PRODUCT OVERVIEW

AEROSIL®

AEROSIL® Fumed Silica

EVONIK
POWER TO CREATE

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SURFACE CHEMISTRY IS JUST AS DELICATE AS WALKING ON WATER

AEROSIL® – MORE THAN JUST A POWDER

AEROSIL® optimizes

- Silicone sealants
- Adhesives
- Sealants
- Wind turbines
- Unsaturated polyesters
- Thermal insulation
- Ceramics
- Metal treatments
- Greases and lubricants
- Cable gels
- Shoe soles
- Mechanical rubber goods
- Paper coatings

- Powder coatings
- Marine paints
- Architectural paints
- Wood coatings
- Printing inks
- 3D Printing
- Inkjet paper
- Toner for copiers and laser printers
- Concrete
- Defoamer
- Battery gels
- Li-Ion batteries
- Lighting

- Electronic and displays
- Airbags
- Foils and films
- Oil and gas
- Ground herbs and spices
- Creams, lotions, and gels
- Deodorants
- Toothpastes
- Dental composites and fillers
- Tablets
- Fire-resistant glass

For more than 75 years, people at Evonik have been working for, on, and with AEROSIL®. They promise their customers a lot – after all, the claim of the AEROSIL® brand is "Invented to improve." How could Evonik keep this promise successfully over time?

The worldwide success of AEROSIL® is based on the particular strengths of the product and the people behind AEROSIL®. They invented AEROSIL® products and keep re-inventing material: modifications, exploring new effects and realizing those effects at new applications.

The service provided for the product family is unique in the world, since scientists and engineers at Evonik are mastering the technology. The challenge is to optimize the AEROSIL® production process as well as a smooth transfer of AEROSIL® to the customers' production lines.
Both challenges are handled with support in the fields of research, applied technology and handling.
Continuous improvement is the result of our effort.

Continuous improvement of the products themselves, the goal for the AEROSIL® team is to help the customers to succeed in their markets by optimizing their processes with AEROSIL®. This approach is needed to perform outstanding.

It's simply reassuring to work together with AEROSIL® experts who not only focus on reliability and security but also **on-time delivery, product safety, quality assurance at the highest level worldwide.**

Worldwide can be taken literally in the AEROSIL® world. AEROSIL® is produced in eight production sites throughout the world based on the same strict quality regulations.

If a brand is able to lead the market in the chemical industry for more than 75 years, it is about trust of the customer which has to be compiled throughout time. We are proud of our long-term relationships. Loyal partnerships only can be achieved when customers get more than just white powder.

AEROSIL®. Inside, to get it right.

Change in paper bag over the period of 75 years. AEROSIL® fumed silica.

WHEN IT COMES TO EXTREME TEMPERATURE FLUCTUATIONS, AEROSIL® KEEPS YOU ALWAYS WELL INSULATED.

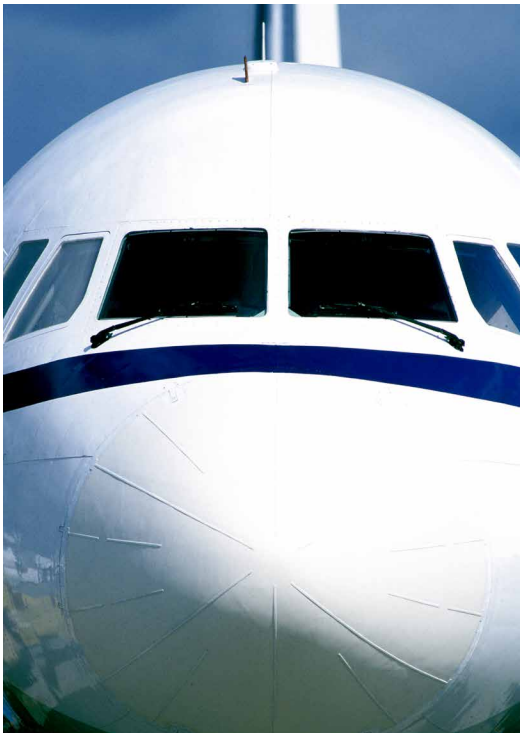
AEROSIL® fumed silica is used in the applications adhesives and sealants to bond and seal cockpits, fuel tanks and pressurized cabins.

Along with the traditional polyester, silicone, paints and coatings applications, hydrophilic AEROSIL® products are used with increasing success in high technology fields. To meet these needs several grades have been developed with especially high chemical purity and distinctive particle nature.

