# SOLESPHERE™ for Skincare and Cosmetics

Tests demonstrate that adding silica gel helps makeup last longer with a softer feel and reduced shine

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# Improving the Softness and Smooth Application of Water-in-Oil Formulations

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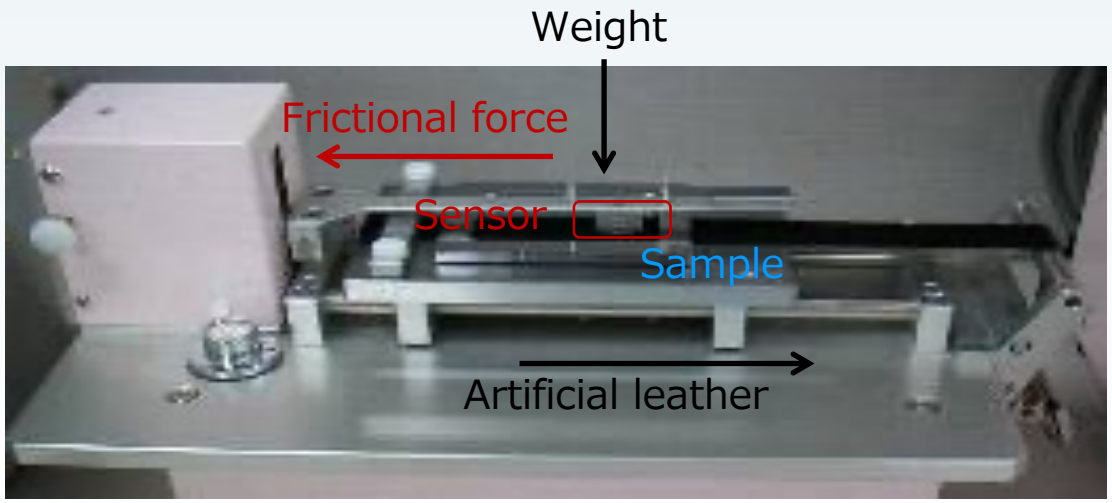
# Testing for Softness and Smoothness

- Softness and smoothness are achieved by reducing a formulation's friction.
- Frictional coefficient (MIU) is correlated with slipperiness.
- The standard deviation of MIU is mean deviation (MDD).
- MDD is correlated with smoothness.

# Testing Frictional Properties

## Process with a KES-SE* Friction Tester

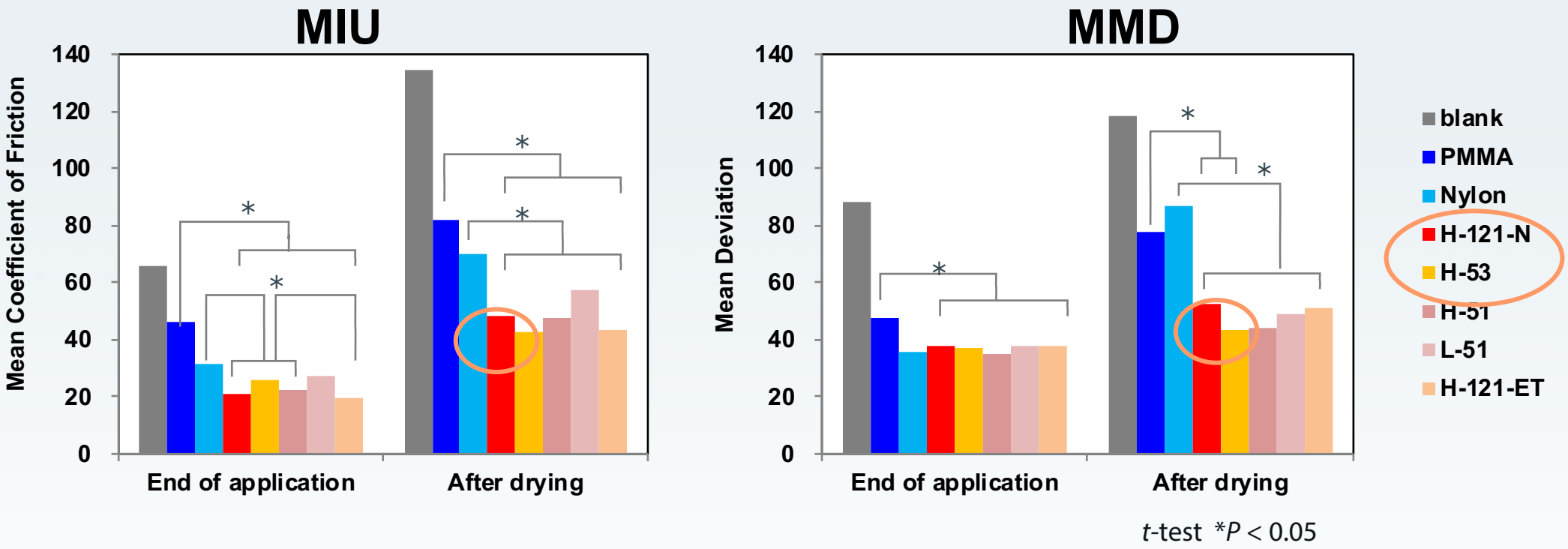
- Spread 20 mg samples on 10 $cm^2$ SUPPLALE** artificial leather
- Tested samples with the following fillers: nylon beads, PMMA beads, SOLESPHERE microspheres
- Dried with air drier
- Evaluated texture with KES-SE friction tester




*Kato Tech Co., Ltd.

