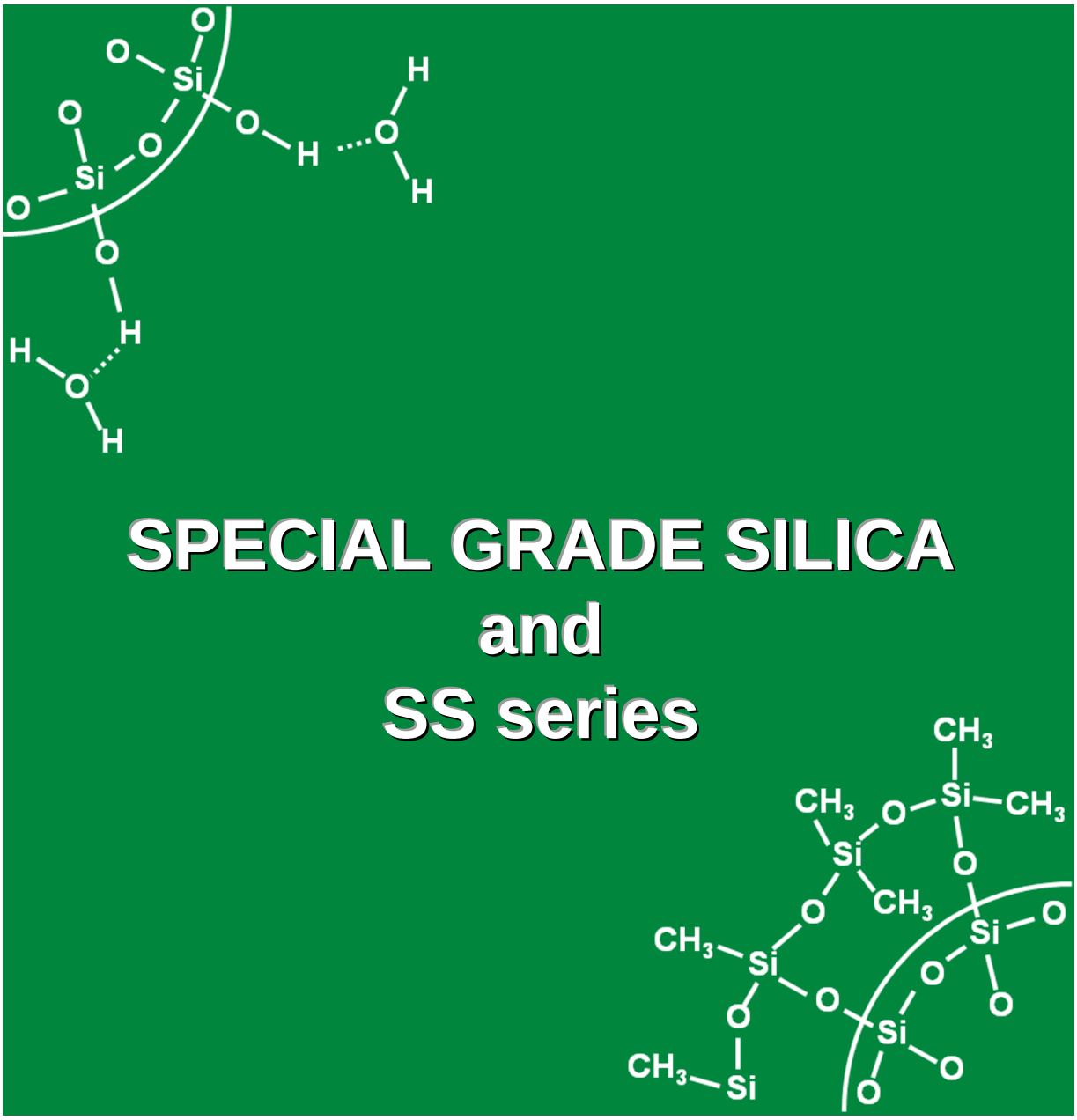
Nipsil®

PRECIPITATED SILICA



SPECIAL GRADE SILICA
and
SS series

TOSOH SILICA CORPORATION

1. INTRODUCTION

Understanding Needs Through Global Sales Activities

Tosoh Silica provides products, services, and information to customers for a wide range of requests. In this respect, it is also our objective to serve customers well while accelerating manufacturing and improving new grades for commercialization.

For this purpose, Tosoh Silica builds and maintains close partnerships with customers to be responsive to their evolving needs. Today, precipitated silica is used in a wide range of products from home appliances to highly advanced OA equipment.

We believe that only a few of the functions of silica are utilized at the present time and that greater potential exist in other fields.

