



AEROPERL® Granulated fumed oxides

Technical Information 1341

Table of contents

	Page
1 Introduction	3
1.1 Evonik fumed silica and fumed metal oxides	3
1.2 Introducing AEROPERL® granulated fumed oxides	5
2 Manufacture and properties of AEROSIL® fumed silica & AEROXIDE® fumed metal oxides	6
2.1 The fumed oxides manufacturing process	6
2.2 Features of fumed silica	6
2.3 Surface modification	7
3 AEROPERL® granulated fumed oxides	7
3.1 General remarks	7
3.2 Particle size and shape of AEROPERL® granulated fumed oxides	7
3.3 Porosity of AEROPERL® granulated fumed oxides	8
3.4 Flowability of AEROPERL® granulated fumed oxides	9
3.5 Improved tamped density of AEROPERL® granulated fumed oxides for better handling	9
4 Application examples	10
4.1 Using AEROPERL® granulated fumed silica as carrier for liquid substances	10
4.2 AEROPERL® granulated fumed oxides for cosmetic applications	11
4.3 AEROPERL® 300 Pharma: A pharmaceutical excipient	11
4.4 AEROPERL® granulated fumed oxides as catalyst carrier	11
5 Handling, packaging and storage	12
6 Product safety	13
7 Additional information	13
8 References	14
9 Appendix	15

1 Introduction

1.1 Evonik fumed silica and fumed metal oxides

Evonik Industries has a clear focus on specialty chemistry. Our 39,000 employees worldwide are dedicated to offering you innovative and essential solutions that can help develop your business and increase your competitiveness.

Within the business unit Inorganic Materials we produce, improve and invent products for and with our customers at numerous sites in Europe, Asia and North America. Today we proudly look back on more than 60 years of experience in product development and in performance enhancement of existing products.^[1] At the same time we also put a strong focus on the design of novel products in order to fulfill the prospective demands of our customers.

AEROSIL® fumed silica and AEROXIDE® fumed metal oxides are important raw materials for a wide variety of industrial applications. The two brand names represent a group of products which are designed for high performance applications. **Table 1** gives an overview on selected AEROSIL® fumed silica and AEROXIDE® fumed metal oxide grades and shows some examples of important applications.^[2] In contrast to AEROXIDE® fumed oxide grades which are essentially crystalline materials (e. g. γ -Alumina, Anatase, etc.), AEROSIL® fumed silica grades are X-ray amorphous. All AEROSIL® grades and AEROXIDE® products are mostly white, fine, fluffy and highly pure powders. The result is an excellent performance in the final application, however these materials often require special handling equipment – a reason, why we offer a competent support by our technical services to our customers.

With this brochure we would like to introduce a group of products which has recently been developed to provide high purity fumed silica and fumed metal oxides with improved properties in various applications to our customers: the AEROPERL® product line.^[3]

^[1] For your convenience, please visit our website at www.evonik.com to gain further information on our business.

^[2] For further information see: www.aerosil.com.

^[3] AEROPERL® products can be classified in two classes: (i) AEROPERL® fumed silica granulates (i. e. granulates based on AEROSIL® fumed silica) and (ii) AEROPERL® fumed metal oxide granulates (i. e. granulates based on AEROXIDE® fumed metal oxides).

In this brochure the expression AEROPERL® is used as a short form for AEROPERL® fumed silica granulates and/or AEROPERL® fumed metal oxide granulates.

Table 1

Selected AEROSIL® fumed silica and AEROXIDE® fumed metal oxides

AEROSIL® fumed silica grades**AEROSIL® OX 50**

Silica grade with low specific surface area (BET), low thickening ability and low agglomeration tendency. AEROSIL® OX 50 is a highly pure grade used e. g. for PET foils, dental composites and for the production of ultra pure silica glass according to the sol-gel process.

AEROSIL® 90, AEROSIL® 130, AEROSIL® 150

Silica grades with low to medium specific surface area (BET) and, therefore, excellent reinforcing abilities and improved thixotropic effects e. g. in silicone rubbers and sealants.

AEROSIL® 200, AEROSIL® 300

Silica grades with medium to high specific surface area (BET). Characterized by excellent rheology control of liquid systems, binders and polymers. Usage as anti-settling and thickening agent. Reinforcing agent for silicone rubbers. Improvement of free-flow and anti-caking of powders. Enhanced transparency level for optical issues. Application in paints and coatings, polyester resins, adhesives and sealants, gel coats, silicone rubbers, printing inks, food and cosmetics.

