

AEROSIL[®] fumed silica and SIPERNAT[®] specialty silica for detergents and cleaning products

Industry Information 2246



AEROSIL® fumed silica and SIPERNAT® specialty silica: a solution for rising consumer expectations

Hygienic and clean homes are essential to modern life. Expectations of consumers on their home care and laundry products have changed rapidly. It is not enough anymore that these products are efficient and easy to apply. In addition consumers also expect them to be safe and environmentally friendly.

Rising consumer expectations make it difficult for producers of home and institutional-care products to formulate with traditional raw materials on new formulations. These formulations can be liquids, powder products, and water-free concentrates, depending on application and consumer expectation. These new product requirements can be solved using specialty silica products like AEROSIL® and SIPERNAT®.

AEROSIL® fumed silica and SIPERNAT® precipitated silica are fine white powders consisting of amorphous silicon dioxide. Because of the amorphous nature of these products they are non-hazardous as certified by competent authorities. Different production processes for the two product families result in products with a wide range of diverse and unique properties. This offers the industry a wide range of solutions for the various applications. Evonik Industries as a global leader in silica technology is the only company offering both silica types globally. Benefits using AEROSIL® fumed and SIPERNAT® precipitated silica products include:

- High absorption capacity, enabling even more compact, sustainable and economical powder formulations
- Carrier function, making it easier to process liquid ingredients into powder formulations
- Rheology modification, leading to more stable and easier to dose liquid formulations
- Improving flowability and reducing caking tendency of powders, simplifying powder production processes and optimizing consumer experience

SIPERNAT® specialty silica: porous silica with high absorption capacity

Additives such as surfactants, perfume oils, and enzymes are widely used in the home care industry, especially in powdered laundry detergents. These are typically liquids that have to be incorporated into a complex powder or granulate pre-mix. SIPERNAT® specialty silica helps to transform liquids or pastes into highly concentrated free flowing powders. Furthermore it facilitates the incorporation of temperature sensitive ingredients or enables the combination of ingredients with incompatibilities.

SIPERNAT® silica products offer a highly porous structure with an interconnected capillary network similar to a sponge (Figure 1). The small diameter of the pores leads to high capillary forces that draw the liquid into the particle. This purely physical absorption mechanism is independent of the chemical characteristics of the liquid; therefore both polar as well as non-polar liquids can be absorbed. The finished absorbate can contain between 50–75% of the liquid actives; silica thus outperforms other traditional solids used in powder detergent formulations. Particle shape, flow optimization, dust profile, and caking characteristics of the finished absorbate are driven by the silica properties.

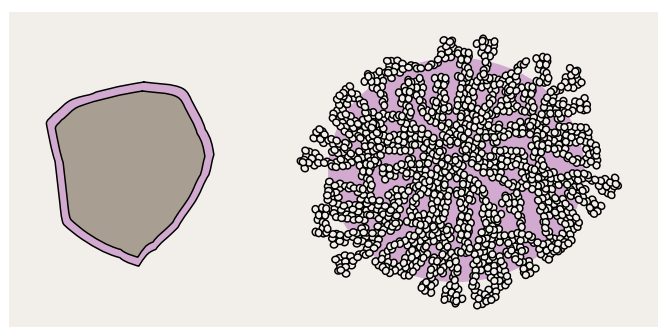


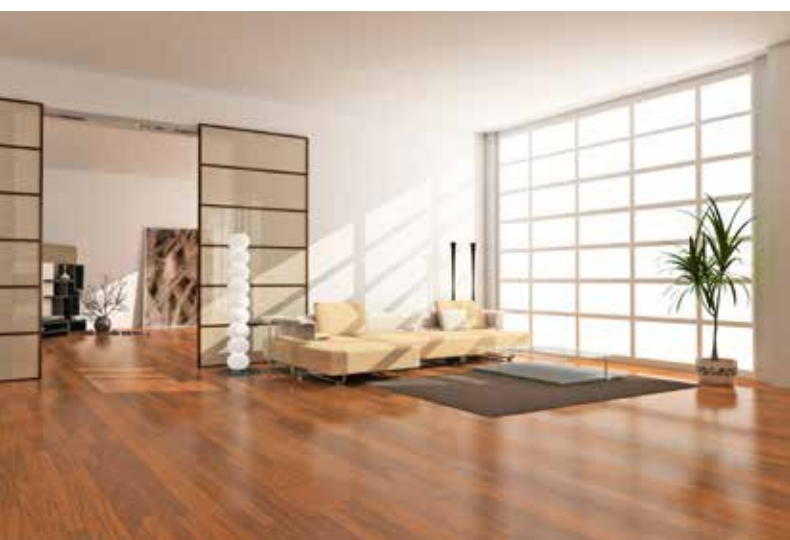
Figure 1
Schematic depiction of liquid at the surface of a non-porous particle (left) and of liquid absorbed in the pores of SIPERNAT® specialty silica (right)