Discovering new frontiers for precipitated silica may result in a better society in the future. We will continue to participate in the international marketplace striving for improved living conditions throughout the world.

Representative Applications

Nipsil® E series, whose particle size can be controlled on the micron level, is used as a matting agent for paint and resins.

On the coated surface, each small particle reflects light in a random direction.

Additionally, Nipsil® E type disperses easily in media and can be stored for long periods of time without having a hard cake form at the bottom.

Production Process

1. Sodium silicate cullet is dissolved and then refined by filtering to obtain transparent sodium silicate solution.

2. The solution reacts with sulfuric acid and $SiO_2 \cdot nH_20$ is precipitated.

3. Through altering the reaction conditions, the diameter of silica particles, surface structure, and pore distribution are controllable.

4. The precipitated silica (wet silica cake) is separated with a filter press and then dried, pulverized, and classified according to particle size.

Fig. 1 Appearance of Nipsil®.

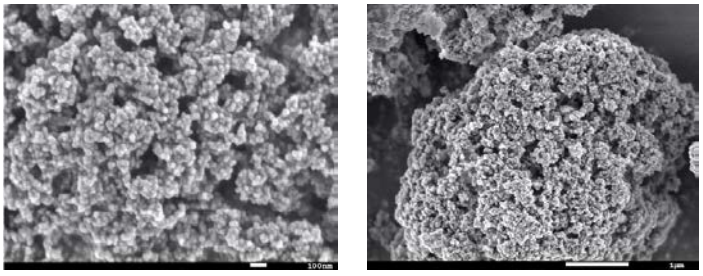


Fig. 2 SEM Photograph of Nipsil®E-200A.