AEROSIL® 380

Silica grade with highest specific surface area (BET). Excellent rheology control of liquid systems, binders and polymers. Best thickening and thixotropy effect. Reinforcing agent for silicone rubbers. Improvement of free-flow and anti-caking of powders. Enhanced transparency level for esthetic issues. Application in paints and coatings, polyester resins, adhesives and sealants, gel coats, silicone rubbers, printing inks, food and cosmetics.

AEROSIL® TT 600

Large particle silica grade with a specific surface area approx. 200 m²/g (BET). Usage as matting and anti-blocking agent. Grade of high purity. Application e. g. in PET films, audio and video tapes, packaging foils, paints and coatings or as catalyst substrate.

AEROXIDE® fumed metal oxide grades**AEROXIDE® TiO₂ P25**

AEROXIDE® TiO₂ P25 is highly pure titanium dioxide grade with a specific surface area approx. 50 m²/g (BET). AEROXIDE® TiO₂ P25 has heat stabilizing properties for silicone elastomers. In addition to that, it can be used as a catalyst carrier or it can be applied as a catalyst itself in various applications.

AEROXIDE® Alu C

Alumina grade with a specific surface area approx. 100 m²/g (BET). Important fields of applications are the lighting industry where it is used as an additive for homogeneous light emission in fluorescent tubes and light bulbs or within polymer coatings like PET films where it acts as an anti-blocking agent. Moreover it is applied in powder coatings as a chargeability-improvement additive or in high quality paper coatings for high gloss ink-jet papers.

1.2 Introducing AEROPERL® granulated fumed oxides

AEROPERL® granulated oxides represent specially granulated AEROSIL® fumed silica and AEROXIDE® fumed oxide grades. AEROPERL® products are fine, white, highly pure granulates with improved handling qualities.

The main features of AEROPERL® products are:

- reduced dust formation
- high tamped density
- optimized flowability and, therefore, better handling
- superior adsorption features
- high degree of porosity (meso- and macro-pores)
- defined particle size distribution

Evonik's AEROPERL® products are in detail:

- **AEROPERL® 300/30** is a hydrophilic fumed silica granulate. Due to its high degree of porosity, AEROPERL® 300/30 is characterized by excellent adsorption behavior and can therefore be used in many types of formulations as an inert carrier for liquids or e.g. as a carrier for catalytic applications.
- **AEROPERL® 300 Pharma** is a hydrophilic fumed silica granulate. While being equally absorptive as the AEROPERL® 300/30 this grade is specially produced to fulfill the special requirements of the pharmaceutical industry. The material is produced according to the guidelines of IPEC-GMP and quality tested according to leading pharmacopoeia monographs (EP, USP/NF).
- **VP AEROPERL® 50/25**^[4] is a hydrophilic fumed silica granulate. VP AEROPERL® 50/25 can be used as raw material for the production of ultra pure silica glass and ceramics, as well as a highly pure carrier for catalyst applications or for thermal insulation.
- **VP AEROPERL® Alu 100/30** is a hydrophilic fumed alumina granulate. VP AEROPERL® Alu 100/30 is used for ceramic and paper compositions or for catalyst support development. In addition, it may be used in different lighting applications, such as fluorescent tubes or light bulbs. For further information see Industry Information No. 2128 "AEROSIL® fumed oxides for ceramics".
- **VP AEROPERL® P25/20** is a hydrophilic fumed titanium dioxide granulate. VP AEROPERL® P25/20 is used for ceramic compositions, as well as for catalyst support development or for photocatalyst applications. Moreover VP AEROPERL® P25/20 is predestinated to be utilized in heterogeneous catalysis since it can be easily separated from liquid phases due to its good sedimentation properties. For further information see Technical Information No. 1243 "AEROXIDE® and AEROPERL® Titanium Dioxide as Photocatalyst".
- **VP AEROPERL® R 806/30** is a hydrophobic fumed silica granulate. Due to its hydrophobic nature it shows a very low water absorption. VP AEROPERL® R 806/30 can be used as a dust-free reinforcing material and/or matting agent for silicone products, rubbers and sealants. For further information see AEROSIL® Invented to Improve brochure No. 197 "Silicone Rubber".