Furthermore, the hydrophilic AEROSIL® grades are characterized by an amorphous structure (determined by X-ray diffraction and high resolution TEM). Depending on the market and application, products with different BET surface areas. Certain types are also available as densified, pharmaceutical, or food grades.

Positive Effects:

- Optimum adjustment of rheology during processing
- Reinforcement of silicone elastomers
- Thickening of non-polar liquids
- Free-flow of foodstuffs and industrial powders
- High chemical purity
- Excellent insulation properties, even at high and low temperatures
- Conversion of liquids to powders, e.g. pharmaceuticals, cosmetics
- Gelification of battery acids
- Rheology control of greases and lubricants



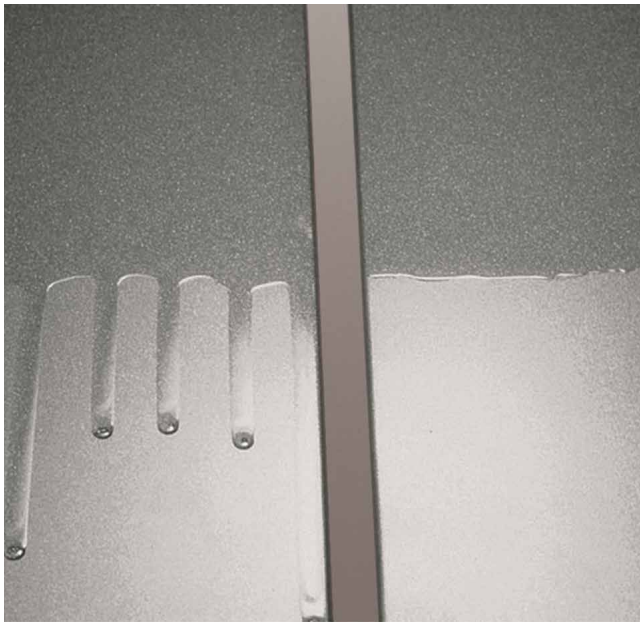
Window frames containing AEROSIL® products exhibit temperature stability even in extreme conditions.

Hydrophilic Fumed Silica

AEROSIL® GRADES	BET SURFACE AREA [m²/g]	LOSS ON DRYING [wt.%]	pH VALUE
AEROSIL® 90	75–105	≤1.0	3.7–4.7*
AEROSIL® 130	105–155	≤1.5	3.7–4.5*
AEROSIL® 150	135–165	≤1.5	3.7–4.5
AEROSIL® 200	175–225	≤1.5	3.7–4.5*
AEROSIL® 200 F	175–225	≤1.5	3.7–4.5
AEROSIL® 200 Pharma	175–225	≤2.5**	3.5–5.5**
AEROSIL® 200 V	175–225	≤1.5	3.7–4.5
AEROSIL® 200 VV Pharma	175–225	≤2.5**	3.5–5.5**
AEROSIL® 255	230–280	≤1.5	3.7–4.5
AEROSIL® 300	270–330	≤1.5	3.7–4.5*
AEROSIL® 300 Pharma	270–330	≤2.5**	3.5–5.5**
AEROSIL® 380	350–410	≤2.0	3.7–4.5*
AEROSIL® 380 F	350–410	≤2.0	3.7–4.5
AEROSIL® OX 50	35–65	≤1.5	3.8–4.8
AEROSIL® TT 600	150–250	≤2.5	3.6–4.5
AEROPERL® 300/30	270–330	≤3.5	4.0–6.0
AEROPERL® 300 Pharma	260–320	≤2.5**	3.5–5.5**

*Typical values for informational purposes only * Narrower range possible ** Tested according to USP/NF and Ph.Eur.*

AEROSIL® IMPROVES THE RHEOLOGICAL PROPERTIES IN NUMEROUS APPLICATIONS.



Application properties of a coating. (left) reference (right) containing 0.5 % of AEROSIL® R 816

Numerous grades of hydrophobic AEROSIL® fumed silica have been developed to solve particular technical problems. AEROSIL® hydrophobic fumed silica is produced by a chemical treatment of hydrophilic grades with silanes or siloxanes. In the finished product, the treatment agent is chemically bonded to the former hydrophilic oxide.

AEROSIL® hydrophobic products are characterized, among other things, by a low moisture adsorption, excellent dispersibility and their ability to adjust rheological behavior, even that of polar systems.

AEROSIL® grades such as R 7200, R 8200 and R 9200 undergo additional structural modification ideal for higher loading levels without impacting the viscosity.