**Idemitsu Technofine Co., Ltd

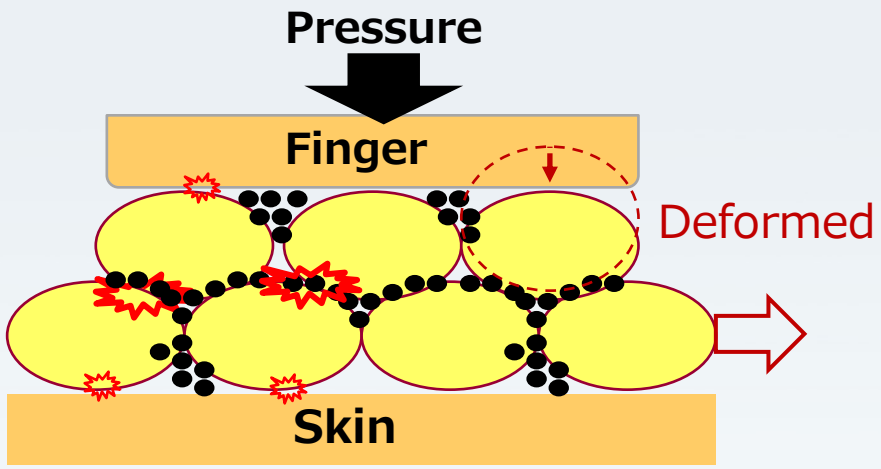
# Frictional Properties Test Results

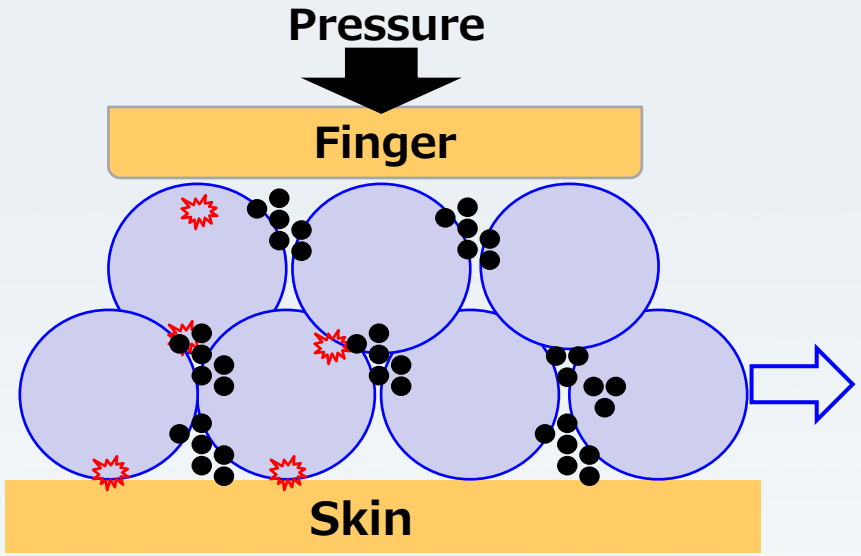



*t*-test $*P < 0.05$

**SOLESPHERE enhanced the formulation's slipperiness and smoothness versus plastic beads, especially after drying.**

# Soft Touch Feel of SOLESPHERE vs. Plastic Beads




## PLASTIC BEADS

- Plastic beads are soft, so they can deform when touched.
- This increases the contact and frictional force between the beads.

## SOLESPHERE MICROSPHERES

- Silica beads are hard and do not deform. They are spherical, which improves rolling.

● = Nano-sized particles (ZnO, etc.)

# Improving a Water-in-Oil Formulation's Sebum Absorption

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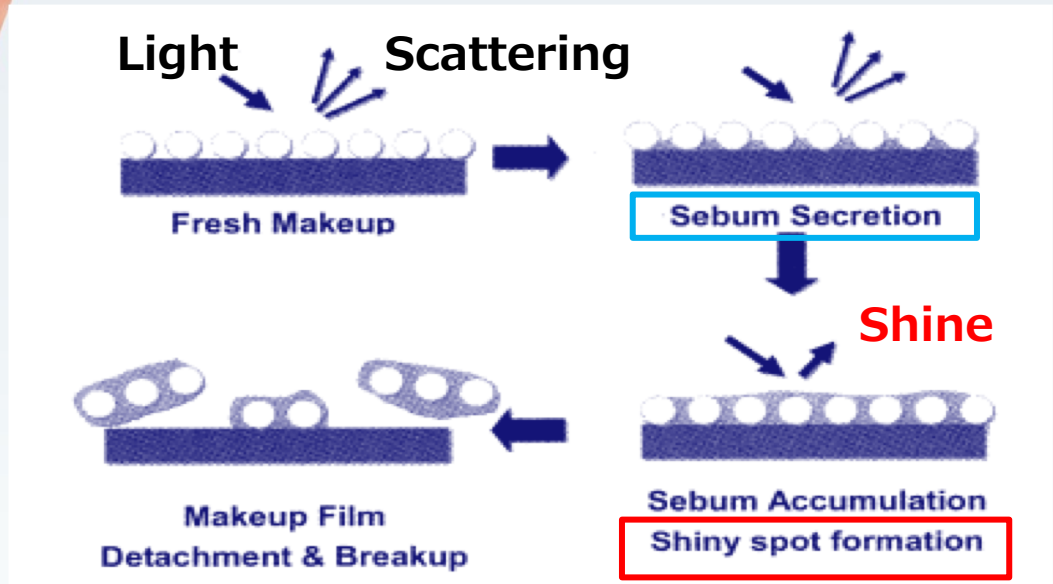
# Influence of Sebum on Cosmetics




As sebum secretion accumulates, two things happen:

1. Light reflection is reduced and shiny spots form
2. Too much sebum causes makeup to collapse/break up

**Sebum secretion causes shiny spots and makeup deterioration.**

* Makeup film deterioration process: Kouichi Nomura, Journal of Oleo Science, Vol.5, 10, p447-454 (2005)

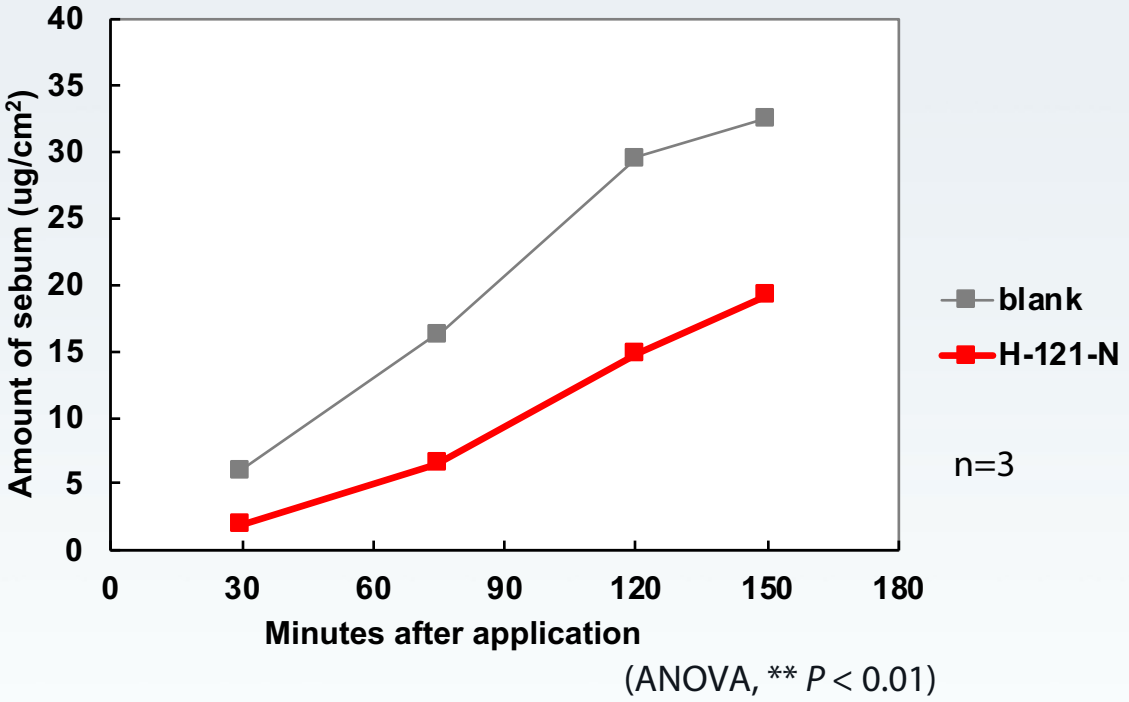
# Testing Sebum Absorption with a Subumeter