We are pleased to answer your personal questions related to these products and discuss your personal needs for the usage of AEROPERL® granulates in your specific applications.

^[4] VP is an abbreviation for experimental product.

2 Manufacture and properties of AEROSIL® fumed silica & AEROXIDE® fumed metal oxides

2.1 The fumed oxides manufacturing process

AEROSIL® fumed silica and AEROXIDE® fumed oxides are manufactured by the hydrolysis of metal chlorides in a hydro-
gen/oxygen flame according to the following chemical reaction^[5] (see also: Evonik Technical Bulletin – Fine Particles
No. 11 “Basic characteristics of AEROSIL® fumed silica”):



The raw materials used are very pure and exclusively of inorganic origin, resulting, therefore, in very pure products. All hydrophilic AEROSIL® types have a silicon dioxide content of more than 99.8% by weight. By variation of the process conditions it is possible to tune various physico-chemical parameters of the products, like for instance the specific surface area (Evonik offers fumed oxides with surface areas between 50 and 380 m²/g), the tamped density or the particle size. All these adjustable parameters lead to a variety of different product properties.

2.2 Features of fumed silica

Another important determinant of the physical attributes of fumed oxides is the content and ratio of various surface-functional groups (Figure 1 gives an example for AEROSIL® fumed silica). The surface constitution with siloxane bridges and silanol groups is responsible for the high affinity and adsorption ability for water and other polar substrates. Hydrophilic fumed oxides are able to adsorb considerable quantities of water without any change in the state of aggregation. Contrary to silanol groups, siloxane functions are usually characterized by their hydrophobic nature. The surface functionalities i. e. silanol groups are the basic prerequisite for the fabrication of surface modified (e. g. hydrophobized) AEROSIL®, AEROXIDE® or AEROPERL® products.

Figure 2 shows the structure of AEROSIL® 200. The image gives a good impression of the branched structure of the material, which is the reason for the high adsorption capacity.

Figure 2

Transmission electron microscope image of AEROSIL® 200.

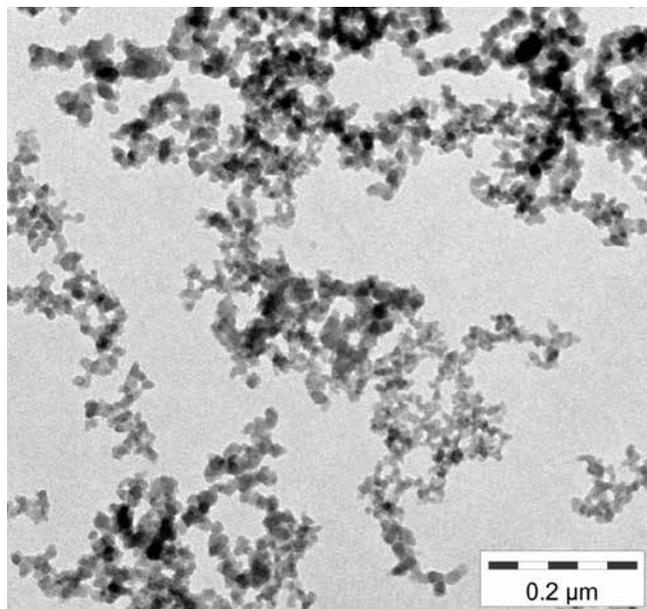
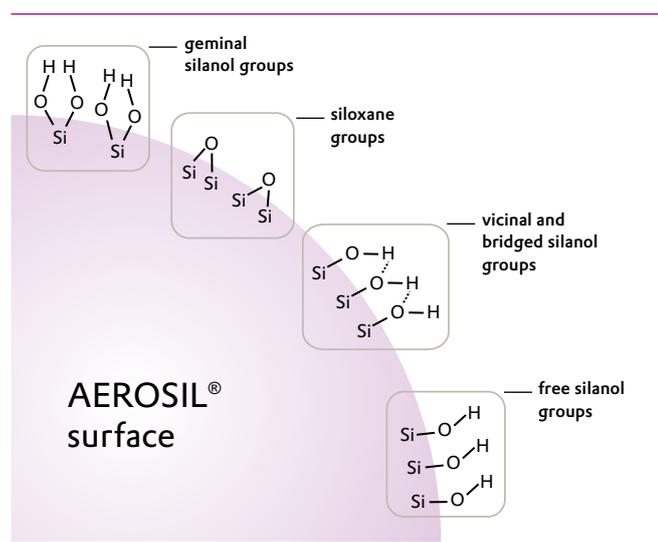


Figure 1

Schematic compilation of different surface-functional groups located on the surface of AEROSIL® products.