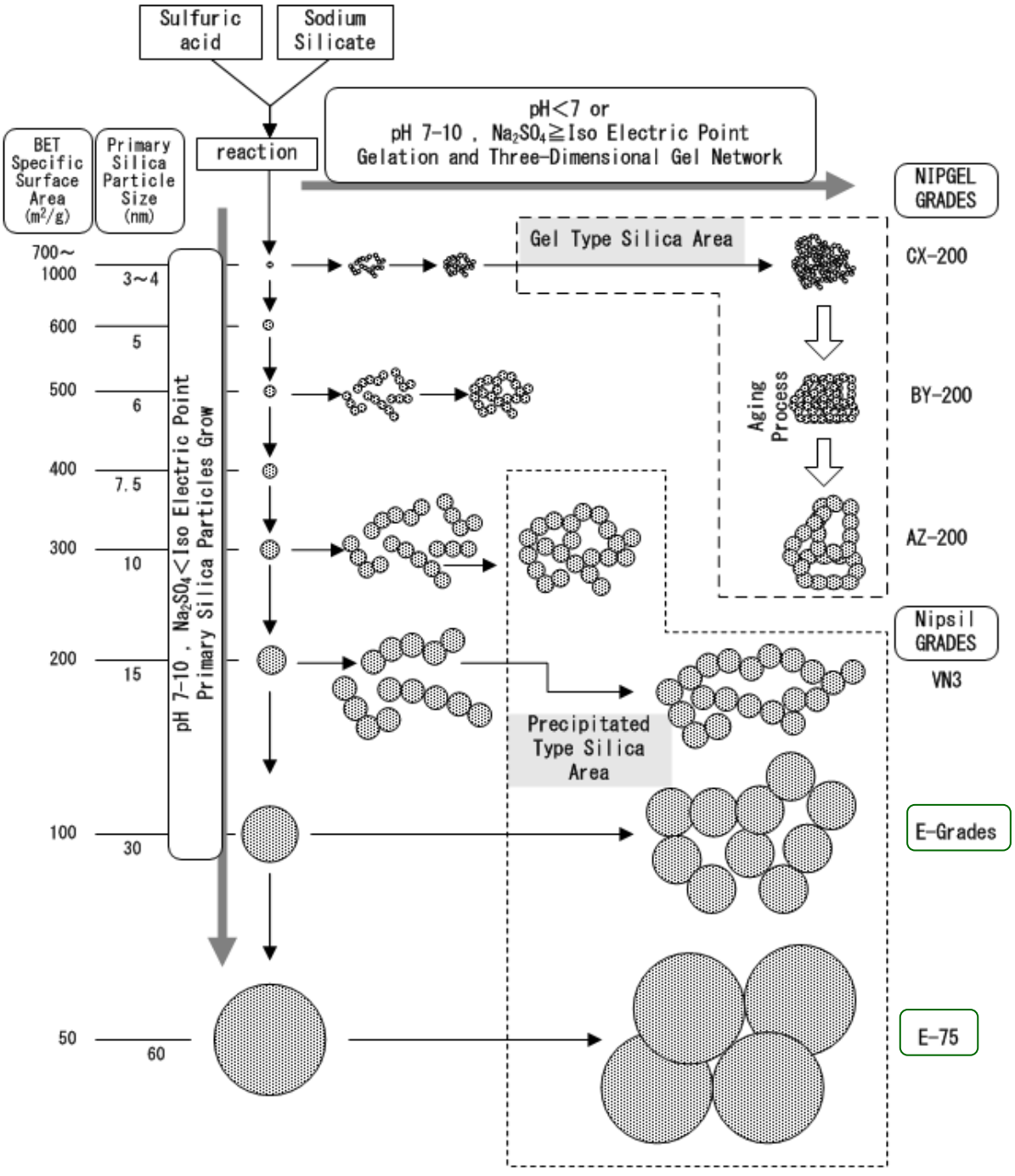


Fig. 3 Polymerization Behavior of Silica and Nipsil® Grades.

2. GRADES AND TYPICAL PROPERTIES OF Nipsil®

Properties \ Grade	E-74P	E-75	E-743	E-150J	E-1030	E-200	E-170	E-220
Loss on Drying (%)	4.0	4.0	3.5	3.5	3.5	3.5	3.5	3.5
pH	6.5	7.0	8.0	7.0	7.0	7.0	7.0	7.0
Specific Gravity (g/mL)	0.19	0.29	0.18	0.26	0.26	0.18	0.20	0.15
Oil Absorption (mL/100g)	180	120	150	200	200	250	250	240
	280	170	230	310	310	340	340	330
Average Particle Size (μm)	3.1	2.4	1.6	4.7	4.7	3.5	3.6	2.1
	4.8	4.5	3.2	8.3	8.3	6.5	6.7	4.9
BET Specific Surface Area (m^2/g)	50	45	55	100	100	130	120	130
Surface Treatment	organic				organic		organic	

Not Standard Value.

DEGREE OF DISPERSION IN PAINT

Degree of Dispersion (μm)	35	30	28	30	30	25	25	22

Table.1 Chemical Composition of Nipsil®.*

	E-1011	E-1009	G-300
SiO_2 (%)	98.5	99.2	96.8
Al_2O_3 (%)	0.86	0.22	0.10
Fe_2O_3 (%)	0.02	0.01	0.02
TiO_2 (%)	0.02	0.02	0.02
CaO (%)	0.03	0.01	0.03
MgO (%)	0.01	0.00	0.01
Na_2O (%)	0.44	0.24	2.04
SO_4^{2-} (%)	0.01	0.01	0.12

*Ignition Base

Table.2 Content of Heavy metals and Noxious Substance in Nipsil®.

	Content(ppm)	Testing Method
Cd	2 >	ICP – AES
Pb	2 >	ICP – AES
Hg	2 >	ICP – AES
Cr^{+6}	2 >	UV – VIS
PBB	5 >	GC / MS
PBDE	5 >	GC / MS
Halogen(F,Cl,Br,I)	50 >	Ion Chromatography
PAH	0.2 >	GC / MS

E-200A	E-1009	E-220A	E-1011	N-300A	K-500	K-503	HD-2	L-250	G-300	Testing Method
3.5	3.5	3.5	3.5	4.0	4.5	4.5	6.0	5.5	5.0	105℃×2hr
6.5	6.5	6.5	6.5	6.0	6.5	6.5	6.5	8.5	10.5	4%Susp.
0.16	0.16	0.12	0.12	0.12	0.11	0.12	0.17	0.11	0.15	JIS 6220 6.8
230	230	230	230	240	300	300	240	180	240	JIS K5101 (Ppt Method)
350	350	350	350	350	430	430	280	340	320	JIS K5101 (Gel Method)
3.0	3.0	1.7	1.7	2.1	2.1	3.0	3.3	2.0	2.2	Coulter Counter Method (AP:30μm)
5.6	5.6	4.2	4.2	5.8	6.0	9.6	7.8	5.5	6.0	Laser Method
130	130	150	150	170	225	225	290	190	150	N_2 Adsorption Method
	organic		organic							