## Process with Subumeter SM815*

- Four men washed their faces.
- They immediately entered a room held at a constant 68 °F degrees and 55-60% humidity.
- After 30 minutes, two 1.0 mg/cm$^2$ samples were applied to their foreheads: one containing SOLESPHERE and one without.
- Sebum was measured with the sebumeter for 10 seconds after 30 minutes and after 150 minutes.


*Integral Co., Ltd.

# Results of Sebum Absorption Testing with a Subumeter




(ANOVA, ** $P < 0.01$)

**SOLESPHERE decreased the sebum leakage.**

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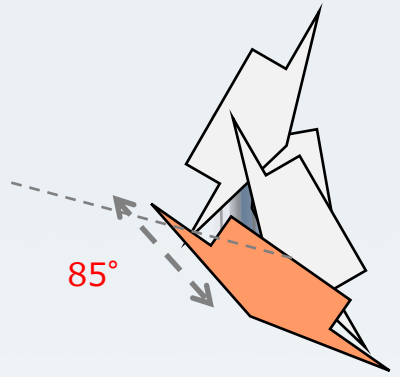
# Testing Sebum Absorption with a Glossmeter

## Process with a BIO Color PG-1M Glossmeter*

- A 1 mg/cm$^2$ sample of artificial sebum was mixed and applied to a BIOSKIN** plate.
- Glossmeter measured shine at an 85° angle according to JIS Z 8741.

| INCI name | Contents (%) |
|---|---|
| Caprylic/capric triglyceride | 33.3 |
| Octyldodecyl myristate | 33.3 |
| Oleic mcid | 20.0 |
| Squalane | 13.4 |




Indication of shine

BIOSKIN plate

*Nippon Denshoku Industries Co., Ltd. | **Beaulax Co., Ltd.

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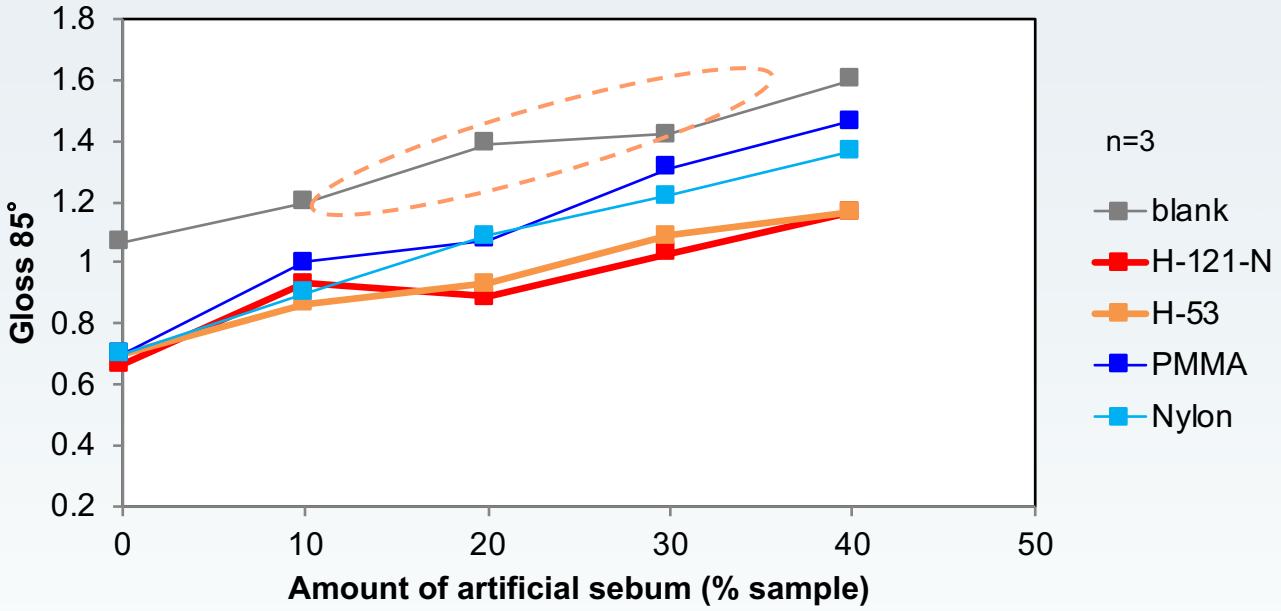
# Results of Sebum Absorption Test with Glossmeter