^[5] Example chosen for SiCl₄

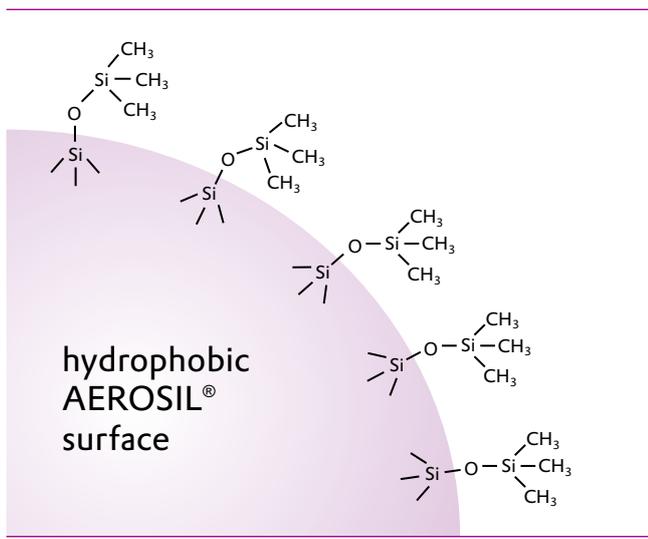
3 AEROPERL® granulated fumed oxides

2.3 Surface modification

By modification of the AEROSIL® surface i. e. reaction of the silanol groups the surface characteristics of the material can be tailored. The reaction of AEROSIL® fumed silica with an alkyl-functional silane e.g. hexamethyldisilazane (HMDS) results in a product bearing trimethyl-silyl groups tightly (covalently) and permanently bound to the surface (see **Figure 3**). A similar procedure is also utilized for the modification of AEROXIDE® grades.

Figure 3

Model of a hydrophobic AEROSIL® particle. The former hydrophilic particle was treated with hexamethyldisilazane (HMDS) to form trimethyl-silyl functionalities on the surface.



A hydrophobic or functionalized silica or metal oxide will show totally different behavior in technical applications compared to the hydrophilic starting material. Thickening and rheological properties are changed dramatically, moisture adsorption ability is shifted. With a directed functionalization of the surface, the compatibility to special applications can be optimized. All these facts do also apply to AEROPERL®.

Our technical and marketing service specialists are looking forward to fulfill your personal needs on further information regarding the functionalization and post treatment of fumed oxides by presenting you our Evonik Technical Bulletins on your request.

3.1 General remarks

AEROPERL® is the brand name for specially granulated fumed oxides. Evonik offers AEROPERL® granulates made from fumed oxides, like silicon dioxide, titania or alumina. The granulates comprise spherical particles with an average diameter in the range of 20 to 40 µm.^[6]

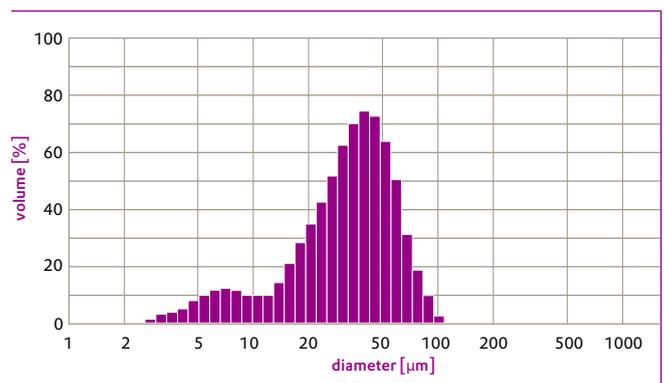
An overview of various physico-chemical data of the AEROPERL® products can be found at the end of this brochure.

3.2 Particle size and shape of AEROPERL® granulated fumed oxides

The production process of AEROPERL® granulates is designed to achieve unique particle size distributions. **Figure 4** shows an example of the particle distribution of AEROPERL® 300 Pharma, as measured by laser diffraction. No particles smaller than 2.5 µm can be detected, the largest beads go up to 100 µm and the D₅₀-value of the particles is 33 µm.