These properties are especially useful in generating scratch resistance effects.

Positive Effects:

- Optimum rheology during processing
- Thickening of polar liquids, e.g. epoxy resins
- Reinforcement of silicone elastomers
- High levels of loading, e.g. molding compounds
- Excellent water-repelling properties leading to improved corrosion protection
- Improvement of dielectric properties, e.g. in cable compounds
- Free-flow of powders, e.g. in fire extinguishers
- Increased scratch resistance, e.g. of paints and plastics

Reinforcement of silicone elastomer

AEROSIL®: strong in improving rheological properties

Hydrophobic Fumed Silica

AEROSIL® GRADES	BET SURFACE AREA [m²/g]	LOSS ON DRYING [wt.%]	pH VALUE	CARBON CONTENT [wt.%]
AEROSIL® R 972	90–130	≤ 0.5	3.6–5.5 *	0.6–1.2 *
AEROSIL® R 972 Pharma	90–130	≤ 0.5 **	3.6–5.5**	0.6–1.2**
AEROSIL® R 972 V	90–130	≤ 0.5	3.6–5.0	0.6–1.2
AEROSIL® R 974	150–190	≤ 0.5	3.4–5.0	0.9–1.5
AEROSIL® R 976	225–275	≤ 1.0	3.8–5.0	1.3–2.2
AEROSIL® R 976 S	215–260	≤ 0.5	4.0–5.5	1.8–2.7
AEROSIL® R 104	125–175	≤ 1.5	≥ 4.0	1.0–2.0
AEROSIL® R 106	220–280	≤ 0.5	≥ 3.7	1.4–3.0
AEROSIL® R 202	80–120	≤ 0.5	4.0–6.0	3.5–5.0
AEROSIL® R 208	80–140	≤ 0.5	4.5–6.5	4.5–6.5
AEROSIL® R 805	125–175	≤ 0.5	3.5–5.5	4.5–6.5
AEROSIL® R 812	230–290	≤ 0.5	5.5–8.0	2.0–3.0
AEROSIL® R 812 S	195–245	≤ 0.5	5.5–9.0	3.0–4.0
AEROSIL® R 816	170–210	≤ 1.0	4.0–5.5	0.9–1.8
AEROSIL® R 7200	125–175	≤ 1.5	4.0–6.0	4.5–6.5
AEROSIL® R 8200	135–185	≤ 0.5	≥ 5.0	2.0–4.0
AEROSIL® R 9200	150–190	≤ 1.5	3.0–5.0	0.7–1.3
AEROSIL® R 711	125–175	≤ 1.5	4.0–6.0	4.5–6.5

*Typical values for informational purposes only * Narrower range possible ** Tested according to USP/NF and Ph. Eur.*

FROM AN OPTICAL PERSPECTIVE AEROSIL® ADDS CLARITY.

AEROSIL® MOX grades are recommended for the production of highly-loaded, low viscous, aqueous dispersions. The fumed mixed oxides are manufactured using a co-fumed process and may be regarded as a mixture of SiO_2 and Al_2O_3 on the molecular level.

AEROSIL® COK 84 is a physical mixture of SiO_2 and Al_2O_3 which provides strong thickening effects in aqueous media.

Positive Effects:

- High-loading levels of AEROSIL® MOX grades in dispersions
- Strong thickening effect in polar media with AEROSIL® COK 84
- Catalyst support
- Rheology control of greases and lubricants

Fumed Mixed Oxides

AEROSIL® GRADES	BET SURFACE AREA [m^2/g]	LOSS ON DRYING [wt.%]	pH VALUE	CHEMICAL COMPOSITION
AEROSIL® MOX 80	60–100	≤1.5	3.6–4.5	SiO_2/Al_2O_3
AEROSIL® MOX 170	140–200	≤1.5	3.6–4.5	SiO_2/Al_2O_3
AEROSIL® COK 84	155–215	≤1.5	3.6–4.3	SiO_2/Al_2O_3

Typical values for informational purposes only

AEROXIDE® EXTREMELY POW(D)ERFUL

The AEROSIL® manufacturing process can also be applied to produce fumed aluminum and titanium oxides.
The treatment processes mentioned previously are also applicable here and result in a wide range of fine particle products with extraordinary properties.

AEROXIDE® Alu C is a pure aluminum oxide with a hydrophilic character. Their primary use is as a free-flow agent and it regulates triboelectric effects.