**When compared with plastic beads,**
**SOLESPHERE better prevented shiny spots from forming.**

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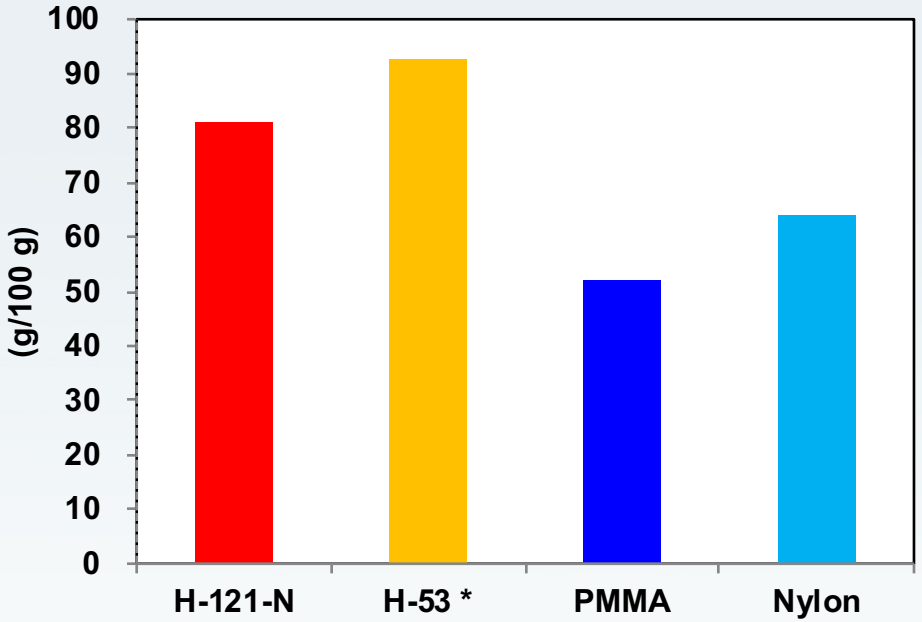
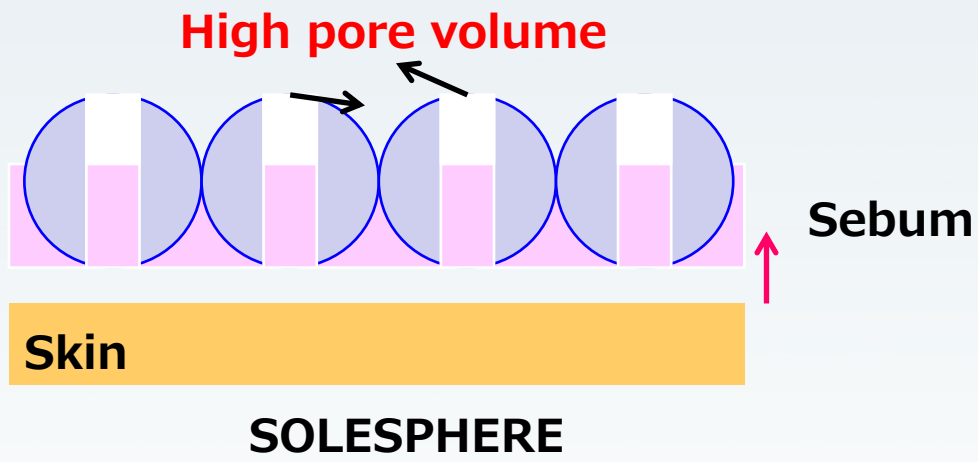
# How SOLESPHERE Absorbs Sebum




*(g/34 g)




**SOLESPHERE's high pore volume can absorb considerable sebum, which helps makeup last longer.**

# Comparison of the Physical Properties of Bead Fillers

| | Grade | Mean particle size (μm) | Pore volume (ml/g) | Specific surface area ($m^2/g$) | Pore diameter (nm) | Oil absorption capacity (ml/100 g) | Bulk gravity (g/ml) |
|---|---|---|---|---|---|---|---|
| **SSP** | H-121-N | 11.7 | 0.62 | 872 | 2.8 | 128 | 0.36 |
| | H-53 | 5.0 | 1.88 | 750 | 10.0 | 375 | 0.10 |
| | H-51 | 5.1 | 0.78 | 870 | 3.6 | 161 | 0.23 |
| | L-51 | 5.1 | 0.82 | 321 | 10.2 | 168 | 0.23 |
| | H-121-ET | 11.8 | 0.83 | 835 | 4.0 | 136 | 0.30 |
| **PMMA** | Microsphere M-305* | 8^ | - | - | - | 53 | 0.36 |
| **Nylon** | SP-500** | 5^ | - | - | - | 68 | 0.28 |

*Matsumoto Yushi-Seiyaku Co., Ltd. | **Toray Industries, Inc. | ^Catalog information

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# SOLESPHERE Improves the Physical Properties of Lipstick

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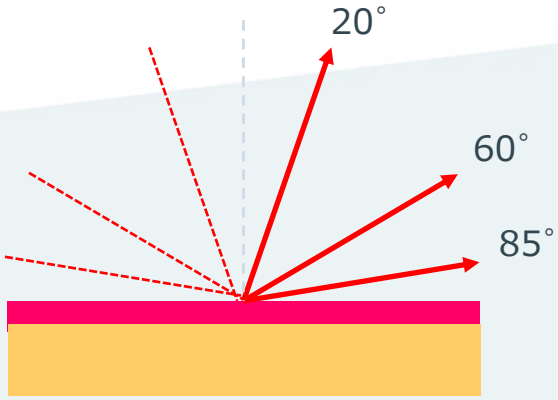
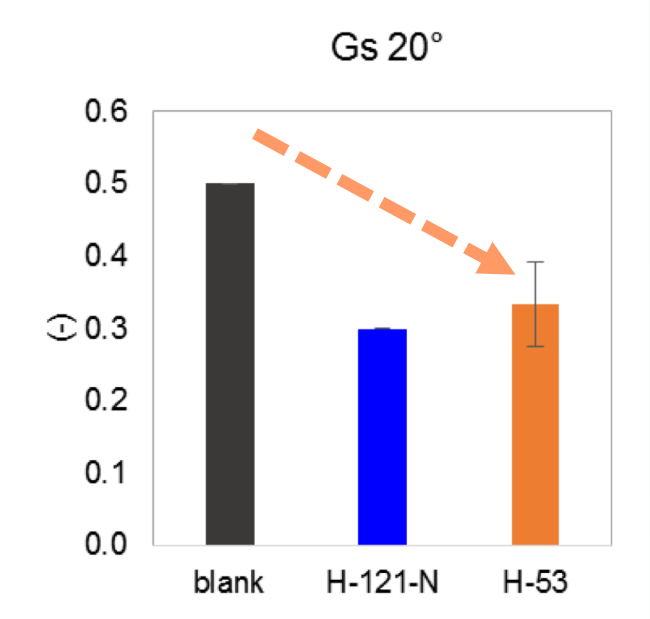
# Testing Gloss and Matte Effect