Figure 4

Particle size distribution of AEROPERL® 300 Pharma, measured by laser diffraction (Cilas). The D₅₀-value of the particles is 33 µm.



^[6] D₅₀-value measured by laser diffraction method.

Besides this special kind of particle size distributions the unique shape of the beads of AEROPERL® types is also remarkable. **Figure 5** shows two scanning electron microscope (SEM) images of different AEROPERL® products (on the left an alumina based material, on the right a titania related one). These illustrations depict the well formed spherical shape of the particles independent from the chemical composition.

3.3 Porosity of AEROPERL® granulated fumed oxides

AEROPERL® granulates are characterized by a high level of porosity. In contrast to fumed oxides, AEROPERL® products are meso- and macro-porous. Therefore, they can ideally be used as carriers and/or adsorbents for molecules of various shape and size. **Figure 6** shows the rough, porous surface of a silica based AEROPERL® type at different magnifications.

Table 2 lists typical data on the pore volume of AEROPERL® grades. Remarkable is the extreme low amount of micro-pores for all AEROPERL® types. AEROPERL® 300/30 and AEROPERL® 300 Pharma exhibit a micro-pore volume of approximately $0.03 \text{ cm}^3/\text{g}$, while all the other AEROPERL® grades show volumes below the detection limit i.e. $<0.01 \text{ cm}^3/\text{g}$.

The values given in this table represent typical data and are not part of the specification.

Figure 5

Scanning electron microscope images of AEROPERL® Alu 100/30 on the left, and AEROPERL® P25/20 on the right.

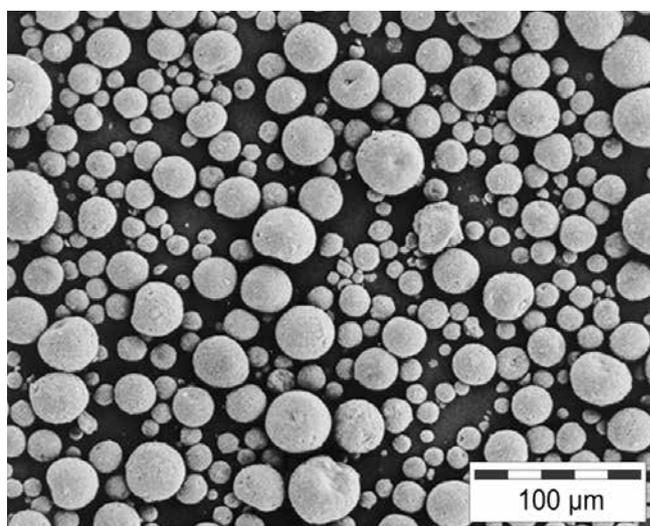
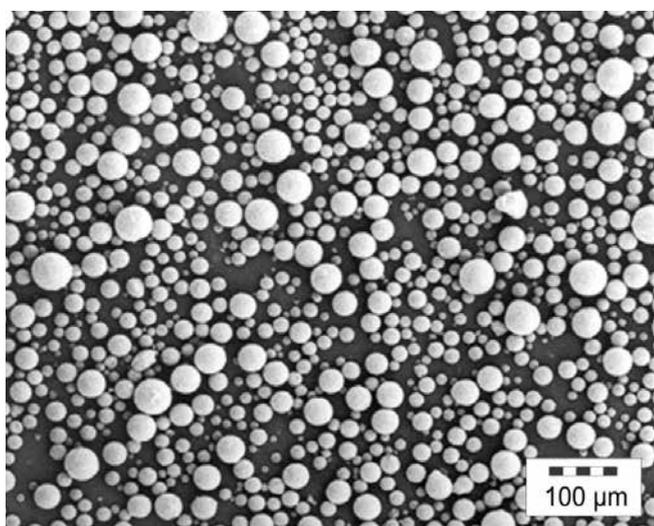


Figure 6

Scanning electron microscope images of AEROPERL® 300 Pharma at different magnifications.

