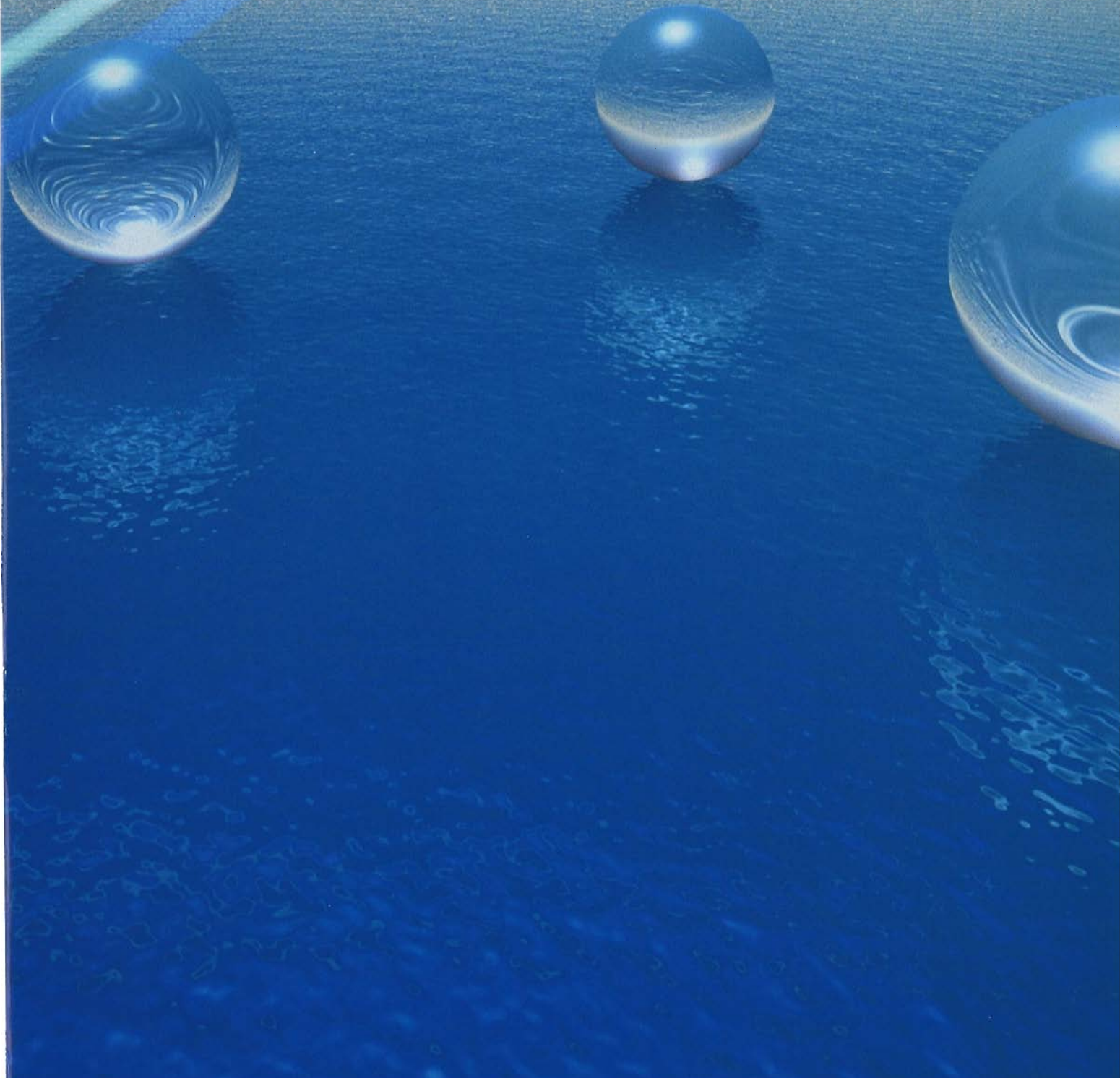


**AGSI**  
Asahi Glass SI-Tech

*High-performance Micro-sphere Fine Silica*

**SUNSPHERE**





*We have  
endeavored as an  
pioneer of silica  
chemistry for half  
a century.*

*We are creating the  
future chemistry  
with limitless  
possibility  
involved.*