25	25	20	20	28	24	34	40			Dispersing Mixer

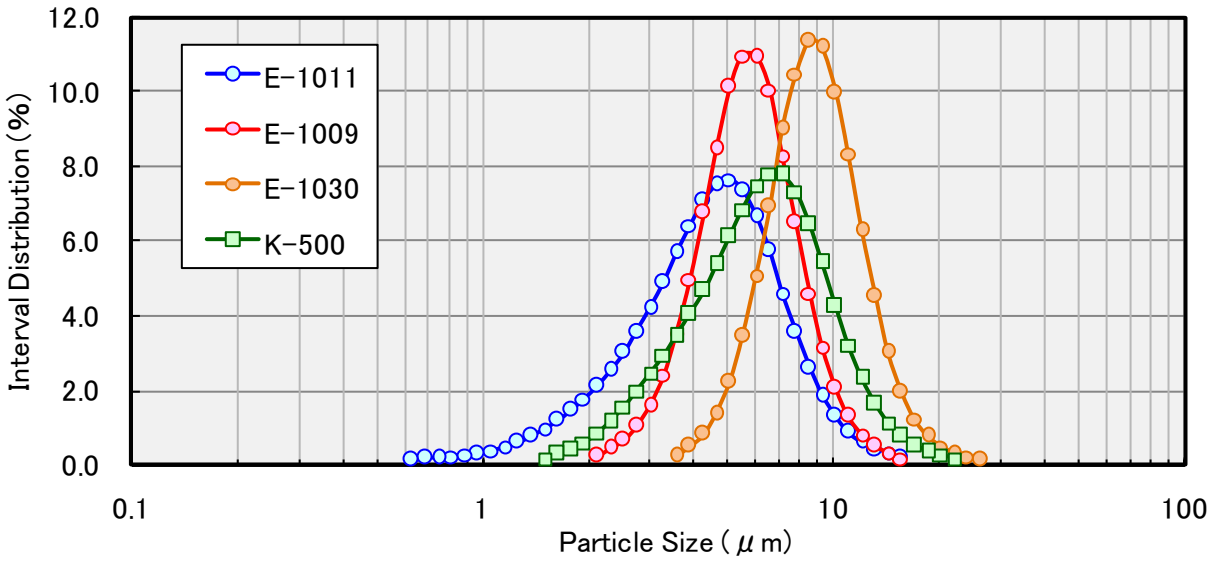


Fig.4 Particle Size Distribution of Nipsil® (Laser

3. APPLICATION FIELDS OF Nipsil®

	Grade	E-74P	E-75	E-743	E-150J	E-1030	E-170
PAINTS, LEATHERS AND INKS	Matting Agent for Baked Type Paints				●	●	●
	Matting Agent for Wood Coatings						●
	Matting Agent for Architectural Coatings				●	●	●
	Matting Agent for Plastics Coatings						
	Matting Agent for Leather Coatings						
	Matting Agent for Gravure Ink					●	●
	Matting Agent for Water Borne Paints	●					●
	Matting Agent for UV Curable Coatings						●
PAPERS	Filler of INK-JET Printing Paper						
	Filler of Thermal Paper		●	●			
	Adhesives Agent				●		
OTHERS	Filler of Antifoaming Agent						
	Carrier for Drugs and Perfume						
	Polishing Agent for Silicon Wafer						
	Filler of Silicone Rubber	●					
	Filler of Special Rubber	●			●		
	Anti-Blocking Agent for OPP Films		●	●			

E-200	E-220	E-200A	E-1009	E-220A	E-1011	N-300A	K-500	K-503	HD-2	L-250	G-300
●	●	●	●	●	●			●			
●	●	●	●	●	●						
●		●	●								
				●	●						
				●			●				
			●	●	●		●	●			
			●		●						
			●		●						
									●		
●		●									
						●				●	●
							●	●			
		●		●							
									●		

4. ADVANTAGE OF Nipsil® IN PAINTS, LEATHERS AND INKS

E-150J E-1030 (organic treatment)

This grade can be used to prevent a slip when the coat sides are piled up, as the matting agent for gravure ink, and as the matting agent for architectural coatings. Because the slip prevention needs considerable unevenness on the coat surface, silica with a large particle diameter is recommended as a matting agent. In addition, it is also suitable as the matting agent for film-thickness baked-type paints.
E-1030, which has had surface organic treatment, can raise storage stability when blending solvent-based paint.

E-200 E-170 (organic treatment)

This grade can be used as the matting agent for flat-based baked-type paints because the balance between oil absorption and particle diameter is good.
The specific gravity is large, so this silica has good workability.
It is also suitable as the matting agent for architectural coatings.
E-170, which has had surface organic treatment, can raise storage stability when blending solvent-based paint.

E-200A E-1009 (organic treatment)

This grade can be used as the matting agent for baked-type paints and PCM paints. The dried film thickness is 10-30 μm in the above case, so E-200A - which has a good balance between matting and coat roughness - is recommended.
It is also used as a coating-type anti-blocking agent for gravure ink.
E-1009, which has had surface organic treatment, can raise storage stability when blending solvent-based paint.