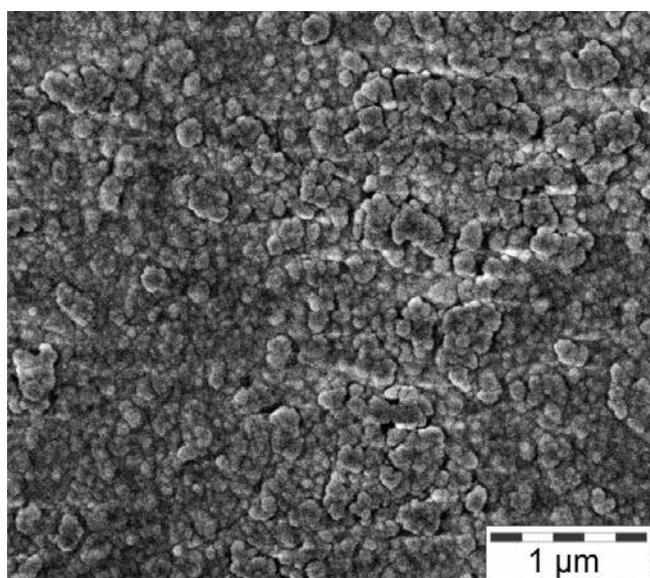
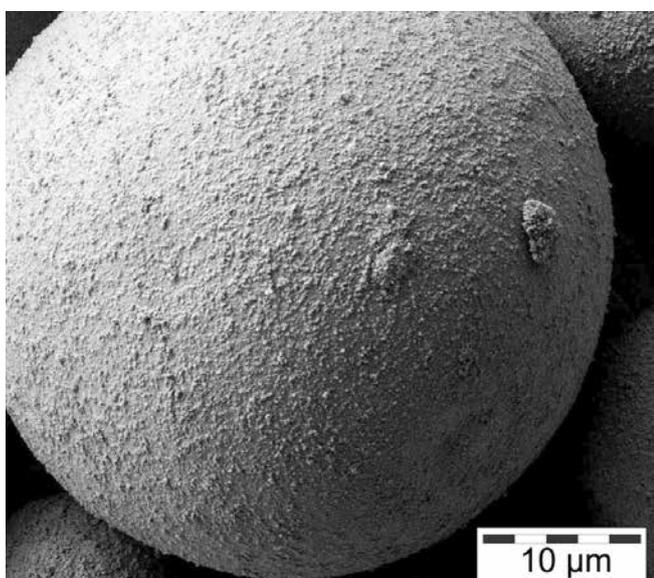


Table 2

Typical data on pore volumes of AEROPERL® granulated fumed oxides.*

AEROPERL® grades	meso-pores** (2–50 nm) [cm ³ /g]	macro-pores*** (> 50 nm) [cm ³ /g]
AEROPERL® 300/30	1.83	2.45
AEROPERL® 300 Pharma	1.81	2.48
VP AEROPERL® 50/25	0.12	1.74
VP AEROPERL® Alu 100/30	0.98	1.17
VP AEROPERL® P25/20	0.44	0.85
VP AEROPERL® R 806/30	1.50	2.25

* approximated values;

** measured by nitrogen adsorption;

*** measured by mercury intrusion.

3.4 Flowability of AEROPERL® granulated fumed oxides

As mentioned before, AEROPERL® products show an improved flowability and are, therefore, easier to handle than standard AEROSIL® or AEROXIDE® products. This is due to their unique particle size distribution and the spherical shape of the AEROPERL® beads. The flowability is an interesting feature when using AEROPERL® granulates as a carrier. It allows the transformation of oily and pasty substances into free flowing powders which can be easily handled.

Figure 7

Flowability of silica adsorbates loaded with liquid (1:1 by weight).

left: AEROSIL® 300; right: AEROPERL® 300 Pharma.



Figure 7 is an impressive illustration of the improvement in flowability of AEROPERL® granulated fumed oxides compared to the related AEROSIL® fumed silica and AEROXIDE® fumed oxides. The excellent flow behavior of the AEROPERL® products remains even after the material is loaded with liquid. Although the orifice of the funnel filled with AEROSIL® 300 (left) is much wider compared to the orifice of the AEROPERL® 300 Pharma test funnel (right), the material does not flow out. This illustration proves the good flowability of AEROPERL® granulates used as a carrier for liquids.