High-Performance Micro-sphere Fine Silica

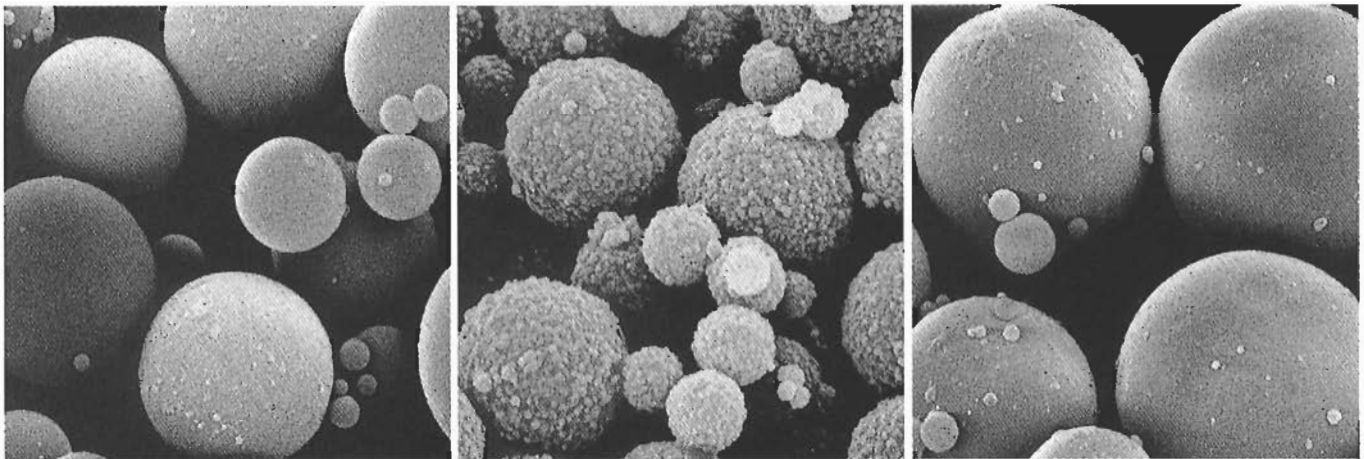
# SUNSPHERE

SUNSPHERE is available in various grades with mean particle diameters from 3 to 20  $\mu\text{m}$  and with oil absorption capacities from 30 to 400 ml/100 g.

SUNSPHERE consists of spherical particles which do not cohere. When blended with a resin, it has a smoother surface than compounds of resin with irregularly shaped particles.

It improves the physical properties of various materials, such as resin fillers and paint (makes the surfaces smoother and improves fluidity, prevents blocking and absorbs moisture).

Electron photomicrographs



H-31

H-32

NP-30

## Product lineup for various applications

### • Multiporous H Series (High Specific Surface Area)

Typical Properties(Unit)	H-31	H-51	H-121	H-201	H-32	H-52	H-122	H-33	H-53
Mean particle diameter( $\mu\text{m}$ )	3	5	12	20	3	5	12	3	5
Specific surface area( $\text{m}^2/\text{g}$ )	800	800	800	800	700	700	700	700	700
Pore volume( $\text{ml}/\text{g}$ )	1	1	1	1	2	2	2	2 <sup>*</sup>	2 <sup>*</sup>
Pore diameter( $\text{nm}$ )	50	50	50	50	250	250	250	300	300
Oil absorption capacity( $\text{ml}/100\text{g}$ )	150	150	150	150	300	300	300	400	400

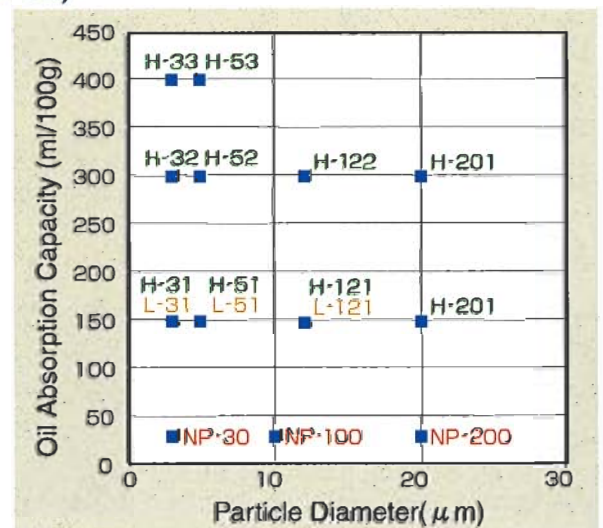
\*1: For reference

### • Multiporous L Series(Low Specific Surface Area)

Typical Properties(Unit)	L-31	L-51	L-121
Mean particle diameter( $\mu\text{m}$ )	3	5	12
Specific surface area( $\text{m}^2/\text{g}$ )	300	300	300
Pore volume( $\text{ml}/\text{g}$ )	1	1	1
Pore diameter( $\text{nm}$ )	130	130	130
Oil absorption capacity( $\text{ml}/100\text{g}$ )	150	150	150

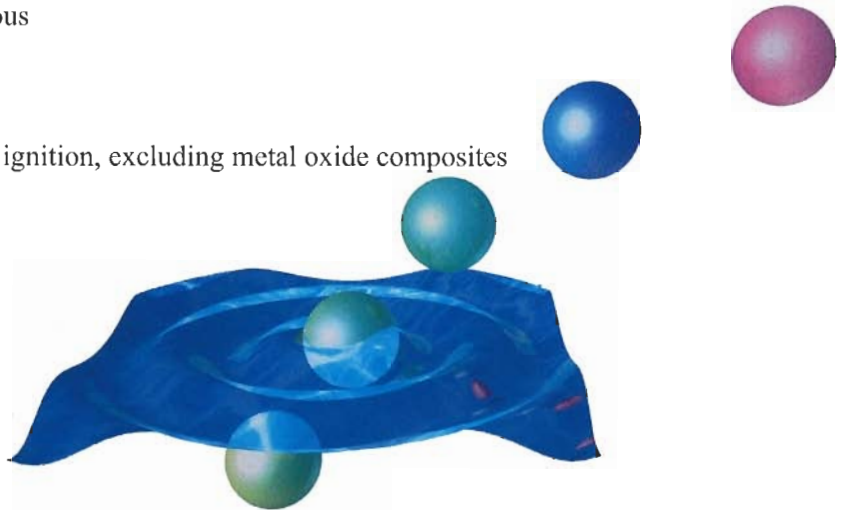
### • Non-Porous NP Series

Typical Properties(Unit)	NP-30	NP-100	NP-200
Mean particle diameter( $\mu\text{m}$ )	4	10	20
Specific surface area( $\text{m}^2/\text{g}$ )	40	50	100
Pore volume( $\text{ml}/\text{g}$ )	0.05	0.1	0.1
Pore diameter( $\text{nm}$ )	-	-	-
Oil absorption capacity( $\text{ml}/100\text{g}$ )	30	35	40