AEROXIDE® TiO_2 P 25 is a titanium dioxide without pigment properties. Due to its purity and fine particle size, it may be used as a catalyst support or as a heat stabilizer for silicone rubber.

Positive Effects:

- Free-flow in powder coatings
- Heat stabilization of silicone elastomers
- Optimization of adsorption properties, e.g. inkjet applications
- Improvement of safety and performance of LIB batteries

AEROXIDE® fumed metal oxides are used as advanced additives in lead acid and Li-ion batteries to increase the performance, life-time and safety of the battery.

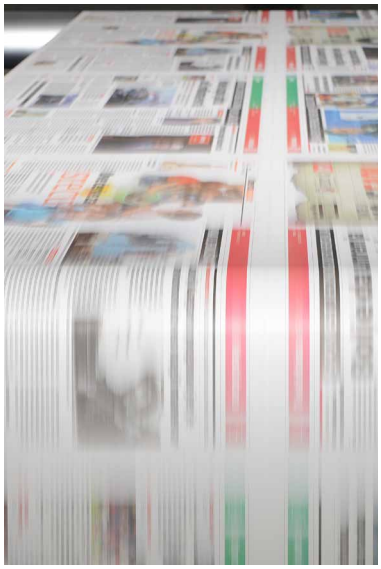
Hydrophilic Fumed Metal Oxides

AEROSIL® GRADES	BET SURFACE AREA [m^2/g]	LOSS ON DRYING [wt.%]	pH VALUE	CHEMICAL COMPOSITION
AEROXIDE® Alu C	85–115	≤ 5.0	4.5–5.5	Al_2O_3
AEROXIDE® Alu 65	55–75	≤ 5.0	4.5–6.0	Al_2O_3
AEROXIDE® Alu 130	110–150	≤ 5.0	4.4–5.4	Al_2O_3
AEROXIDE® TiO_2 P 25	35–65	≤ 1.5	3.5–4.5	TiO_2
AEROXIDE® TiO_2 P 90	70–110	≤ 4.0	3.2–4.5	TiO_2
AEROXIDE® TiO_2 PF 2	45–70	≤ 2.0	3.5–4.5	TiO_2 / Fe_2O_3

Typical values for informational purposes only

AERODISP® MIXING YOUR LIFE EASIER

AEROSIL® is used as a rheology modifier in coatings and adhesives formulations, among others. Dispersions are easy to mix with other components.



Dispersions used in the paper industry.

Evonik has extensive knowledge, sophisticated equipment and many years of experience, which are necessary to produce high quality dispersions.

AERODISP® is the ideal solution for the dust-free handling of AEROSIL® fumed silica and AEROXIDE® fumed metal oxides. A special manufacturing process and many years of know-how enable us to provide these products in an exceptional state of dispersion.

Positive Effects:

- High ink absorptivity in photo inkjet papers
- Improved surface properties for cleaning, polishing and coating of metals, paper, textiles etc.
- Improved mechanical properties of latex rubber
- Optimized adhesion properties of self-adhesive labels
- Improved optical properties of wood stains
- Optimized rheological properties of paints, varnishes and battery gels
- Enhanced anti-blocking effect in PET-film

AERODISP® Dispersions

AERODISP® GRADES	SOLIDS CONTENT [1] [wt.%]	pH VALUE [2]	VISCOSITY [mPas]	DENSITY [g/cm³]	STABILIZING AGENT/REMARKS
SiO_2 DISPERSIONS, ALKALINE					
AERODISP® W 7520	20	9.5–10.5	≤100	1.12	Ammonia
AERODISP® W 7520 N	20	9.5–10.5	≤100	1.12	Sodium hydroxide
AERODISP® W 7520 P	20	9.0–10.0	≤300	1.12	Caustic Potash
AERODISP® W 7622	22	9.5–10.5	≤1000	1.13	Ammonia
AERODISP® W 1226	26	9.0–10.0	≤100	1.16	
AERODISP® W 1244	48	10.6–11.2	≤200	1.41	Caustic Potash
VP Disp. W 1250	50	9.5–10.5	≤2000	1.38	Ammonia
AERODISP® W 7330 N	30	9.5–10.5	≤1000	1.20	Sodium hydroxide
AERODISP® WR 8520	20	10.0–11.0	≤100	1.13	DMEA
AERODISP® W 7225 P	25	9.8–10.8	≤300	1.16	Caustic Potash
SiO_2 DISPERSIONS, ACIDIC					
AERODISP® W 1714	14	5.0–6.0	≤100	1.08	Phosphate/[3]
AERODISP® W 1824	24	5.0–6.0	≤150	1.15	Phosphate/[3]
AERODISP® W 1836	34	4.0–6.0	≤200	1.23	Phosphate/[3]
AERODISP® W 7512 S	12	5.0–6.0	≤100	1.07	Ammonia
SiO_2 DISPERSIONS, CATIONIC					
AERODISP® WK 7330	30	2.5–4.0	≤1000	1.20	Cationic Polymer/[3]
Al_2O_3 DISPERSIONS					
AERODISP® W 630	30	3.0–5.0	≤2000	1.26	
AERODISP® W 440	40	3.0–5.0	≤1000	1.38	
AERODISP® W 925	25	3.0–5.0	≤1000	1.20	
TiO_2 DISPERSIONS					
AERODISP® W 740 X	40	5.0–7.0	≤1000	1.41	
VP Disp. W 2730 X	30	6.0–8.0	≤5000	1.28	
SiO_2 DISPERSIONS					
AERODISP® G 1220	20	–	≤300	1.23	Ethylene Glycol
VP Disp. G 6020 X	20	–	≤200	1.24	Ethylene Glycol