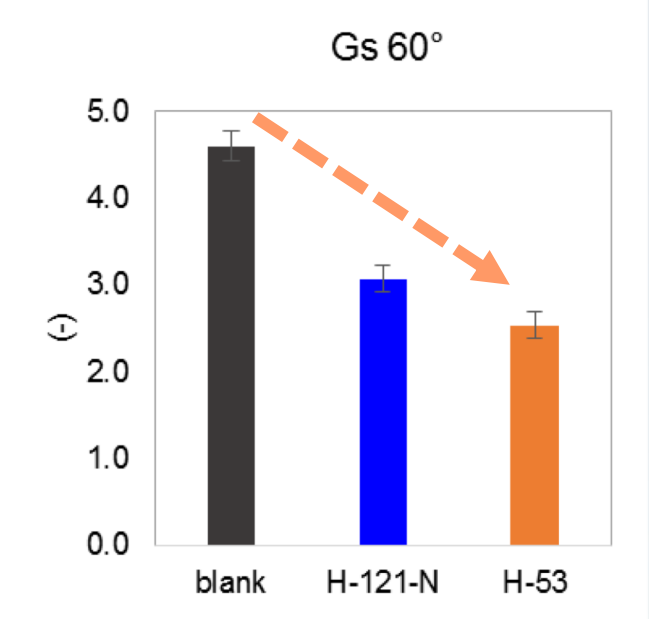
- A 1 mg/cm$^2$ lipstick formulation sample was applied to a BIOSKIN plate.
- Density = 1.0 mg/cm$^2$
- Thickness: 10 µm*
- PG-1M glossmeter** measured shine at 20°, 60° and 85° angles.

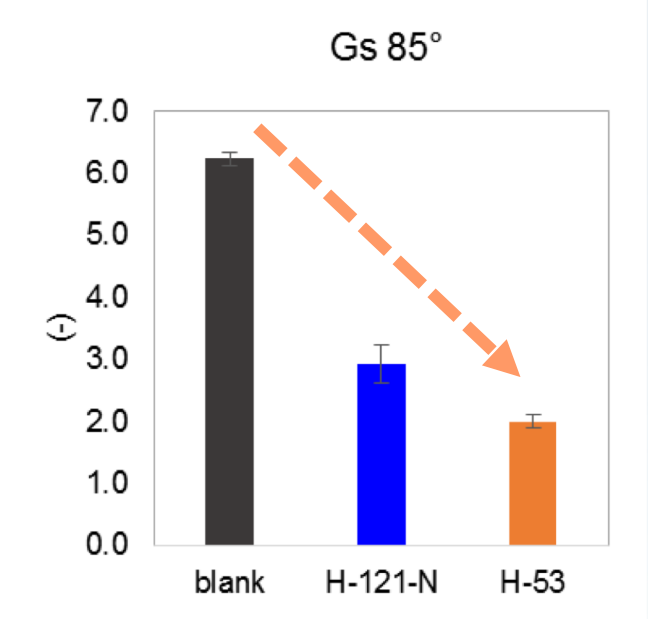



*General thickness of lipstick film: 8~20µm, Ref.: J. Soc. Cosmet. Chem. Japan, 37 (2003) 17-24.
**Nippon Denshoku Industries Co., Ltd.

# Results of Gloss and Matte Effect Testing




- **Adding SOLESPHERE to the formulation decreased its glossiness.**
- **SOLESPHERE can provide a matte effect for cosmetic formulations.**

# SOLESPHERE Improves the Formulation Stability of Lipstick

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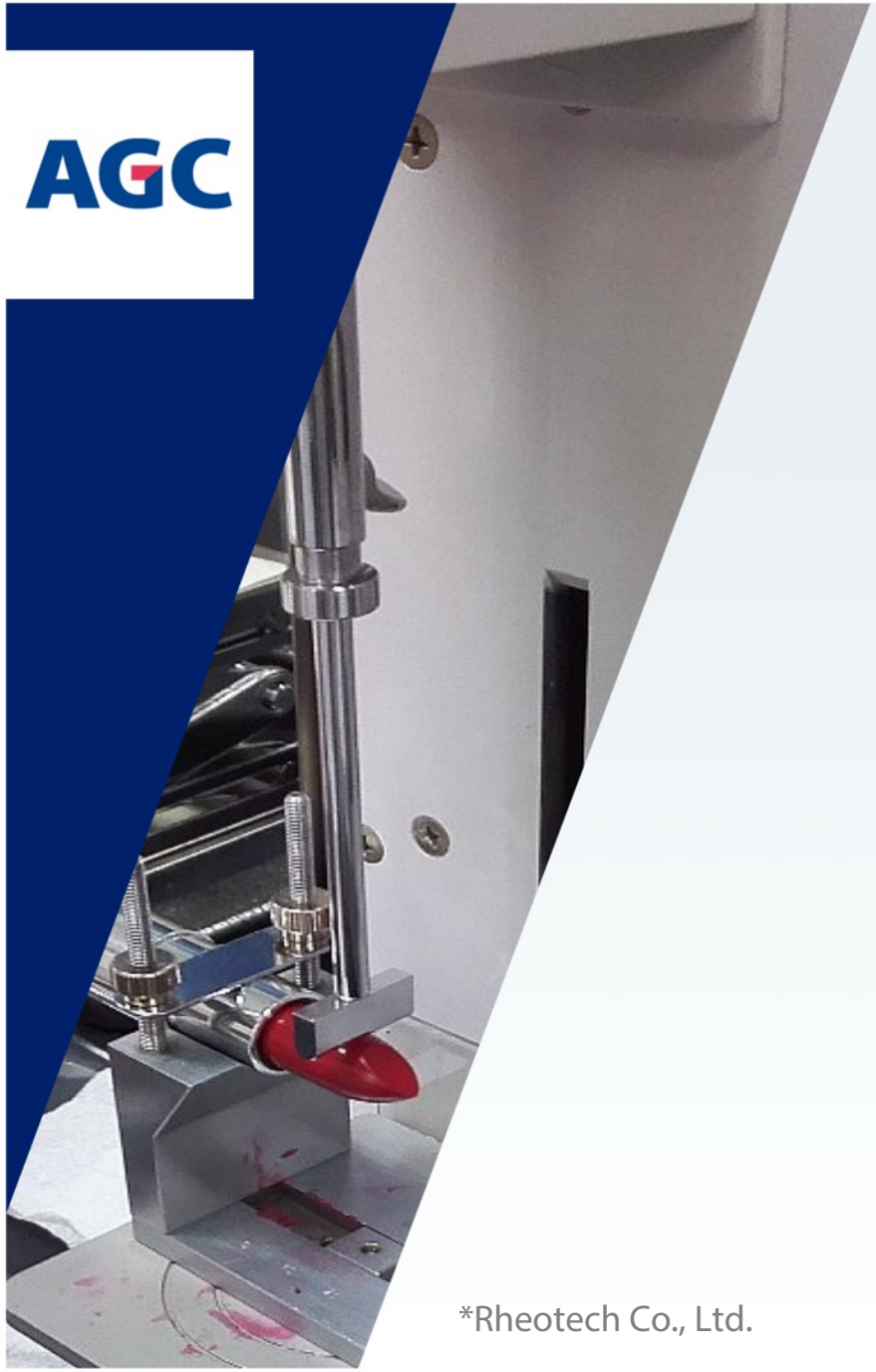