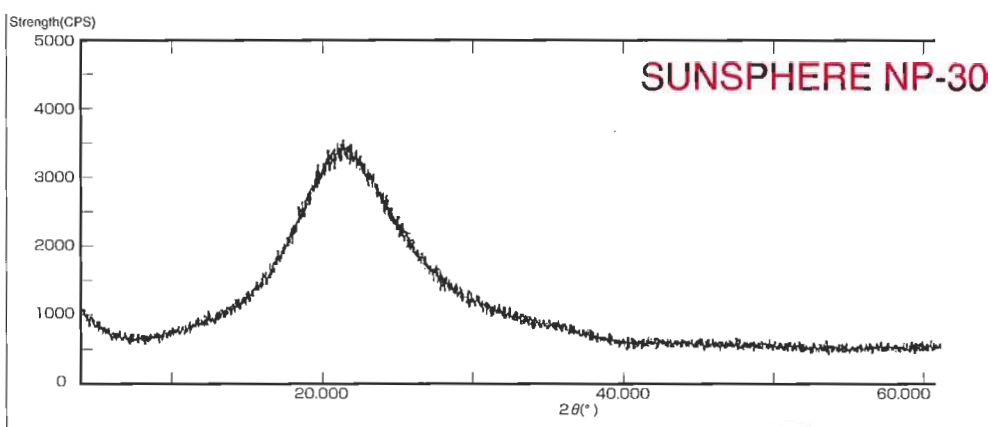
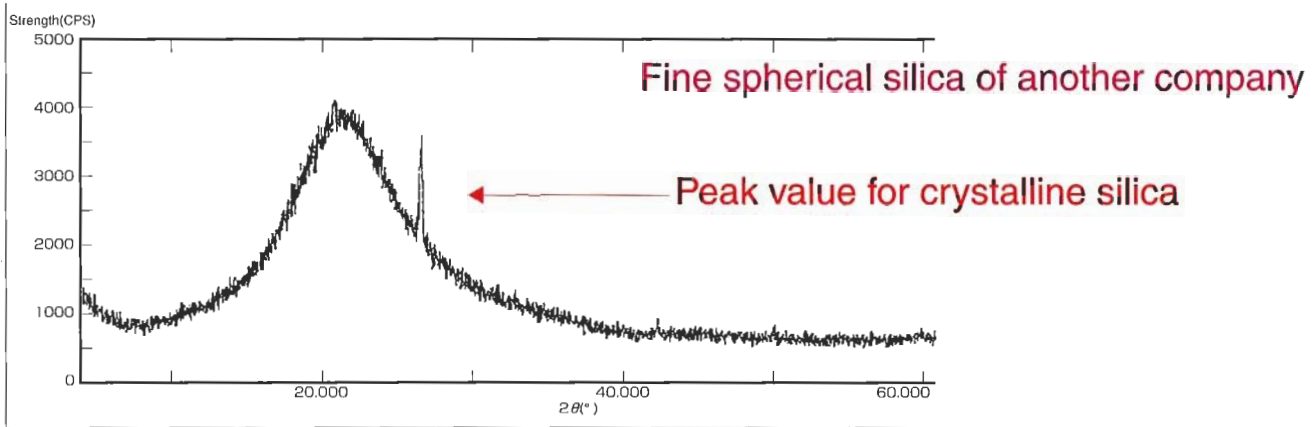
**\*General Characteristics**

<b>Form</b>	Spherical, amorphous
<b>Specific gravity</b>	2.12~2.18
<b>Refractive index</b>	1.45
<b>Purity*1</b>	98% or more after ignition, excluding metal oxide composites
<b>Water solubility*1</b>	2% maximum
<b>Impurities*1</b>	
Heavy metals	20 ppm maximum
Arsenic	5 ppm maximum
Fluorine	30 ppm maximum
<b>*CAS No.</b>	7631-86-9
<b>*EINECS No.</b>	231-545-4



\*1: Japanese Standards for Cosmetic Ingredients (old)

## Safety of SUNSPHERE



**Safety**

The basic ingredient of SUNSPHERE is a sodium silicate solution (an alkaline solution of amorphous silica dissolves in water) that is amorphous silica. The X-ray diffraction diagrams of SUNSPHERE and another company's product are shown above. SUNSPHERE shows a halo specific to amorphous substances, while the product of another company shows a distinctive peak of crystalline silica. This peak indicates the existence of  $\alpha$ -quartz at a minimum diffraction rate of 200 ppm.

