thermoplastic resin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive groups</td>
<td>Polyurethane</td>
<td>Epoxy</td>
</tr>
<tr>
<td>Amino groups</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Epoxy groups</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Hydroxy groups</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Methacryl groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carboxyl groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mercapto groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acidanhydride groups</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Resin Compounds
- Single-end reactive silicone fluids
  - Lubricating property
  - Release property
- Dual-end reactive silicone fluids
  - Wear resistant
  - Water repellent
- Block copolymer
  - Enhanced properties
- Graft copolymer

### Silicone Master Pellets

By blending few amounts of Silicone Master Pellets with resin, it is easy to obtain a compound in which the silicone is evenly dispersed.

- Lubricating property, Release property
- Anti-blocking property, Impact resistant
- Stress relaxation, Coloring property

### Table

<table>
<thead>
<tr>
<th>Product name</th>
<th>Resin</th>
<th>Silicone content %</th>
<th>MFRg / 10mins</th>
<th>MFR Test condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-22-2101</td>
<td>Homo Polypropylene</td>
<td>50</td>
<td>33</td>
<td>210°C / 2.16kg</td>
</tr>
<tr>
<td>X-22-2125H</td>
<td>Low density polyethylene</td>
<td>50</td>
<td>20</td>
<td>190°C / 2.16kg</td>
</tr>
<tr>
<td>X-22-2138B</td>
<td>Ethylene vinylacetate copolymer</td>
<td>40</td>
<td>5</td>
<td>190°C / 2.16kg</td>
</tr>
<tr>
<td>X-22-2102</td>
<td>Polycetal</td>
<td>40</td>
<td>55</td>
<td>190°C / 2.16kg</td>
</tr>
<tr>
<td>X-22-2184-30</td>
<td>ABS</td>
<td>30</td>
<td>45</td>
<td>220°C / 2.16kg</td>
</tr>
</tbody>
</table>

(Not specified values)

---

Contact to: Sales and Marketing Department | Phone: +81-(0)3-3246-5132

We can discuss the Silicone formulation with your preferred resin. Please do not hesitate to contact us.
Silicone Rubber for LIMS with Transparency

KE-2061 Series

KE-2061 Series can be applied to a wide range of molding products as it improved the transparency and yellowing of conventional transparent LIMS grade, and has a lineup from low to high hardness.

Features

Hardness A wide range of hardness (Durometer A) between 30 and 90.

Heat resistance Small changes in transparency due to heat.

Optical properties Change in hardness doesn't affect light transmittance and refraction.

General properties

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness Durometer A</td>
<td>30</td>
<td>39</td>
<td>50</td>
<td>59</td>
<td>70</td>
<td>79</td>
<td>86</td>
</tr>
<tr>
<td>Light transmittance</td>
<td>95%</td>
<td>95%</td>
<td>95%</td>
<td>95%</td>
<td>95%</td>
<td>95%</td>
<td>95%</td>
</tr>
<tr>
<td>Haze value</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Density 23°C g/cm³</td>
<td>1.02</td>
<td>1.03</td>
<td>1.03</td>
<td>1.04</td>
<td>1.05</td>
<td>1.07</td>
<td>1.08</td>
</tr>
<tr>
<td>Tensile strength MPa</td>
<td>3.5</td>
<td>5.2</td>
<td>6.3</td>
<td>7.3</td>
<td>11.0</td>
<td>11.4</td>
<td>6.0</td>
</tr>
<tr>
<td>Elongation at break</td>
<td>350</td>
<td>300</td>
<td>230</td>
<td>180</td>
<td>98</td>
<td>78</td>
<td>40</td>
</tr>
<tr>
<td>Tear strength kN/m</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>9</td>
<td>10</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>

(Not specified values)

Contact to: Sales and Marketing Department Phone: +81-(0)3-3246-5151
The silicone rubbers in the KE-501EM-U and KE-5550-U Series provide vibration dampening for automotive applications and perform well over a wide range of temperatures.