E-220A E-1011 (organic treatment)

This grade excels as a matting agent for plastic coatings. In addition, it can be used as the matting agent for wood coatings, baked-type paints and leather coatings.
However, it is difficult to spread whilst coating because the particulate silica has strong cohesion.
E-1011 suppresses the cohesion and has good dispersibility.
It is also used as a coating-type anti-blocking agent for gravure ink.
E-1011, which has had surface organic treatment, can raise storage stability when blending solvent-based paint.

K-500 K-503

These grades can be used as the matting agent for leather coatings and for gravure ink.
This silica has been controlled to have high oil absorption and high specific surface area, so it can mat without losing transparency.
Although they can be used for paints, it should be well distributed or filtered because it has strong cohesion.

5. ADVANTAGE OF Nipsil® IN THERMAL PAPER

E-75	E-743

These grades are blended with the coloring layer of a thermal paper and can be used to prevent the adhesion of printing dregs to a thermal head.
These silica's, having a balanced number of Si-OH groups on the surface, inhibiting oil adsorption preventing dirt in the melted coloring layer increasing the beauty of the print.

6. ADVANTAGE OF Nipsil® IN ANTIFOAMING AGENT

N-300A	L-250	G-300

Blending N-300A (neutral), L-250 (weak alkaline) or G-300 (alkaline) as a nucleating agent of an antifoaming agent—for example a mineral oil system or a silicone system—improves bubble minimization and bursting.
L-250 and G-300 can obtain hydrophobic silica easily. They have good reactivity with hydrophobizing agents and, demonstrate outstanding antifoaming performance.

7. ADVANTAGE OF Nipsil® IN PRESSURE SENSITIVE ADHESIVE

E-150J	E-200	E-200A

These grades can be blended with natural rubber or plastic glue, and coats as a form of paper adhesive. Blending this silica prevents sticking; the adhesion state is achieved by pressurization.

8. ADVANTAGE OF Nipsil® IN SPECIAL RUBBER

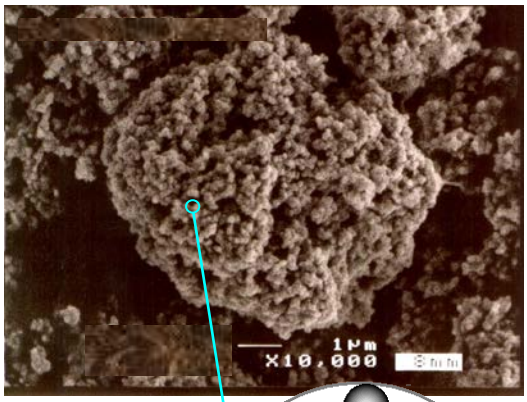
E-150J	E-74P	HD-2

They can be used as a reinforcing filler of special rubbers, such as fluorocarbon rubber and acrylic rubber. They excel in processability (low viscosity) and is characterized by high elasticity and low compression set. It is suitable for high compounds and high dispersion compounds.

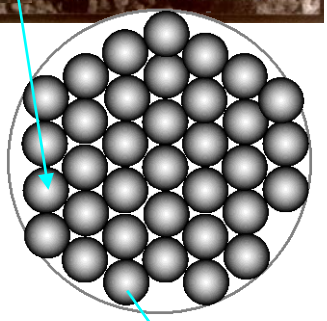
9. ADVANTAGE OF Nipsil®

9-1 Particle Shape relation of properties.

Fig. 5 Particle Shape of Low Surface Silica.

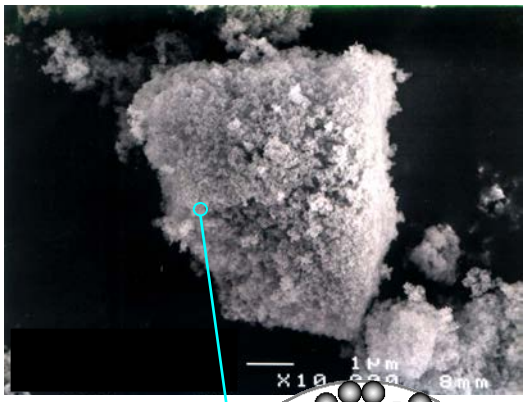


Model Figure

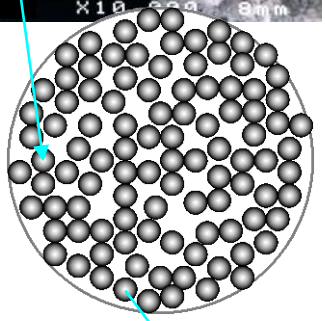


Primary Particles	150nm (Large)
Specific Surface Area	Low
Oil Adsorption	Low

Fig. 6 Particle Shape of E-200A.