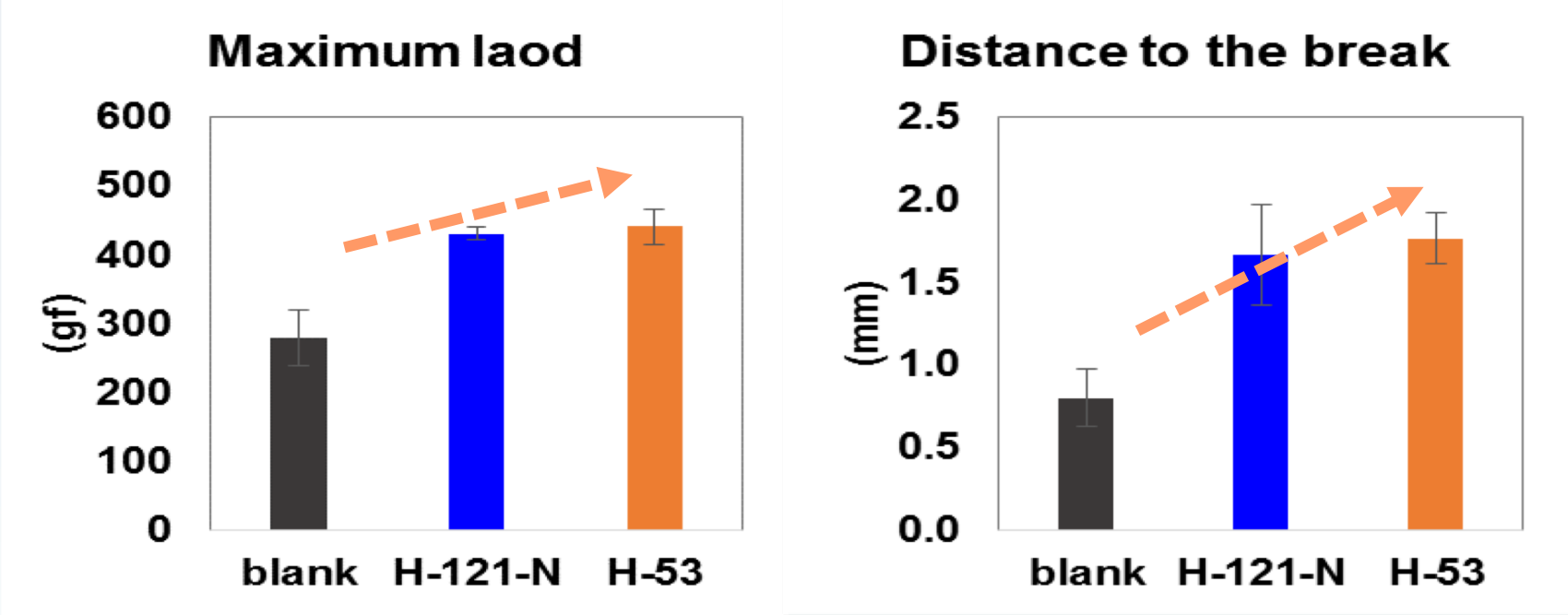
# Testing Formulation Stability

## Process

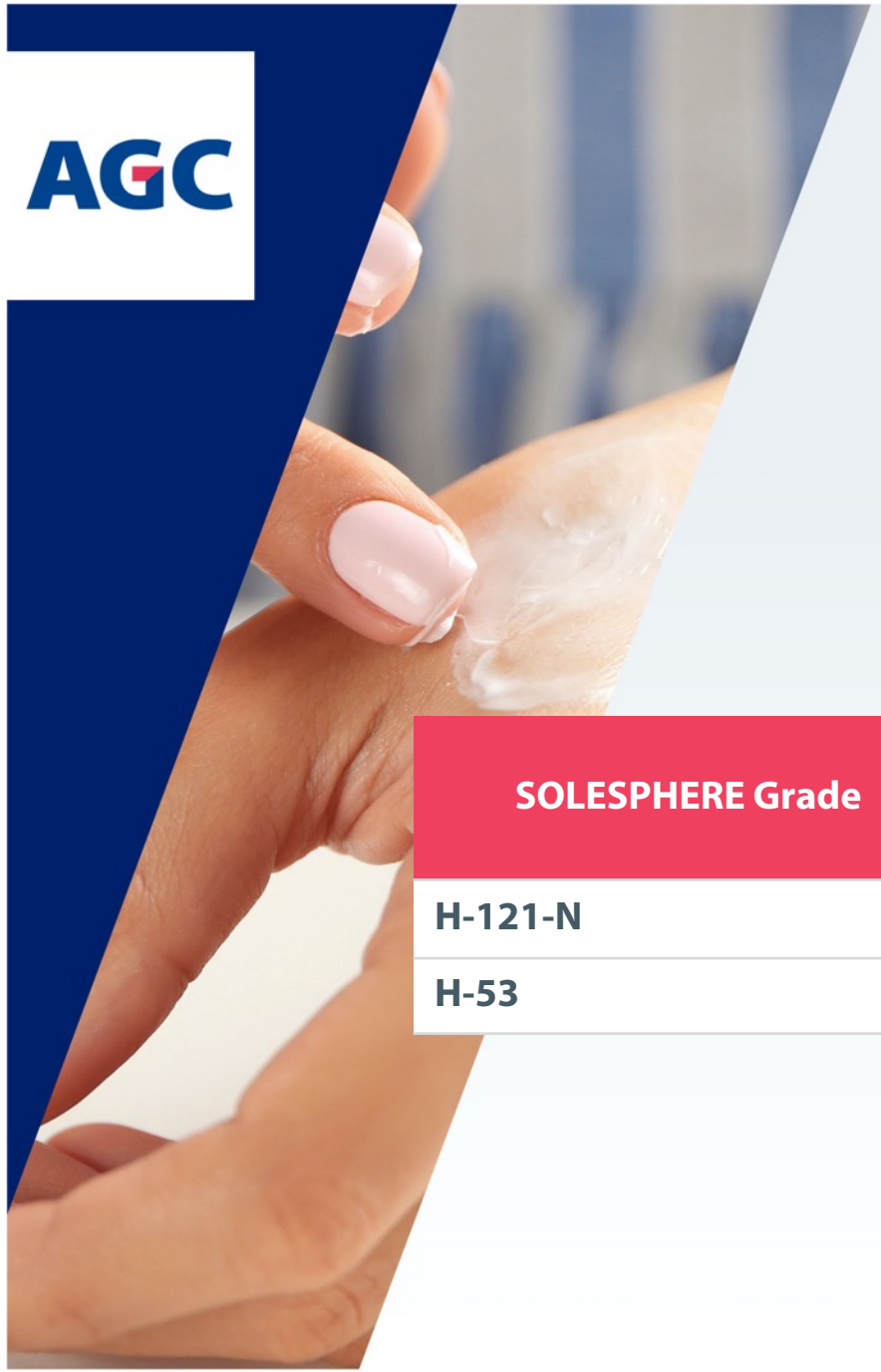
- A lipstick formulation sample was clamped on the stage by a supporting fixture.
- It was stored overnight at 25 °C.
- Sample was measured by a FUDOH rheometer RTC.*