General

SIPERNAT® specialty silica is available in a range of different aggregate sizes and specific surface areas. The variation of structure in the material leads to various absorption capacities of the material as exemplified by the DOA absorption value.

SIPERNAT® carrier-product overview

Product name	DOA Absorption (ml/100g)	Particle size (d50, µm)	BET surface area (m ² /g)	Tamped density (g/l)
SIPERNAT® 50	305	40	475	180
SIPERNAT® 50 S	290	18	500	100
SIPERNAT® 340	235	30	175	160
SIPERNAT® 22	260	110	190	260
SIPERNAT® 22 S	265	11.5	190	90
SIPERNAT® 2200	250	320	185	250



AEROSIL® fumed silica: versatile rheology control

For many liquid laundry detergents, automatic dishwashing liquids, or liquid household cleaners certain rheological profiles are desired for better performance and handling. Rheology also plays a role in stability allowing for better handling, dosing, and storage. The special structure and versatile nature of AEROSIL® fumed silica efficiently and reliably modifies the rheology of many different liquid formulations independent of typical formulation effects (e.g. high salt or builder content, pH value, organic solvents, low water content or water free, oil content, dispersed particles). In such liquids AEROSIL® particles build up a three-dimensional network from agglomerated silica aggregates (Figure 2), thereby increasing the viscosity. Under mechanical stress (stirring, shaking or spreading) the network breaks down and the viscosity decreases. Once again at rest, the network re-builds, giving rise to an increase of the viscosity. This process is known as non-Newtonian or shear thinning behavior.

The same three-dimensional networks of AEROSIL® fumed silica can help to stabilize dispersed particles (Figure 3) in liquid or semi-liquid formulations (chelating agents in dishwashing gels, abrasives in polishers, micro perfume capsules in laundry detergents) and prevent them from sedimentation. The formation and stability of the three dimensional network is influenced by the strength of the

connecting forces of the AEROSIL® particles as well as the interaction of AEROSIL® particles with the liquid matrix. Therefore, the optimal AEROSIL® chemistry and concentration needs to be determined for each formulation type. The desired rheological effect can often be obtained at low concentrations, usually at 2–5% of the formulation. The wide range of surface modifications offers a solution for almost any matrix. The particle networks have a high level of effectiveness for water free or low water containing formulations.

General rule of thumb

Liquid solvent (main component)	AEROSIL® type
non – polar liquids e.g. silicon oil, paraffin oil, mineral oil	hydrophilic AEROSIL® type e.g. AEROSIL® 200, AEROSIL® 300
polar liquids e.g. ethylene glycol, propylene glycol, glycerin	hydrophobic AEROSIL® type AEROSIL® R 972, AEROSIL® R 816

Dry emulsions

Hydrophobic AEROSIL® products are able to turn aqueous formulations into a dry, free flowing powder with an extremely high water content of up to 95%. The water droplets are coated by the AEROSIL® particles and prevent them from coalescing, making a water in air silica emulsion (Figure 4).