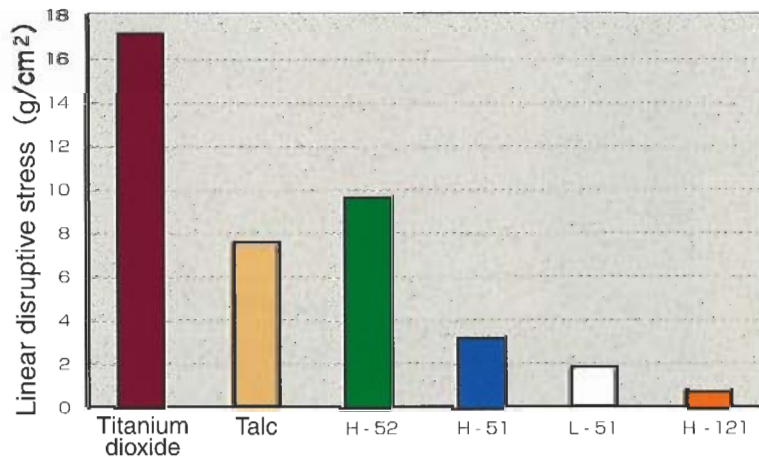
# Typical Elemental analytical data of SUNSPHERE

Material	Unit	Determination threshold	Representative analytical value
Fe	ppm	1	<100
Al	ppm	1	<500
Na	ppm	1	<2000
Ti	ppm	1	<400
K	ppm	1	<50
Ca	ppm	1	<200
Mg	ppm	1	<40
Cr	ppm	1	N.D.
Co	ppm	1	N.D.
Cd	ppm	1	N.D.
Pb	ppm	1	N.D.
Cr6+	ppm	10	N.D.
As	ppm	0.1	N.D.
T-CN	ppm	0.1	N.D.
T-Hg	ppm	0.01	N.D.
P	ppm	1	N.D.
Cu	ppm	1	N.D.
Zn	ppm	1	<2
Ni	ppm	1	N.D.

## Linear Disruptive Stress of SUNSPHERE

The Linear disruptive stress depends on the friction coefficient and adhesion. SUNSPHERE consists of spherical particles which do not cohere. When blended with a resin, it has a smoother surface than compounds of resin with irregularly shaped particles.

### Linear disruptive Stress data

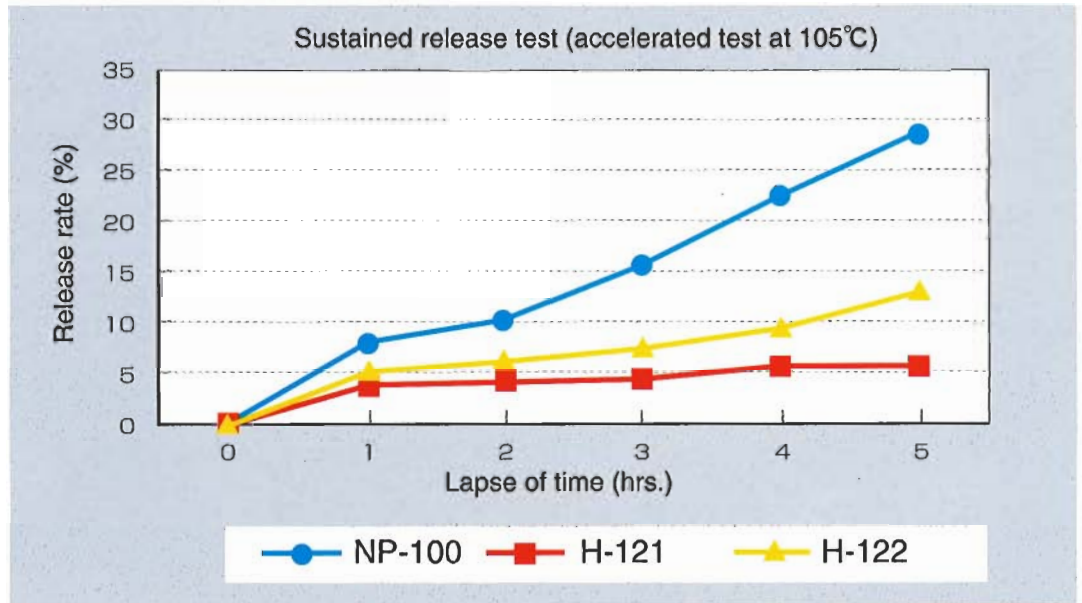


### Particle Strength of SUNSPHERE

Type	NP-30	H-51	H-52	H-53
Pore volume (ml/g)	0.02	0.8	1.6	2.0
Compression strength (Mpa)	1900	40	4	Lower than determination threshold