Model Figure



Primary Particles	20nm (Medium)
Specific Surface Area	Medium～High
Oil Adsorption	Medium～High

In the case of silica with the same particle diameter (secondary particles), the larger oil absorption and the gap between primary particles causes the weight of a silica particle to become lighter. When the weight is the same, the number of particles is greater if the oil absorption of silica is larger.

9-2 Adsorption Isotherm of Silica.

Because the Si-OH group on the surface of silica absorbs moisture readily, the moisture value becomes high in humid conditions. Therefore, any remaining product after use must be sealed in a packing bag.

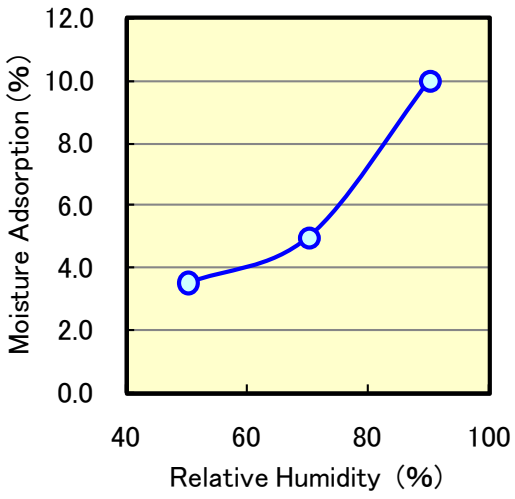


Fig. 7 Adsorption Isotherm of E-200A.

10. MATERIAL SAFETY

10-1 MATERIAL SAFETY DATA

FOR SAFETY INFORMATION PLEASE REFER TO THE OFFICIAL SAFETY DATA SHEET (SDS) FOR YOUR COUNTRY

Nipsil® is an amorphous silica without any crystal structure.

Nipsil® is a high purity silica and non-hazardous material to silicon syndrome and toxic.

10-2 PHYSICAL CHARACTERISTICS

- White impalpable powder
- Porosity
- Tasteless and no smell
- True specific gravity：1.95
- Index of refraction：1.45～1.47

10-3 CHEMICAL CHARACTERISTICS

- Inactive (only dissolving in hydrofluoric acid and strong base)

10-4 OFFICIAL SECIFICATIONS OF Nipsil®

Specification Name	Specification Number and Naming
Japanese Pharmacopoeia	Light anhydrous silicic acid
Pharmaceutical additive Standard	Water containing silicon dioxide
Raw material standard for quasi-drugs	Silica anhydride
Japanese Law on Chemical Substitution Act No.	1-548 Silicon Dioxide
Substance to be notified by the safety law (Article 57-2[1])	312 (Silica)
CAS No.	112926-00-8（Synthetic amorphous silicon dioxide）
TSCA No. (USA)	7631-86-9 (Silica)
EINECS No. (EUROPE)	231-545-4（Silicon dioxide）
ELC No. (KOREA)	KE-3273 3（Synthetic amorphous silicon dioxide）
IECSC No. (CHINA)	（Synthetic amorphous silicon dioxide）
ECN No. (TAIWAN)	（Synthetic amorphous silicon dioxide）
Japan Hygienic Olefin And Styrene Plastics Association	[B]NJ-1724、[B]NL-1847、[B]NL-23032 etc
FDA	§178.3297、§172.480 (Silica)

Please Refer to Safety Data Sheet (SDS) for your Country of Each Grade, for Handling Information.

HYDROPHOBIC SILICA

Nipsil® SS series

1. QUALITY of Nipsil® SS

SS floats ~~in~~on water.	Uncoated silica sinks in water.

Fig. 8 SS Floats ~~in~~on Water.

~~Through~~ Hydrophobic silica's can be produced by treating the surface of precipitated silica's with various organic compounds.
Compared to conventional silica, this silica repels water and is more compatible with various organic media.
As a result, resistance to water and humidity is drastically improved.

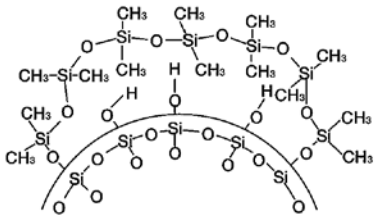
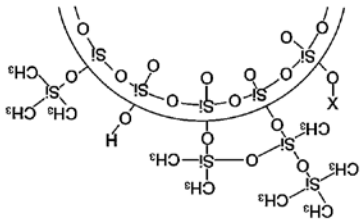


Fig. 9 Surface Structure of Nipsil® SS



SUPER WATER REPELLENCY

Hydrophobic silica ~~combination~~ has a high water contact angle.
~~According to this effect~~ Due to this feature, the water repellent performance of the coatings ~~is high,~~ and the resistance to chemicals is improved.