**Features**
- Excellent heat resistance, cold resistance and weather resistance.
- Consistent vibration dampening properties at both high and low temperatures.

**Applications**
- Muffler hangers, Engine mounts, Suspension bushes

**General properties**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>KE-501EM-U</th>
<th>KE-5550-U</th>
<th>KE-551-U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Low dynamic magnification</td>
<td>High decrement</td>
<td>For general purpose</td>
</tr>
<tr>
<td>Density</td>
<td>g/cm³</td>
<td>1.10</td>
<td>1.25</td>
</tr>
<tr>
<td>Hardness</td>
<td>Durometer A</td>
<td>53</td>
<td>50</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>MPa</td>
<td>8.3</td>
<td>9.0</td>
</tr>
<tr>
<td>Elongation at break</td>
<td>%</td>
<td>550</td>
<td>710</td>
</tr>
<tr>
<td>Tear strength</td>
<td>Crescent</td>
<td>28</td>
<td>35</td>
</tr>
<tr>
<td>Rebound resilience</td>
<td>%</td>
<td>74</td>
<td>21</td>
</tr>
<tr>
<td>Viscelasticity</td>
<td>(Temperature: Room temperature / Frequency: 30Hz / Displacement: 400µm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elastic modulus E'</td>
<td>MPa</td>
<td>4.22</td>
<td>5.67</td>
</tr>
<tr>
<td>tan δ</td>
<td></td>
<td>0.07</td>
<td>0.39</td>
</tr>
<tr>
<td>Dynamic magnification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E' at 0.1Hz, 400µm</td>
<td>MPa</td>
<td>3.66</td>
<td>4.07</td>
</tr>
<tr>
<td>E' at 100Hz, 50µm</td>
<td>MPa</td>
<td>4.56</td>
<td>11.41</td>
</tr>
<tr>
<td>Dynamic magnification : E'/0.1</td>
<td></td>
<td>1.25</td>
<td>2.80</td>
</tr>
<tr>
<td>Curing agent</td>
<td></td>
<td>C-15/1.5 phr</td>
<td>C-8/2.0 phr</td>
</tr>
</tbody>
</table>

Curing condition: Press cure 165°C × 10min + Post cure 200°C × 4h (Not specified values)

**Viscoelasticity**

![Viscoelasticity Graph](image-url)
Features

- **Rapid cure**: UV-cure system means the potential for shorter tack time and a heating-free workflow
- **Good adhesion**: Adheres strongly to many substrate materials
- **Low water vapor permeability**
- **Low low-molecular-weight siloxane**

Applications

- For protecting electrodes against corrosion, dielectric coatings, lens fastening, display fastening

General properties

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SMP-7004-3S</th>
<th>SMP-7014-3S</th>
<th>SMP-7015-3S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>Coating</td>
<td>Adhesion</td>
<td>Adhesion</td>
</tr>
<tr>
<td>Reaction type</td>
<td>Radical</td>
<td>Radical</td>
<td>Radical</td>
</tr>
<tr>
<td>Appearance</td>
<td>Yellow transparent</td>
<td>Yellow slightly cloudy</td>
<td>Yellow slightly cloudy</td>
</tr>
<tr>
<td>Viscosity (Stirred viscosity)</td>
<td>mPa.s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended curing conditions</td>
<td>UV light source</td>
<td>Estimated light intensity</td>
<td>mJ/cm²</td>
</tr>
<tr>
<td>Modulus of elasticity</td>
<td>MPa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensile strength</td>
<td>MPa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elongation at break</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water vapor permeability 40°C×24h (t=0.8mm)</td>
<td>g/m²</td>
<td>9.90</td>
<td>4.00</td>
</tr>
<tr>
<td>Applicability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED-UV (366nm)</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Atmospheric air cure</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Die shear strength test