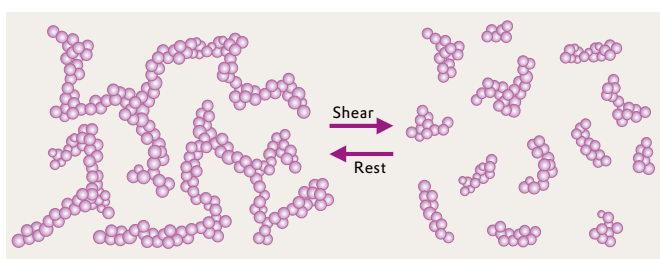


Figure 2
Mechanism of thickening of AEROSIL® fumed silica

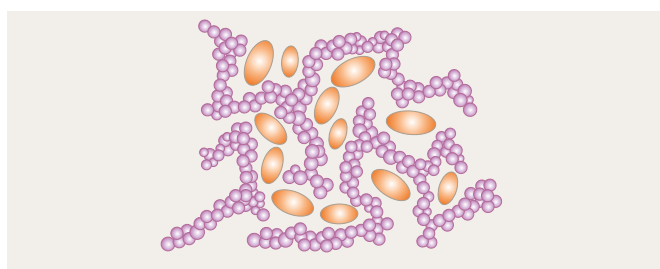


Figure 3
Schematic representation of particles stabilized in three dimensional network of AEROSIL® fumed silica

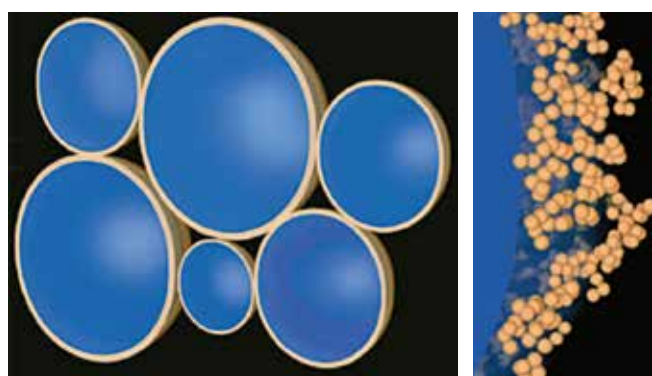


Figure 4
Schematic depiction of Dry Emulsion (left) and close-up silica layer (right)

We can use the same effect as well for foam stabilization. In this case air bubbles are coated by hydrophobic AEROSIL® particles, leading to an extremely stable foam.

General

AEROSIL® is a fumed, highly-dispersed and amorphous synthetic silica. It is available in a wide range of different specific surface specifications and surface modifications. Products of hydrophilic and hydrophobic surface character (AEROSIL® R products) are produced. For easier handling some products are also available in the form of stable dispersions (AERODISP® range).

AEROSIL® fumed silica	BET surface area (m ² /g)	Tamped density (g/l)
hydrophilic products		
AEROSIL® 200	200±25	approx. 50
AEROSIL® 300	300±30	approx. 50
AEROSIL® 380	380±30	approx. 50
hydrophobic products		
AEROSIL® R 972	110±20	approx. 50
AEROSIL® R 974	170±20	approx. 50
AEROSIL® R 805	150±25	approx. 50
AEROSIL® R 816	190±20	approx. 50



AEROSIL® and SIPERNAT® products as spray drying aids

Powdered laundry detergents are traditionally produced by spray drying processes. During production caking can occur on the inner wall of the spray tower which makes regular cleaning necessary. The addition of AEROSIL® and SIPERNAT® products directly into the spray tower, separately from the slurry, covers the surface of the dried particle and prevents them from sticking together. They also can absorb liquid during the drying process, thus improving the dryer's efficiency.

AEROSIL® and SIPERNAT® products as flow and anticaking aid

Mixing just a small percentage (1–2 w/w%) of AEROSIL® or SIPERNAT® silica products into powders can remarkably improve their powder flowability. Better powder flow can facilitate storage, dosing and packaging. The effect is achieved by separating powder particles from each other and thereby decreasing inter-particle forces or by removing liquid bridges that hold the powder particles together.