# SUNSPHERE sustained release test data

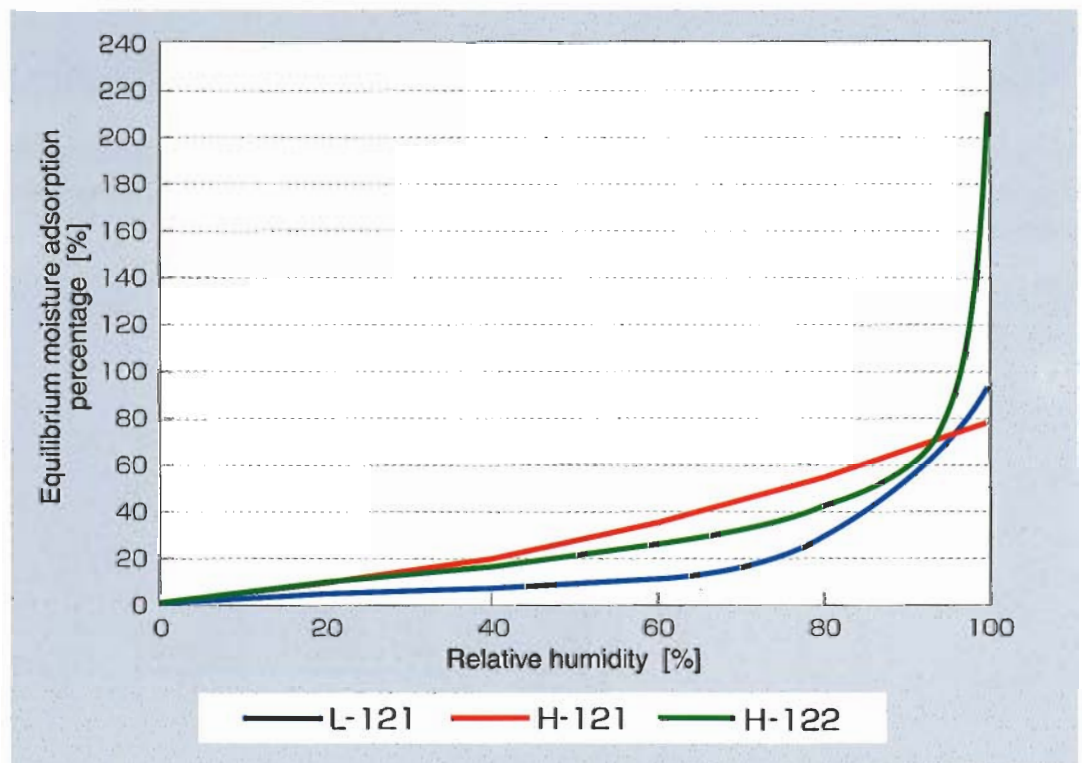
**Release test** SUNSPHERE can adsorb liquid agents to solidify them. When it contains a liquid agent, fragrance or solid agent, it exhibits sustained release qualities.



(Fragrance: Amylcinnamic aldehyde)