*Rheotech Co., Ltd.

# Results of Lipstick Formulation Stability Test




**SOLESPHERE provided some physical stability.**



# Physical Properties of SOLESPHERE

| SOLESPHERE Grade | Mean particle size (µm) | Pore volume (ml/g) | Specific surface area ($m^2/g$) | Oil absorption capacity (ml/100 g) |
|---|---|---|---|---|
| **H-121-N** | 12.4 | 0.62 | 843 | 132 |
| **H-53** | 4.9 | 1.87 | 760 | 359 |

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# SOLESPHERE Improves Smooth Application of Water-in-Oil Sunscreen

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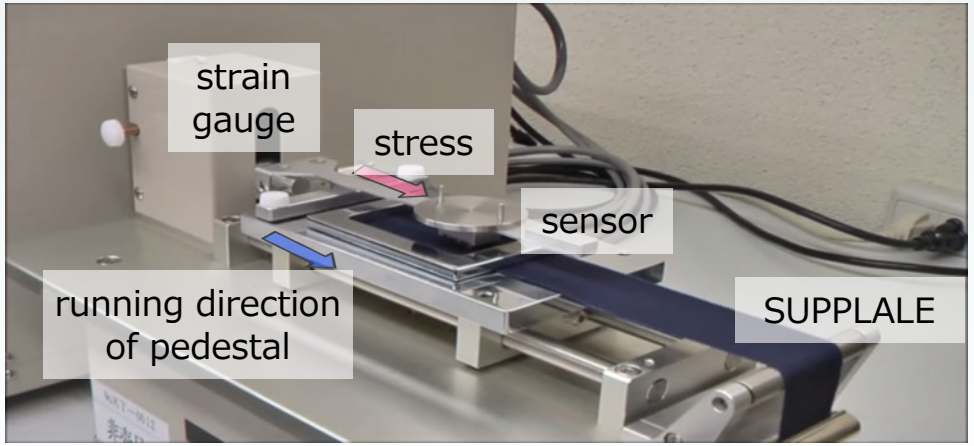
# Bead Fillers Tested

| Fillers | INCI | Particle size (um) | Specific surface area ($m^2/g$) | Oil absorption (mL/100 g) | Specific volume (mL/g) |
|---|---|---|---|---|---|
| **SSP H-121-N** | Silica | 11.7 | 872 | 128 | 2.8 |
| **SSP H-53** | Silica | 5.0 | 750 | 275 | 9.6 |
| **SSP L-51** | Silica | 5.2 | 339 | 163 | 4.2 |
| **PMMA** | Polymethyl methacrylate | 8 | – | 53 | 2.7 |
| **Nylon** | Nylon-12 | 5 | – | 58 | 3.6 |
| **Competitor's silica** | Silica | 6.1 | 181 | 140 | 3.5 |