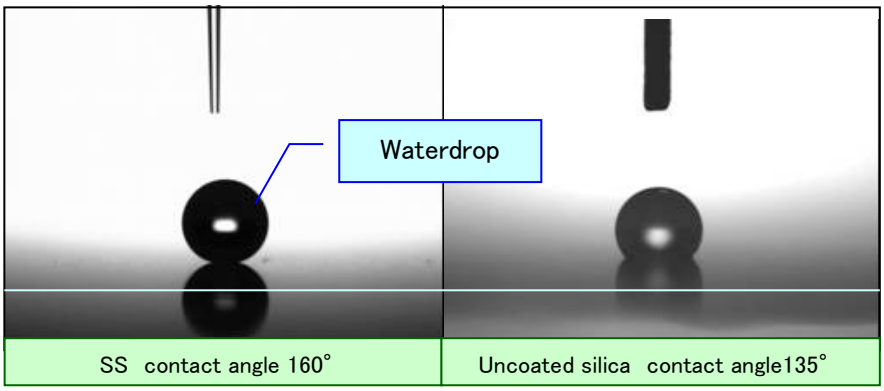


Fig. 10 Contact Angle

2. ADVANTAGE OF Nipsil® SS QUALITY IN PAINTS, LEATHERS AND INKS

SS-50series ~~**SS-55series**~~

When hydrophobic silica is blended as the matting agent for paints and gravure inks, it has the following advantages.

1. Both water-repellent performance of the coatings ~~is high,~~ and resistance to chemicals ~~is~~ are improved.
2. Hydrophobic silica ~~can~~ prevents the adsorption of the paint curing agent with the silanol group.
3. Gloss and ~~a~~ color changes and adsorption ~~with~~of the paint ingredient may be improved with the use of SS series silica.

3. ADVANTAGE OF Nipsil® SS QUALITY ANTIFOAMING AGENTS

SS-10 ~~**SS-100**~~ **SS-20** **SS-215** **SS-210A**

Blending as a nucleating agent of an antifoaming agent - for example a mineral oil system or a silicone system - improves bubble minimization and bursting.
SS-10 (basic silica is alkaline) ha~~ves~~ an excellent antifoaming effect, since it is small particle size and high hydrophobic interface.

4. ADVANTAGE OF Nipsil® SS IN SILICONE RUBBER AND SPECIAL RUBBERS

SS-30P **SS-70** ~~**SS-95**~~

~~It~~ They can be used ~~as~~for ~~a~~ reinforcing filler for RTV silicone rubbers and other special rubbers.
It is characterized by low viscosity and low compression set and improves water repellency performance and resistance to chemicals.

5. ADVANTAGE OF Nipsil® SS IN RHEOLOGY MODIFIER

SS-30P

Untreated precipitated silica loses mobility upon absorption of water.~~By carrying out light doping of SS,~~ By adding just a little SS, ~~mobility~~ fluidityis considerably improvable. It is effective also to the resin powder which form agglomerate easily.

6. GRADES AND TYPICAL PROPERTIES OF Nipsil® SS

Properties \ Grade	SS-50C	SS-50B	SS-50F	SS-178B	SS-70	SS-30P
Loss on Drying (%)	2.0	2.0	2.0	2.0	2.0	3.0
pH	8.0	8.0	8.0	8.0	8.0	7.5
Average Particle Size (μm)	2.8	2.0	1.3	3.4	5.3	9.0
	5.5	4.0	2.2	6.5	—	—
BET Specific Surface Area (m^2/g)	80	80	85	70	50	110
DBA Value (m-mol/kg)	10	10	15	10	15	15
M Value (%)※	60	60	55	60	60	60

Not Standard Value. ※M value: vol%of methanol when silica starts wetting in aqueous methanol solution.

APPLICATION FIELDS OF Nipsil® SS

	Grade	50F	50C	50B	178B	70	30P
PAINTS,LEATHER AND INKS	Matting Agent for Baked Type Paints		●		●		
	Matting Agent for Plastics Coatings	●		●	●		
	Matting Agent for Gravure Ink			●			
	Matting Agent for UV Curable Coatings	●		●	●		
OTHERS	Filler of Antifoaming Agent						
	Filler of Silicone Rubber ,Special Rubber					●	●
	Anti-caking agents, flow agents						●

Table.3 Chemical Composition of Nipsil®SS.