Further dispersions (aqueous/non-aqueous) of hydrophilic and hydrophobic silica and metal oxides are available on request.
Typical values for informational purposes only

[1] *Solid contents may vary +/-1 %*
[2] *Measured according to EN ISO 787-9 method*
[3] *Stabilized with small amounts of aluminum compounds.*

Developmental products are labeled with the VP Disp. designation. Their commercialization depends on market response. Even though they are produced in commercial quantities, future availability should be verified. In some cases, these products may not have undergone complete testing.

SPECIAL HYDROPHOBIC SILICA AND HYDROPHOBIC METAL OXIDES

Specialized industries have different requirements for fumed oxides with specific properties. In order to fulfill these high technical requirements, combinations of different raw materials (SiO_2, Al_2O_3 or TiO_2), surface treatments and many manufacturing processes are employed.

The R and N grades of AEROSIL® products listed below can be used to regulate flow tribo-charge and stability of toner for copiers and laserprinters. AEROXIDE® TiO_2 T 805, an efficient UV-filter, is characterized by its ease of dispersibility and low moisture adsorption.

AEROXIDE® Alu C 805 is especially recommended for moisture sensitive powder coating and battery applications.

Positive Effects:

- Regulation of toner tribo-charge
- Free-flow agent for toner
- Improved storage stability of toner
- Loading levels in dental composites
- Effect for the self-cleaning of surfaces
- Increased heat stability of silicone elastomers

AEROSIL® AND AEROXIDE® GRADES	BET SURFACE AREA [m^2/g]	pH VALUE	CARBON CONTENT [wt.%]	CHEMICAL COMPOSITION
AEROSIL® RY 50	15–45	4.5–7.5	3.0–4.5	SiO_2
AEROSIL® NY 50	20–40	5.0–6.0	2.5–3.8	SiO_2
AEROSIL® RY 200	80–120	4.0–7.0	4.0–6.5	SiO_2
AEROSIL® RY 200 S	65–95	4.5–6.5	3.5–5.0	SiO_2
AEROSIL® RY 200 L	80–120	4.0–7.0	4.0–6.6	SiO_2
AEROSIL® RY 300	110–140	4.5–5.5	7.0–8.0	SiO_2
AEROSIL® RX 50	25–45	6.0–8.0	0.5–1.0	SiO_2
AEROSIL® NAX 50	30–50	5.5–7.5	0.5–1.0	SiO_2
AEROSIL® RX 200	115–165	5.5–8.5	2.0–3.0	SiO_2
AEROSIL® RX 300	180–220	6.0–8.0	3.0–4.0	SiO_2
AEROSIL® R 504	125–175	8.5–11.0	2.0–4.5	SiO_2
AEROSIL® NX 90 S	50–70	5.0–7.5	0.8–1.2	SiO_2
AEROSIL® NX 90 G	50–80	5.0–7.5	0.7–1.5	SiO_2
AEROSIL® NX 130	80–120	5.5–7.5	1.0–2.0	SiO_2
AEROSIL® REA 200	110–150	8.0–10.0	5.0–7.5	SiO_2
AEROSIL® REA 90	40–70	7.5–10.0	3.0–6.0	SiO_2
AEROSIL® NA 50 Y	25–45	6.5–9.0	2.0–4.0	SiO_2
AEROSIL® NA 200 Y	100–150	6.5–9.5	3.5–6.5	SiO_2
AEROSIL® NA 50 H	30–50	8.0–10.0	≤2.0	SiO_2
AEROSIL® RA 200 HS	120–160	8.0–10.0	≤3.5	SiO_2
AEROSIL® NA 130 Y	50–80	6.5–9.5	5.0–7.5	SiO_2
AEROXIDE® TiO_2 T 805	35–55	3.0–4.0	2.7–3.7	TiO_2
AEROXIDE® Alu C 805	75–105	3.0–4.5	3.5–4.5	Al_2O_3
AEROXIDE® TiO_2 NKT 90	50–75	3.0–4.0	2.5–4.5	TiO_2
AEROXIDE® STX 501	25–45	6.0–9.5	0.2–1.0	TiO_2 / SiO_2
AEROXIDE® STX 801	45–65	6.0–9.0	0.7–1.1	TiO_2 / SiO_2