# Moisture Adsorption of SUNSPHERE

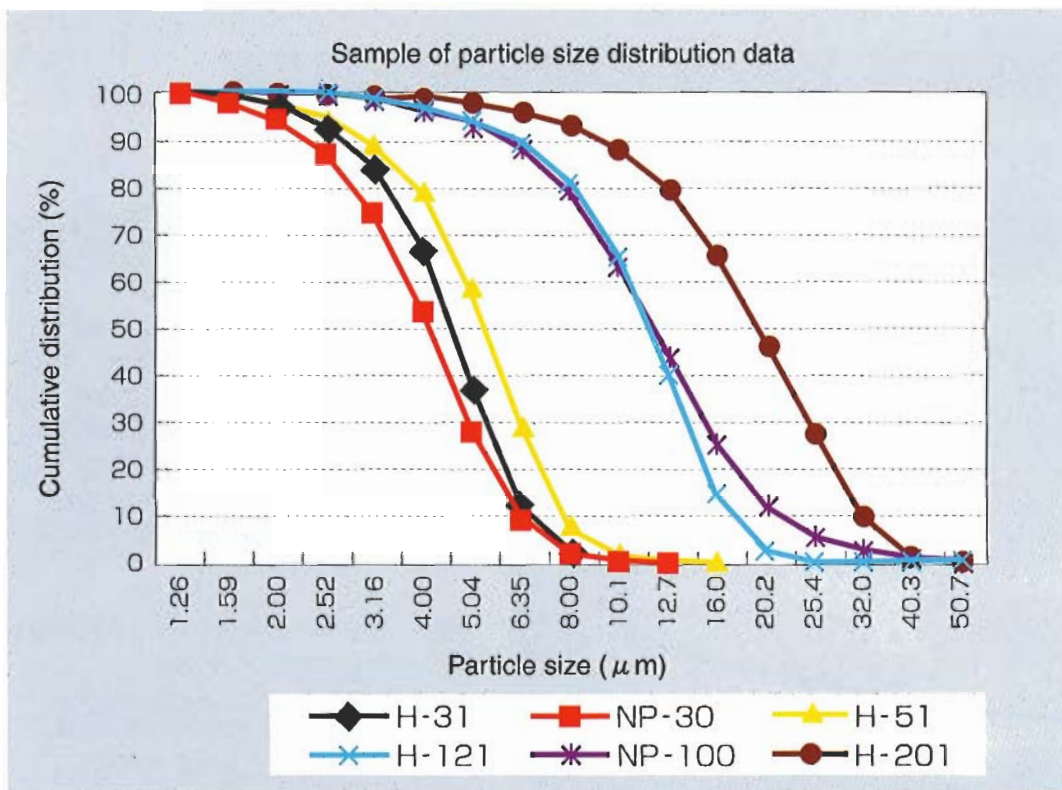
**Moisture Adsorption**



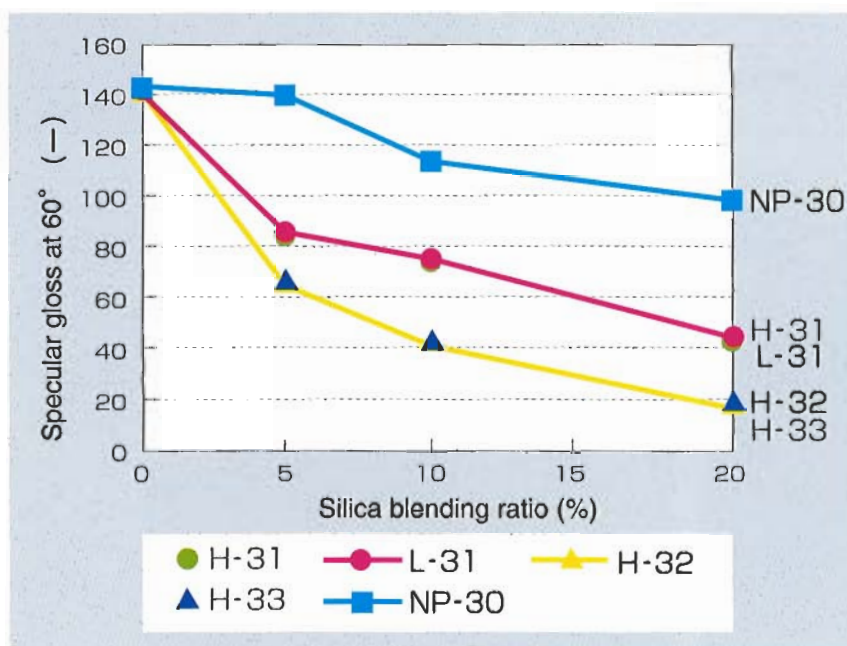
**Surface treatment**

SUNSPHERE consists of cohered and combined primary particles of silica. 80% of the volume of a particle of SUNSPHERE consists of pores (voids). Since the inner and outer surfaces of SUNSPHERE are coated with Si-O-H (silanol) compounds, it can be subjected to surface treatment.

# SUNSPHERE particle size distribution



# Physical properties of a urethane resin and SUNSPHERE coating compounded



Resin: Urethane resin  
 Film thickness: 25 µm  
 Quantity of silica: Blending ratio  
 (to solid resin content)

## Matte effect

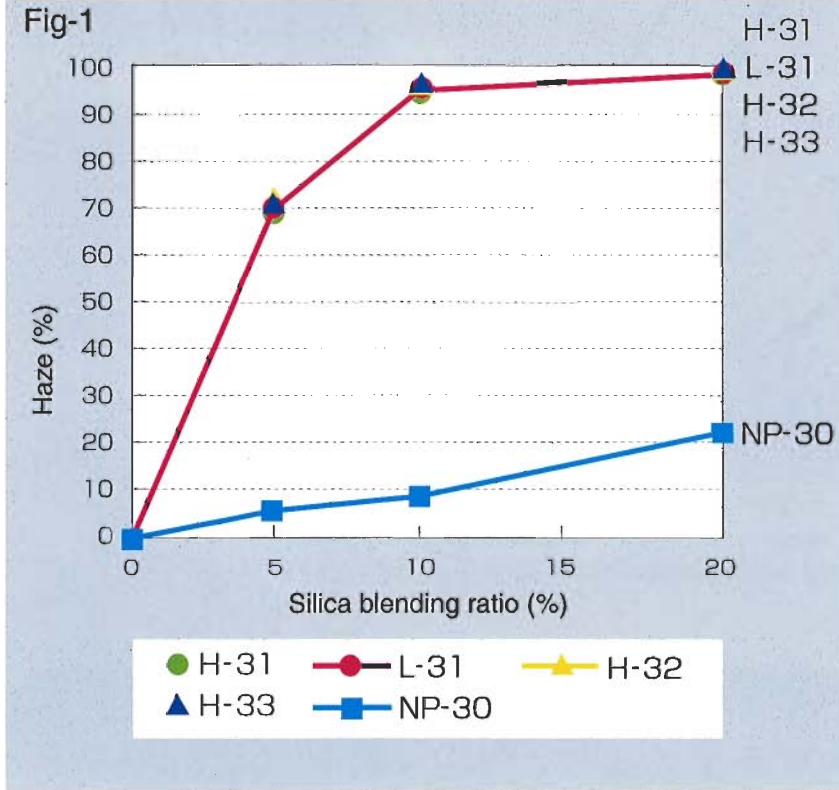
Fine powder silica is widely used for matte finishing of paint. Also, SUNSPHERE exhibits a high matte effect. The diagram above shows measurement results for a specular gloss (at 60°) of the coatings formed by urethane resin compounded with various types of SUNSPHERE. Unlike irregularly shaped silica, SUNSPHERE consisting of spherical silica particles of almost identical size that forms uniform cavities and bumps on the surfaces, even of thin coating films. As is evident from this diagram, the types with high porosity (H-32 and H-33) provide a considerably strong matte effect even in small quantities. The higher porosity types provide better light diffusibility because air is left in the porous silica particles.