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SMP-7004-3S</th>
<th>SMP-7014-3S</th>
<th>SMP-7015-3S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Die shear</td>
<td>Glass substrate / Glass column</td>
<td>18.6</td>
<td>19.1</td>
</tr>
<tr>
<td>PET substrate / Glass column</td>
<td>MPa</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Curing conditions*</td>
<td>UV light source</td>
<td>Metal halide lamp (33mW)</td>
<td></td>
</tr>
<tr>
<td>Estimated light intensity</td>
<td>mJ/cm²</td>
<td>2,000</td>
<td></td>
</tr>
</tbody>
</table>

*Opened to the atmosphere under room temperature

Test piece preparation method

1) 15 mg of each product was applied to the substrate.
2) Cylinders were pressed down using finger.
3) Product was UV-cured with a metal halide lamp while left exposed to air.
4) Die shear strength was measured.

Reliability test data SMP-7014-3S

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Initial</th>
<th>Leaving under high temperature</th>
<th>Temperature and Humidity Controlled Test</th>
<th>Heat cycle test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Die shear</td>
<td></td>
<td></td>
<td>150°C×500 h</td>
<td>60°C/90%RH×500h</td>
</tr>
<tr>
<td>Glass substrate / Aluminum column</td>
<td>MPa</td>
<td>9.1</td>
<td>20.3*</td>
<td>10.3</td>
</tr>
<tr>
<td>Aluminum substrate / Glass column</td>
<td>MPa</td>
<td>9.1</td>
<td>20.0</td>
<td>17.3</td>
</tr>
<tr>
<td>SUS304 substrate / Glass column</td>
<td>MPa</td>
<td>7.6</td>
<td>20.3*</td>
<td>18.1</td>
</tr>
</tbody>
</table>

*Limit of measurement

Contact to-- Sales and Marketing Department Phone: +81-(0)-3-3246-5152
UV Cure Silicone Rubbers for Optical Bonding
KER-4530 / KER-4530-F / KER-4531 / KER-4532

Features
● One-part
● Delay curing type (Can be worked after UV irradiation)
● Metal halide/LED light source available
● Step curing function: 3,000mJ/cm² +23°C×2h
● Lower MURA risk - Excellent elongation: 450% - 600%

Application examples

Test method of the curing speed curve

Curularity

Contact to: Sales and Marketing Department IV Phone: +81-(0)3-3246-5152
UV Cure Silicone Products

**UV Addition Cure Type Liquid Silicone Rubber KER-4690-A/B**

KER-4690-A/B is a UV addition cure type liquid silicone rubber.

**Features**

- The material loses its stickiness and becomes non-flowable after a few minutes of UV exposure.
- Visible light to wavelength 250nm is transmissive before and after cured.
- In the curing process this material is curable under room temperature.
  User does not need to be concerned about volume expansion.

**General Properties**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Grade</th>
<th>KER-4690-A</th>
<th>KER-4690-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Colorless transparent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viscosity after mixed</td>
<td>mPa·s</td>
<td>3,000</td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>g/ml</td>
<td>1.03</td>
<td></td>
</tr>
<tr>
<td>Hardness Durometer A</td>
<td>23℃</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Elongation at break</td>
<td>%</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>Tensile strength</td>
<td>MPa</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>Tear strength, crescent piece</td>
<td>kN/m</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Cure shrinkage</td>
<td>%</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>

(Not specified values)

**Reducing curing time by heating**

**UV Radial Cure Type Liquid Silicone Rubber KED Series**

KED Series is a UV radical cure type liquid silicone rubber.

**Features**

- Rapid cure by UV irradiation
- Molding can be made owing to non-adhesive type.
- Product line-up with different hardness is prepared.
- Physical properties can be adjusted by mixing KED-1P and KED-2P.