The data represents typical values. Special products can be developed and delivered on demand.
Developmental products are labeled with the VP designation. Their commercialization depends on market response. Even though they are produced incommercial quantities, future availability should be verified. In some cases, these products may not have undergone complete testing.

For us, handling includes emptying of packaging units, storage in silos, conveying within the plant, dosing and incorporating AEROSIL® fumed silica into the processing equipment.

Typical bag packaging of Evonik. AEROSIL® fumed silica.

PACKAGING AND HANDLING

Our expertise is concentrated on applications

Standard Packaging

AEROSIL® products are supplied in a multi-layer paper bag and are equipped with a polyethylene coating on one layer. The net weight of these bags are neither 10 kg, 15 kg or 20 kg (also 20 lbs paper bags in NAFTA available), depending on the AEROSIL® grade and their corresponding tapped density.

Flexible Intermediate Bulk Container (FIBC)

Evonik also delivers AEROSIL® products in FIBCs. These are flexible containers made of woven polypropylene bands, with loops attached to the upper corners for lifting purposes. The valve used to empty the container is located in the center of the base and is adapted to Evonik´s uniquely-designed Powder Emptying System (PESy). This system is available to our customers and enables the simple and dust-free emptying of our product. The quantity delivered varies according to the product.

Silo Transport

When large amounts of AEROSIL® fumed silica are required, delivery by silo transport is another option. While silotruck shipment is standard practice in Europe and Japan, the use of railcars prevails in NAFTA. Bulk-delivered quantities vary by transport equipment and product.

Thermal Packaging for AERODISP®

AERODISP® dispersions are available in 60 kg canisters, 220 kg drums and in 1000 kg Intermediate Bulk Containers, IBC. Depending on the region and season, additional thermal insulation packaging is used.

Compaction Technology

Certain AEROSIL® grades are also available in a compacted form under the names AEROSIL® V and AEROSIL® VV. The densification process is carried out by means of a vacuum combined with mechanical pressure. AEROSIL® V and AEROSIL® VV differ from each other with respect to the compaction technology used (for details please check AEROSIL® website or contact our business managers).

AEROPERL® Technology

Upon request, certain hydrophilic and hydrophobic fumed oxides can be delivered in granulated form. These products are manufactured using a specially-developed AEROPERL® process. AEROPERL® products display a high tapped density, good abrasion resistance and a high moisture adsorption. Products manufactured according to the AEROPERL® process exhibit excellent free-flow behavior and handling properties.

Storage Stability

We recommend all AEROSIL® grades to be stored in closed containers under dry conditions, protected from volatile substances and processed within 1 to 2 years after manufacture. AERODISP® dispersions should be protected from heat and frost and should be processed within 6 to 24 months after manufacturing date, depending on the grade. The date of production can be determined via the control number printed on each packaging unit.

THE ADVANTAGE OF A GLOBAL ENTERPRISE–LOCAL PROXIMITY

THE ADVANTAGE OF A GLOBAL ENTERPRISE–LOCAL PROXIMITY

In almost every country in the world, Evonik has experts to give customers help and advice: The AEROSIL® sales team. Evonik produces AEROSIL® on three continents. Research centers and applied technology in Germany, the USA, Japan, India, Singapore and China help find the best solution. Beyond those facts local proximity is represented literally: we are close to our customers.

It is a supplier's duty to understand the customers' wishes and fulfill them on a constant basis and solve any problems. From paints to pharmaceuticals, toners to thermal insulation–customer proximity is the key that opens many doors to innovative companies in many different industries for the market leader AEROSIL® over the past 75 years.

AEROSIL®. Inside, to get it right.

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