# Physical properties of resin and SUNSPHERE compounded

Dynamic friction coefficient

Table-1

Blank	L-31	H-31	H-32	H-33	NP-30
0.29	0.18	0.19	0.25	0.20	0.16



## Blocking effect

Fine powder silica is widely used as an anti-blocking agent for films. Also, SUNSPHERE exhibits a high blocking effect. The above diagram shows the measured values for the friction coefficient of OPP films coated with PP resin blended with various types of SUNSPHERE. Unlike irregularly shaped silica, SUNSPHERE consisting of spherical silica particles of relatively uniform size forms uniform cavities and bumps on the surfaces. Hence, the SUNSPHERE coating contacts many individual points of the film, rather than large areas, so that the friction coefficient is low. (Fig. 2) This effect develops significantly on thin films. As shown in Fig. 1, NP-30, that is a nonporous material, provides a high blocking effect without reducing the transparency of films unlike other porous types.

Measuring method: Friction coefficient test conforming to JIS K 7125  
 Film: OPP film  
 Friction surface: Sample film/Cold-rolled steel plate (SPCC.B #1000)

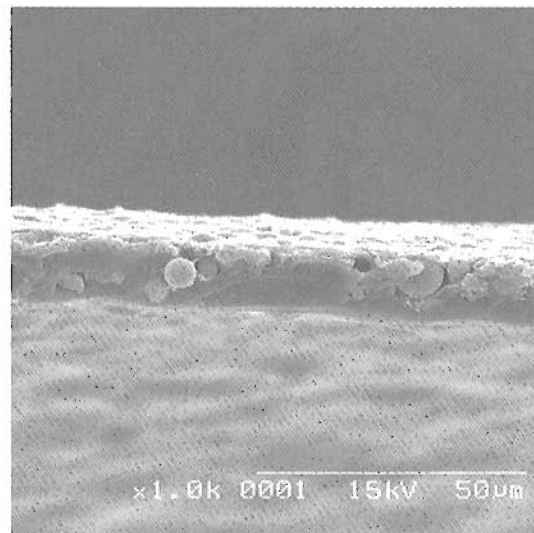
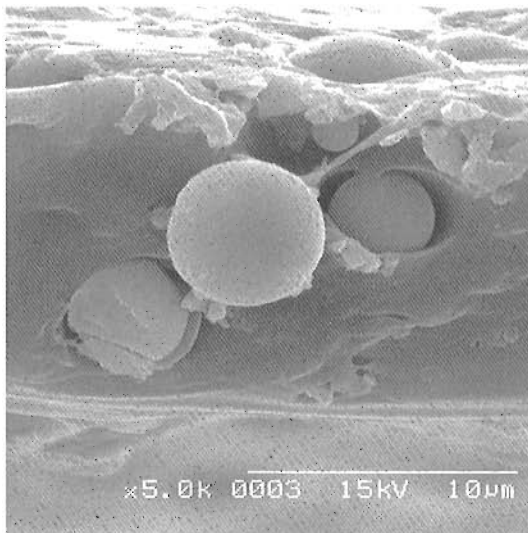