Internet and literature service

- Please visit our websites www.aerosil.com and www.sipernat.com
- Specialty silica as flow aid, anticaking agent and as carrier substance – Recommended mixing procedures from powders and granulates, Technical Information TI 1213
- Successful use of AEROSIL® fumed silica in liquid systems, Technical Information TI 1279
- SIPERNAT® specialty silica and AEROSIL® fumed silica as flow and anticaking agent, Technical Information TI 1351
- SIPERNAT® specialty silica and AEROSIL® fumed silica in spray drying applications, Technical Information TI 1365

Handling, packaging and storage

Packaging & handling

AEROSIL® and SIPERNAT® products are delivered in multiply bags of various weights, depending on the product and market. We also offer certain silica products in semi-bulk packaging – the FIBC (Flexible Intermediate Bulk Container). The FIBC option offers dust-free discharge, requires less manual labor (compared to paper bags) and eliminates any possible risk of external contamination in a closed system. Bulk deliveries are available as well. For more information on packaging, please request our Technical Information 1232 “Types of Packaging for Performance Silica”, the Technical Information 1231 “Packaging Forms for AEROSIL®”, the Technical Information 1219 “Semi-bulk Packaging for AEROSIL®” or the Technical Information 1321 “Semi-bulk Packaging for fine particle SIPERNAT® products”. Several options for dust free and automated handling (conveying, dosing, feeding, etc.) into both solid or liquid systems are possible. For more detailed Information regarding the handling of silica, please request our Technical Bulletin Fine Particles No 28 “Handling of synthetic silica and silicate”.

Storage

Although AEROSIL® and SIPERNAT® products are largely chemically inert and their composition does not change chemically over time, their high specific surface area could result in the adsorption of volatile substances (in case of moisture, this adsorption is reversible). For this reason, we recommend storing all AEROSIL® and SIPERNAT® products in a dry place, protected from moisture and organic vapors. For more detailed Information regarding the stability of silica please request the corresponding Product Information. During prolonged periods of storage, AEROSIL® fumed silica and SIPERNAT® specialty silica may become slightly compacted. This can lead to a minor increase in tamped density, affecting the related product properties.

Please contact a sales agent in your area for detailed product, packaging, handling or storage specific information.





The Advantage of a Global Company: Local Proximity

As one of the world's leading manufacturers of specialty chemicals, Evonik bases its management philosophy on being as decentralized as possible, and as centralized as necessary. This decentralized organization is evident at all levels and divisions, which are divided into operating units able to respond to market needs quickly, flexibly and with the customer in mind.

The Business Unit Silica – one of the most important manufacturers of colloidal silicon dioxide – takes advantage of the global presence of Evonik.

AEROSIL® and SIPERNAT® production plants, technical service centers, and research centers are located in all regions of the world. With distributors located worldwide, we guarantee that you will enjoy the best possible service.

This information and any recommendations, technical or otherwise, are presented in good faith and believed to be correct as of the date prepared. Recipients of this information and recommendations must make their own determination as to its suitability for their purposes. In no event shall Evonik assume liability for damages or losses of any kind or nature that result from the use of or reliance upon this information and recommendations. EVONIK EXPRESSLY DISCLAIMS ANY REPRESENTATIONS AND WARRANTIES OF ANY KIND, WHETHER EXPRESS OR IMPLIED, AS TO THE ACCURACY, COMPLETENESS, NON-INFRINGEMENT, MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE (EVEN IF EVONIK IS AWARE OF SUCH PURPOSE) WITH RESPECT TO ANY INFORMATION AND RECOMMENDATIONS PROVIDED. Reference to any trade names used by other companies is neither a recommendation nor an endorsement of the corresponding product, and does not imply that similar products could not be used. Evonik reserves the right to make any changes to the information and/or recommendations at any time, without prior or subsequent notice.

AEROSIL®, AERODISP® and SIPERNAT® are registered trademarks of Evonik Industries or its subsidiaries.



Europe / Middle-East /
Africa / Latin America

Evonik Resource Efficiency GmbH

Business Line Silica
Rodenbacher Chaussee 4
63457 Hanau
Germany

PHONE +49 6181 59-12532

FAX +49 6181 59-712532

ask-si@evonik.com

www.evonik.com

North America

Evonik Corporation

Business Line Silica
299 Jefferson Road
Parsippany, NJ 07054-0677
USA

PHONE +1 800 233-8052

FAX +1 973 929-8502

ask-si-nafta@evonik.com

Asia Pacific

Evonik (SEA) Pte. Ltd.

Business Line Silica
3 International Business Park
#07-18, Nordic European Centre
Singapore 609927

PHONE +65 6809-6877

FAX +65 6809-6677

ask-si-asia@evonik.com

Evonik. Power to create.