TOSPEARL* 120 FL, 130 FL, 145 FL and 1100 FL
silicone beads for BOPP film applications

**SILANES**

**Key Features and Typical Benefits**

- Spherical geometry and narrow particle size distributions helps provide slip and antiblocking for polyolefin films such as BOPP
- Able to be compounded with thermoplastics using typical polymer processing equipment, e.g. extruders, due to high heat resistance
- Stable and low coefficient of friction (CoF) surfaces typically are obtained after film extrusion TOSPEARL FL beads do not migrate
- Generally no change in the printability of films is expected

**Typical Physical Properties**

<table>
<thead>
<tr>
<th>Property</th>
<th>TOSPEARL 120 FL beads</th>
<th>TOSPEARL 130 FL beads</th>
<th>TOSPEARL 145 FL beads</th>
<th>TOSPEARL 1100 FL beads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>White spherical beads</td>
<td>White spherical beads</td>
<td>White spherical beads</td>
<td>White spherical beads</td>
</tr>
<tr>
<td>Mean Particle Diameter(1) (µm)</td>
<td>1.8 - 2.3</td>
<td>2.3 - 3.1</td>
<td>4.0 - 5.0</td>
<td>8.5 - 10.5</td>
</tr>
<tr>
<td>Weight Loss @ 250 °C and 0.5 hours, %</td>
<td>&lt; 1.0</td>
<td>&lt; 1.0</td>
<td>&lt; 1.0</td>
<td>&lt; 1.0</td>
</tr>
<tr>
<td>pH(2)</td>
<td>6.0 - 8.0</td>
<td>6.0 - 8.0</td>
<td>6.0 - 8.0</td>
<td>6.0 - 8.0</td>
</tr>
<tr>
<td>Bulk Specific Gravity</td>
<td>0.35</td>
<td>0.36</td>
<td>0.43</td>
<td>0.66</td>
</tr>
<tr>
<td>Particle Specific Gravity</td>
<td>1.32</td>
<td>1.32</td>
<td>1.32</td>
<td>1.32</td>
</tr>
<tr>
<td>Refractive Index</td>
<td>1.42</td>
<td>1.42</td>
<td>1.42</td>
<td>1.42</td>
</tr>
</tbody>
</table>

(1) Measured on a Coulter Counter Multisizer II (Electrical Sensing Zone method)
(2) A 2% dispersion in methanol/water (1/1)

Typical properties are average data and are not to be used as or to develop specifications.

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Particle Size Distribution for TOSPEARL FL Beads

![Graph showing particle size distribution](image)

- **TOSPEARL 120 FL**
- **TOSPEARL 130 FL**
- **TOSPEARL 145 FL**
- **TOSPEARL 1100 FL**

Instrument: Coulter Counter Multisizer II (Electrical Sensing Zone method)
Dispersion medium: aqueous surfactant solution
Dispersion condition: Ultrasonic dispersion

TOSPEARL 120 FL, 130 FL, 145 FL and 1100 FL beads have a very sharp particle size distribution.

Thermal Stability

Thermogravimetric analysis data of TOSPEARL 120 FL silicone resin beads is shown below. The scan rate was 10 °C per minute. TOSPEARL 120 FL silicone resin beads showed thermal decomposition at temperature in excess of 420 °C. Weight loss was minimized to 12-13% even if heated to 900 °C. TOSPEARL 130 FL, 145 FL and 1100 FL silicone resin beads show the same behavior of thermal properties.

![Thermal Stability Graph](image)

Scanning Electron Micrographs

- **TOSPEARL 120 FL**
- **TOSPEARL 130 FL**
- **TOSPEARL 145 FL**
- **TOSPEARL 1100 FL**

SEM illustrates the uniform size distribution of the spherical 2, 3, 4.5 and 10-micron beads.

Potential Applications

Antiblocking and slip agent for BOPP films

TOSPEARL 120 FL, 130 FL, 1100 FL and 145 FL’s beads low surface energies, uniform sizes and spherical shapes are key properties that help impart lubricity properties to films.

The slip properties are illustrated using a simple test.

A comparison with a blank and a silica – containing surface shows significantly better lubricity of the surface containing the TOSPEARL FL grades:

<table>
<thead>
<tr>
<th>Slide Angle (°)</th>
<th>Silica (2 µm)</th>
<th>TOSPEARL beads 120 FL (2 µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOSPEARL 120 FL bead</strong></td>
<td>5°</td>
<td>0.15</td>
</tr>
<tr>
<td><strong>Silica</strong></td>
<td>17°</td>
<td>0.30</td>
</tr>
<tr>
<td><strong>Blank</strong></td>
<td>19°</td>
<td>1.80</td>
</tr>
</tbody>
</table>

1) The ideal thickness of skin layer containing TOSPEARL 120 FL beads is 40% of the diameter of the particle in order to assure good retention
2) ASTM D-1894 (film on film)
3) ASTM D-1894 (film on metal)

Note: Test data. Actual results may vary.

Low coefficient of friction surfaces can be obtained with dosage levels of TOSPEARL 120 FL beads as low as 0.05%.

Good hot-slip properties can facilitate easy processing and faster line speeds for packaging, such as cigarette production, and converting equipment because TOSPEARL FL grades help prevent film from tearing.

The antiblocking properties of TOSPEARL FL beads help prevent adhesion during film production, either on a finished roll, or on the inside of the bubble.

In addition, the small differences between the refractive indices of TOSPEARL FL beads and the polyolefin resin can help yield films of high transparency and clarity with high gloss.

Note: Test results. Actual results may vary.

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Heat stable TOSPEARL beads can be added to the skin layers of BOPP films by a multi-layer extrusion process. After biaxial orientation by stretching, the beads protrude from the surface of the films and act as anti-blocking agents.

**Patent Status**

Nothing contained herein shall be construed to imply the nonexistence of any relevant patents or to constitute the permission, inducement or recommendation to practice any invention covered by any patent, without authority from the owner of the patent.

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Customers must evaluate Momentive Performance Materials products and make their own determination as to fitness of use in their particular applications.

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