



**TOSPEARL* 120 FL, 130 FL,
 145 FL and 1100 FL**
 Silicone Beads for BOPP film
 applications

MARKETING BULLETIN

SILANES

TOSPEARL 120 FL, 130 FL, 145 FL and 1100 FL silicone beads are spherical methyl silsesquioxane beads with narrow particle size distributions and mean particle diameters of approximately 2, 3, 4.5 and 10 microns, respectively. Their uniform particle sizes, thermal stabilities and low surface energies make them excellent candidates to consider for use as additives to BOPP films in which slip and anti-block properties are required.

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

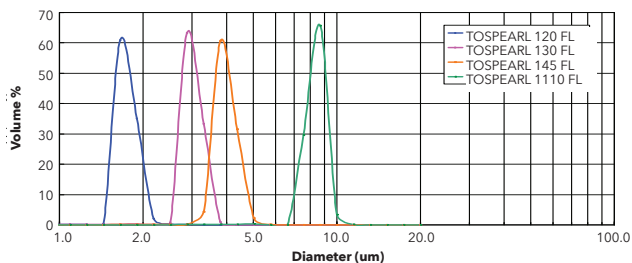
Property	TOSPEARL 120 FL beads	TOSPEARL 130 FL beads	TOSPEARL 145 FL beads	TOSPEARL 1100 FL beads
Appearance	White spherical beads	White spherical beads	White spherical beads	White spherical beads
Mean Particle Diameter ⁽¹⁾ (µm)	1.8 - 2.3	2.3 - 3.1	4.0 - 5.0	8.5 - 10.5
Weight Loss @ 250 °C and 0.5 hours,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

(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.

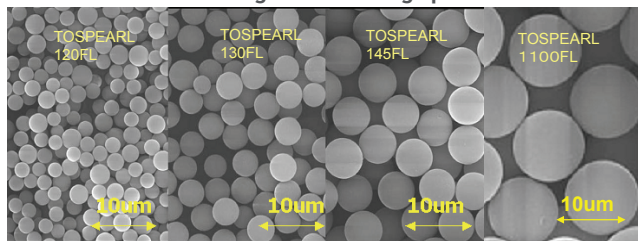
Particle Size Distribution of TOSPEARL FL Beads



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

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

Scanning Electron Micrographs

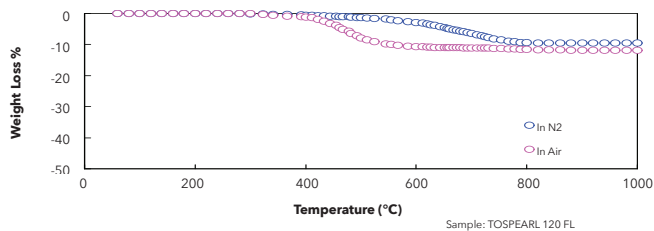


SEM illustrates the uniform size distribution of the spherical 2, 3, 4.5 and 10-micron beads.

Note: Test results. Actual results may vary.

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.



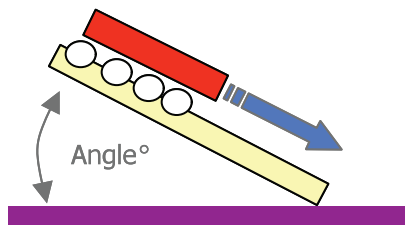
Test data. Actual results may vary.

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.



Angle is recorded when block starts sliding.

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

	Slide Angle (°)
TOSPEARL 120 FL bead	5°
Silica	17°
Blank	19°

Note: Test data. Actual results may vary.

Comparison of Properties of BOPP Film⁽¹⁾ Using TOSPEARL 120 FL beads or Silica

	Silica (2 μm)	TOSPEARL beads 120 FL (2 μm)
Dosage Level (%)	0.15	0.15
Coefficient of Friction ⁽²⁾ @ 23°C	0.30	0.20
Coefficient of Friction ⁽²⁾ @ 80°C	1.80	0.60
Coefficient of Friction ⁽³⁾ @ 80°C	1.40	0.50

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)
 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%.

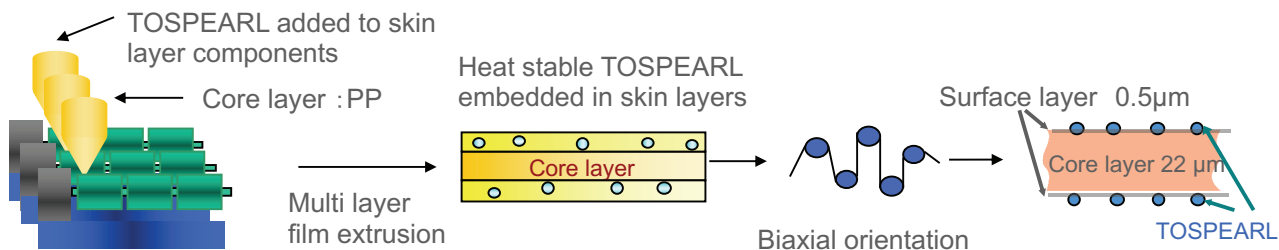
Good hot-slip properties can facilitate easy processing and faster line speeds for packaging, such as cigarette production, and converting equipment because TOSPEARL FL grades help prevent film from tearing.

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.

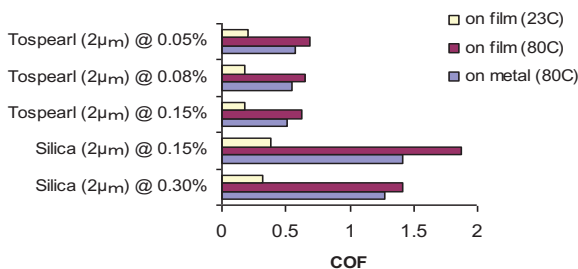
In addition, the small differences between the refractive indices of TOSPEARL FL beads and the polyolefin resin can help yield films of high transparency and clarity with high gloss.

BOPP Film Process

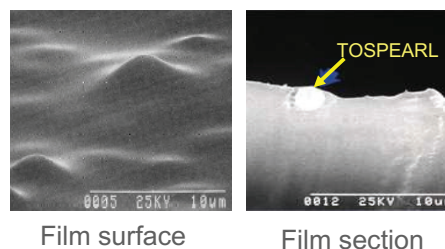
Food packaging film application



Slip performance COF (ASTM-D1894)



Film with protrusion



- TOSPEARL based formulation provides the solution to low COF.
- TOSPEARL enhances anti-blocking properties in BOPP films.
- Can use typical polymer processing equipment because of high heat resistance (350 C)
- FDA approved TOSPEARL as antiblocking agent for use in food contact packaging

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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