**General Properties**

<table>
<thead>
<tr>
<th>項目</th>
<th>KED-1P</th>
<th>KED-2P</th>
</tr>
</thead>
<tbody>
<tr>
<td>項目</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One point</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td>1,380</td>
<td>540</td>
</tr>
<tr>
<td>Refractive index</td>
<td>1.457</td>
<td>1.462</td>
</tr>
</tbody>
</table>

(Cure conditions:
1. Pouring the sample into the case to make its thickness 2.0mm.
2. Irradiating UV light under N₂ atmosphere from both of the top of the sample and back.
3. The amount of irradiating UV is 2,000mJ/cm² for each side.

Contact to: Sales and Marketing Department / Phone: +81-(0)3-3246-5152
Silicone Division
6-1, Ohtemachi 2-chome, Chiyoda-ku Tokyo, Japan

<Modified Silicone Fluids> <Silicone Master Pellets> <Silicone Powders>

Sales and Marketing Department I
Phone : +81-(0)3-3246-5132 Fax : +81-(0)3-3246-5361

Silicone Resins > Silicone Oligomers < Alkoxysilanes < Silane Coupling Agents
Sales and Marketing Department II
Phone : +81-(0)3-3246-5131 Fax : +81-(0)3-3246-5361

Sales and Marketing Department III
Phone : +81-(0)3-3246-5151 Fax : +81-(0)3-3246-5362

Sales and Marketing Department IV
Phone : +81-(0)3-3246-5152 Fax : +81-(0)3-3246-5362

Shin-Etsu Silicones of America, Inc.
1150 Damar Drive, Akron, OH 44305, U.S.A.
Phone : +1-330-630-9860 Fax : +1-330-630-9855

Shin-Etsu do Brasil Representação de Produtos Químicos Ltda.
Rua Coronel Oscar Porto, 736 11º Andar - 114/115
Paraiso São Paulo - SP Brasil CEP: 04003-003
Phone : +55-11-3939-0690 Fax : +55-11-3052-3904

Shin-Etsu Silicones Europe B. V.
Bolderweg 32, 1332 AV, Almere, The Netherlands
Phone : +31-(0)36-5493170 Fax : +31-(0)36-5326459

Products & Services: Fluid products

Germany Branch
Rheinaustrasse 190-196, 65203 Wiesbaden, Germany
Phone : +49-(0)611-962-5366 Fax : +49-(0)611-962-9266

Shin-Etsu Silicone Taiwan Co., Ltd.
Hung Kuo Bldg. 11F-D, No. 167, Tun Hua N. Rd.,
Taipei, 10549 Taiwan, R.O.C.
Phone : +886-(0)2-2715-0055 Fax : +886-(0)2-2715-0066

Products & Services: Elastomer products

Shin-Etsu Silicone Korea Co., Ltd.
GT Tower 15F, 411, Seocho-daero, Seocho-gu,
Seoul 137-856, Korea
Phone : +82-(0)2-590-2500 Fax : +82-(0)2-590-2501

Shin-Etsu Silicone Singapore Pte. Ltd.
4 Shenton Way, #10-03/06, SGX Centre, Singapore 068807
Phone : +65-6743-7277 Fax : +65-6743-7477

Shin-Etsu Silicones India Pvt. Ltd.
Flat No.712, 7th Floor, 24 Ashoka Estate, Barakhamba Road
New Delhi 110001, India
Phone : +91-11-43623081 Fax : +91-11-43623084

Shin-Etsu Silicones (Thailand) Ltd.
7th Floor, Hannindh Tower, 54 North Sathorn Road,
Bangkok 10500, Thailand
Phone : +66-(0)2-632-2941 Fax : +66-(0)2-632-2945

Shin-Etsu Silicone International Trading (Shanghai) Co., Ltd.
29F Junyiao International Plaza, No.789,
Zhao Jia Bang Road, Shanghai 200032, China
Phone : +86-(0)21-6443-5550 Fax : +86-(0)21-6443-5868

Guangzhou Branch
B-2409, 2410, Shine Plaza, 9 Linhexi Road,
Tianhe, Guangzhou, Guangdong 510610, China
Phone : +86-(0)20-3831-0212 Fax : +86-(0)20-3831-0207

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