# Testing Slipperiness and Smoothness

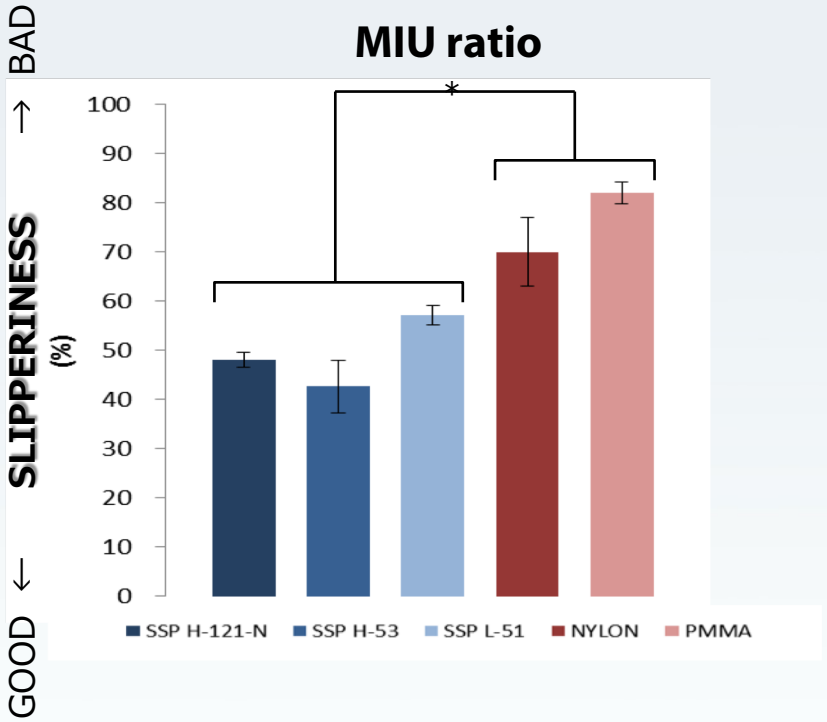
## Method

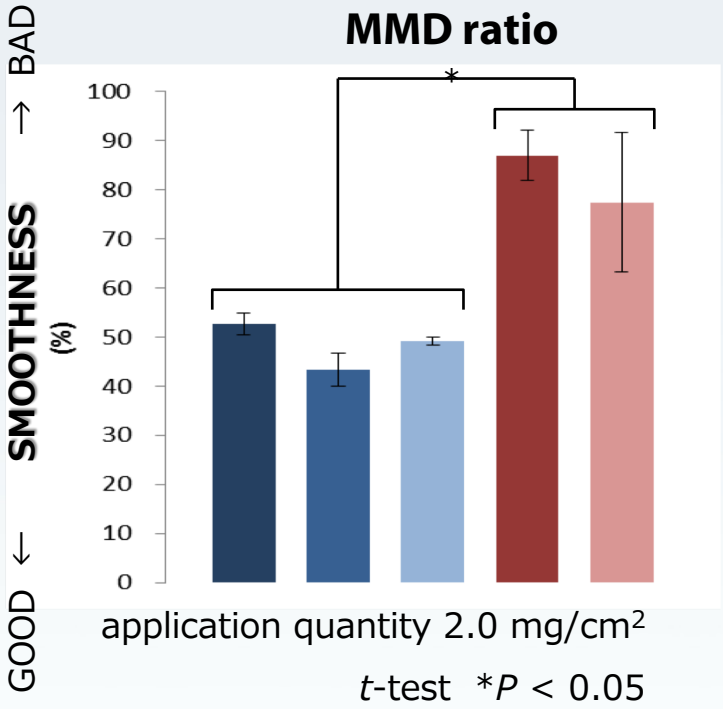
- Five 2.0 and 3.0 mg/cm$^2$ samples of water-in-oil sunscreen formulations were applied to a 10 cm$^2$ sample of SUPPLALE artificial leather.
- Formulations used nylon, PMMA and SOLESPHERE bead fillers.
- Samples were stored overnight at 25 °C.
- Samples were blow dried.
- Samples were evaluated with a KES-SE* friction tester for MIU and MMD.




*Kato Tech Co., Ltd.

# Comparison of Smooth Feel Using Different Bead Fillers



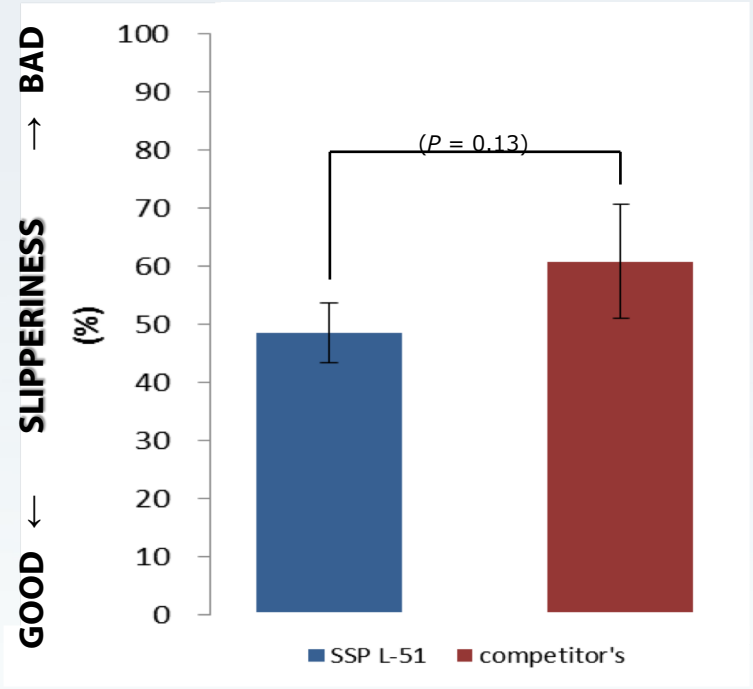

application quantity 2.0 mg/cm$^2$

*t*-test $*P < 0.05$

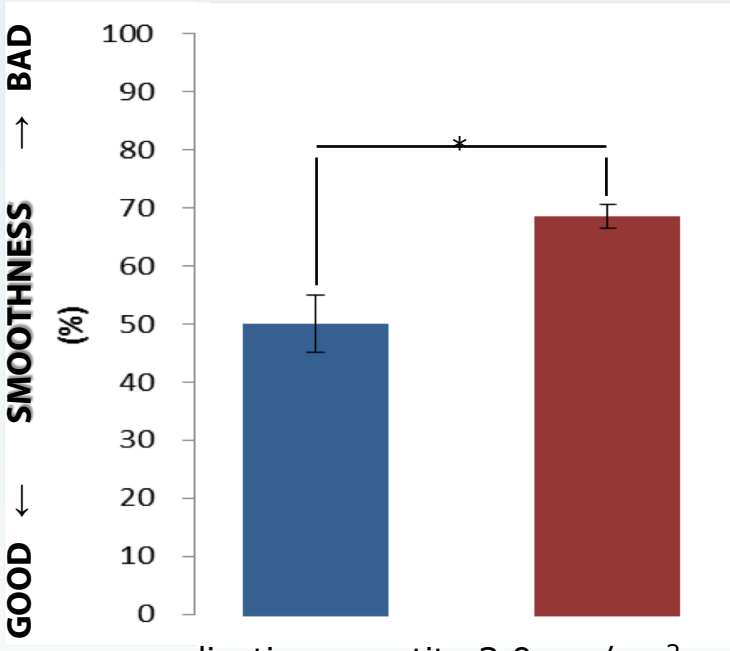
- **SOLESPHERE provided higher slipperiness and smoothness**
- **SOLESPHERE: hard particle and point-contact**

# SOLESPHERE vs. Other Brand Silicas

**MIU ratio**




**MMD ratio**




application quantity 3.0 mg/cm$^2$

*t*-test $*P < 0.05$

- **SOLESPHERE provided higher slipperiness and smoothness.**
- **SOLESPHERE has higher specific volume and more particles per unit weight.**

# Conclusions

- It’s challenging to achieve both SPF and good frictional properties in sunscreens, BB creams and cosmetics. For example, the high load of UV absorbers such as ethylhexyl methoxycinnamate causes high stickiness.
- SOLESPHERE microspherical gels can moderate stickiness because they impart high slipperiness and smoothness properties into both oil- and water-based formulations.