Fig-2:FPVA+L-31 (90:F10) Film of cross section Electron photographs

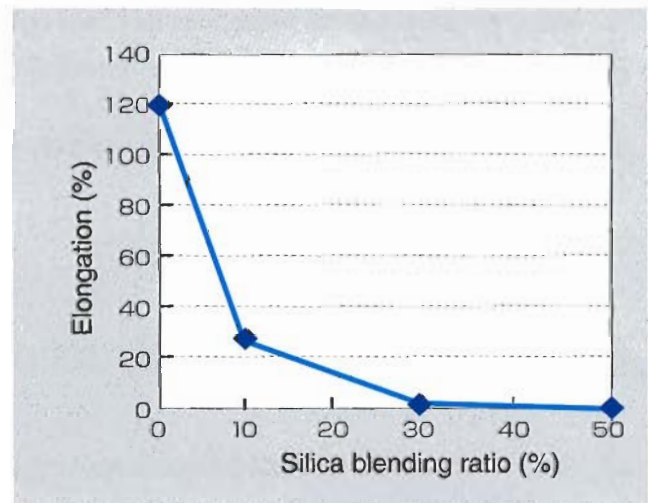
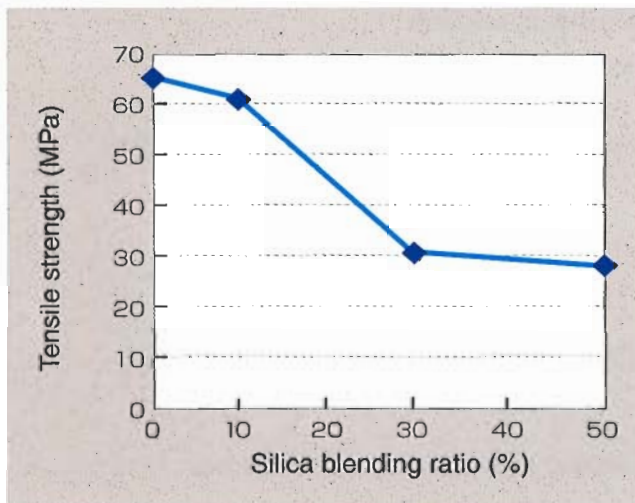
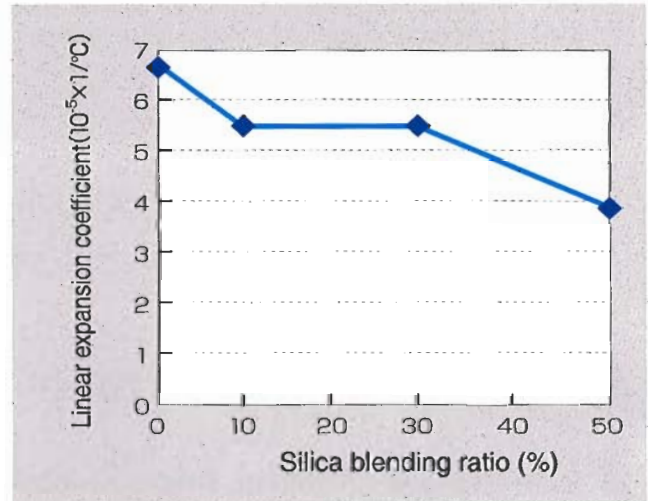
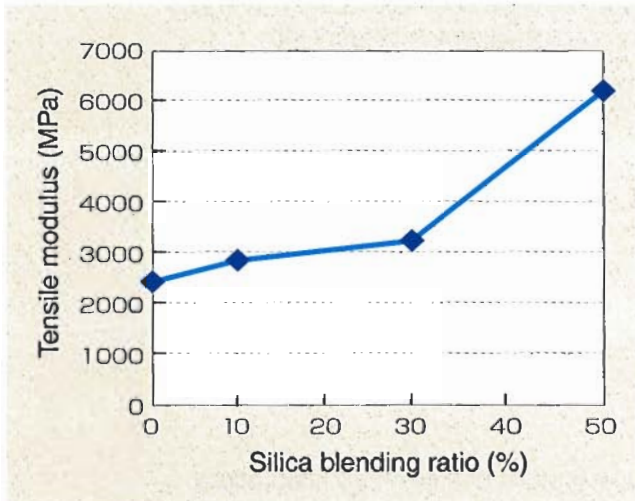


### Manufacturing conditions of plastic plates

SUNSPHERE NP-30 was blended with polycarbonate resin, and plates were formed using an injection molding machine.

Tensile strength test

Test method: Conforming to ASTM D638



### Characteristics as resin filler

Fine powder silica is widely used as a resin filler. SUNSPHERE is optimally suited for use as a resin filler. The above diagrams shown above give the results of evaluation of the characteristics of the plastic plates of polycarbonate resin compounded with NP-30. Addition of SUNSPHERE improves the modulus and expansion coefficient but decreases the tensile strength and elongation. SUNSPHERE's spherical silica particles of relatively uniform size can improve the dimensional stability of resins. Non-porous NP-30 and NP-100 can improve the thermal stability. The porous types retain their moisture absorbing capacity even when they are blended with resins. Therefore, they can absorb moisture penetrating plastic plates to ameliorate the increase of moisture in plastic containers.



## [Features]

- Since SUNSPHERE consists of spherical particles, it provides smoother surfaces

The particles do not cohere, and their rolling effect provides a smooth texture. When resins are compounded with SUNSPHERE, smoother surfaces than with irregularly shaped particles are ensured.

- Product lineup suitable for various applications

SUNSPHERE is available in various grades with mean particle diameters from 3 to 20  $\mu\text{m}$  and with oil absorption capacities from 30 to 400ml/100g. You can select the optimum type according to your intended application.



## [Examples of use]

- Resin fillers (smooth surfaces, improved fluidity, anti-blocking effect and moisture adsorption)
- Drug carriers and sustained-release carriers (solidification of liquid agents, sustained release of contained liquid agents, fragrances and solid agents, and catalyst carriers)
- Paints and inks (coating materials for recording media for ink-jet printers, and special electronic material paints)
- Others (improvement of powder fluidity, and provision of various functions through surface treatment)









## [Important instructions for handling and storage]

- When handling this material, take care not to spill the particles. Provide adequate ventilation and exhaust equipment.
- Store the material, avoiding high temperatures and humidity. Take care not to damage the containers of the material to prevent spillage.



## Main analytical instrument

 <b>Grain size</b>	Laser diffraction scattering type particle size distribution meter, Coulter counter, image processor
 <b>Shape</b>	Transmission electron microscope, Scanning electron microscope, Microscope
 <b>Strength</b>	Micro-compressive strength tester
 <b>Fluidity</b>	Powder tester
 <b>Pore properties</b>	Simplified surface area measuring instrument, Pore distribution measuring instrument (BET method, mercury injection method)
 <b>Composition analysis</b>	Atomic absorption photometer, Gas chromatography, Liquid chromatography, ICP emission spectrophotometer, FTIR, Oil-absorption measuring instrument, Color-difference meter, Spectrophotometer, C-rate measuring instrument, Viscometer, Diagonometer, pH meter



※ "SUNSPHERE" is registered in France and Japan

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