	SS-10	SS-30P	SS-50
SiO_2 (%)	92.4	93.2	92.0
Al_2O_3 (%)	0.10	0.40	0.92
Fe_2O_3 (%)	0.04	0.04	0.55
TiO_2 (%)	0.06	0.06	0.06
CaO (%)	0.01	0.01	0.01
MgO (%)	0.01	0.01	0.01
Na_2O (%)	1.73	0.30	0.31
SO_4^{2-} (%)	0.11	0.08	0.06

*Ignition Base

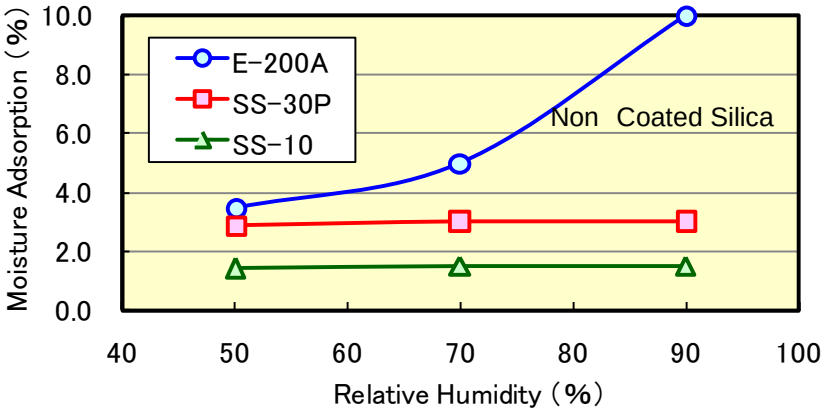


Fig.11 Adsorption Isotherm of Nipsil® SS.

SS-10	SS-20	SS-210A	Testing Method
1.5	2.0	1.5	105℃×2hr
11.5	7.5	10.0	4%Susp.
2.5	2.0	2.4	Coulter Counter Method (AP:30μm)
—	—	—	Laser Method
90	100	100	N_2 Adsorption Method
5	20	5	—
65	60	60	—

10	20	210A
●	●	●
	●	

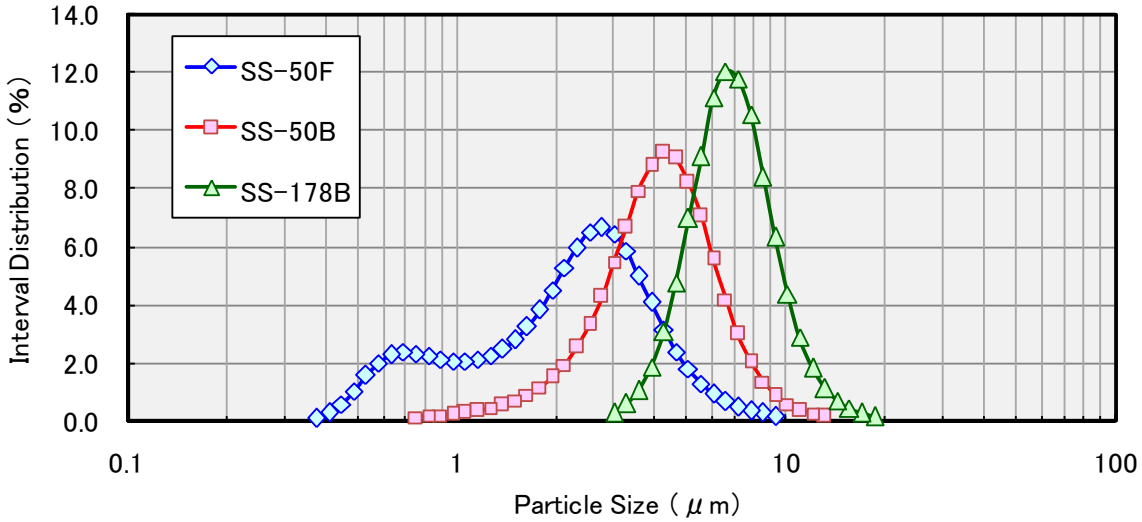


Fig.12　Particle Size Distribution of Nipsil® SS (Laser Method)

TOSOH SILICA CORPORATION

Head Office : Shiba-Koen ND Bldg. 2-5-10, Shiba, Minato-ku,Tokyo
105-0014, JAPAN TEL 81-3-5446-2837 FAX 81-3-5446-5570

Production bases : 4560, Kaisei-cho, Syunan-si, Yamaguchi
746-0006, JAPAN TEL 81-834-62-3564

Marketing Division
Printed in Japan 2019.08.02

For USA Sales:

Tosoh USA, Inc.
www.tosohusa.com
info.tusa@tosoh.com

For European Sales:

Tosoh Europe B.V.
www.tosoheurope.com
info.tse@tosoh.com