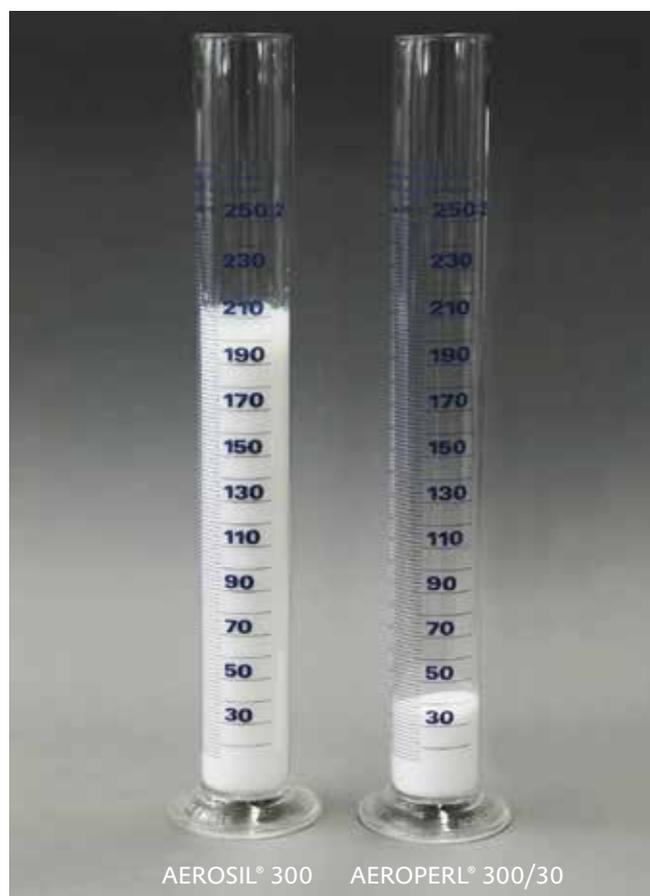
3.5 Improved tamped density of AEROPERL® granulated fumed oxides for better handling

The difference in tamped densities between an AEROSIL® fumed silica and an AEROPERL® granulate is illustrated in Figure 8. Compared to the corresponding AEROSIL® or AEROXIDE® grade, the same weight of AEROPERL® granulates take up only about 10–30% of the space. Therefore, the tamped density of an AEROPERL® granulate is up to 10-times higher, compared to the respective AEROSIL® or AEROXIDE® grade with the same specific surface area (BET). The improved tamped density results in reduced storage space, easier weighing, less dust, and faster incorporation.

Figure 8

Difference in tamped densities between AEROSIL® 300 fumed silica (left) and the corresponding AEROPERL® grade (right)

–both cylinders contain the same weight of material.



4 Application examples

4.1 Using AEROPERL® granulated fumed silica as carrier for liquid substances

Precise dosing of liquid ingredients into a powder blend is often a challenging procedure, especially when these liquids are highly viscous or sticky. Converting these liquids into free-flowing powders by using carrier silica offers a perfect answer to these challenges. These powders in the industry often are referred to as Dry Liquids. They can be dosed exactly and handled easily without sticking to the equipment.

The flow- and dust characteristics of the final product are determined by the properties of the carrier silica used. Here the particle size distribution of the carrier is important. A coarser particle size generally corresponds with better flowability and lower dust of the resulting product. AEROPERL® granulated fumed silica combine the chemical purity of fumed silica with a granular structure, which is ideal as carrier.

In order to get the optimum performance out of AEROPERL® products as carrier the proper mixing technique is very important. Generally a gentle mixing is recommended. The AEROPERL® product should be put into the mixer first, and then the liquid should be added as finely dispersed as possible while the mixer is moving. The best method is to atomize or spray the liquid. Highly viscous liquids or pastes can be heated before addition; this reduces the viscosity and accelerates the absorption.

In order to keep the porous structure of the AEROPERL® products we recommend to mix with low shear forces and to keep the mixing time as short as possible. Overmixing may happen due to too high shear forces, pressure on the product during mixing or prolonged mixing time and will result in partly destruction of the porous structure and subsequently reduction of the absorption capacity.

Recommended mixer types are e. g. ploughshare- or paddle mixers (see **Figures 9** and **10**). Some of these mixers are equipped with additional high shear intensifier blades to supplement the low shear main mixing tools. These additional high shear tools should not be used when processing AEROPERL® products. The mixing time in general should not exceed a few minutes.

Detailed recommendations on the mixing process can be found in our Technical Information 1213: "Performance silica as flow agent and carrier substance – Recommended mixing procedures for powders and granulates".

Figure 9
Ploughshare® mixer; © Gebr. Lödige Maschinenbau GmbH,
Elsenerstr. 7–9, D-33102 Paderborn, Germany

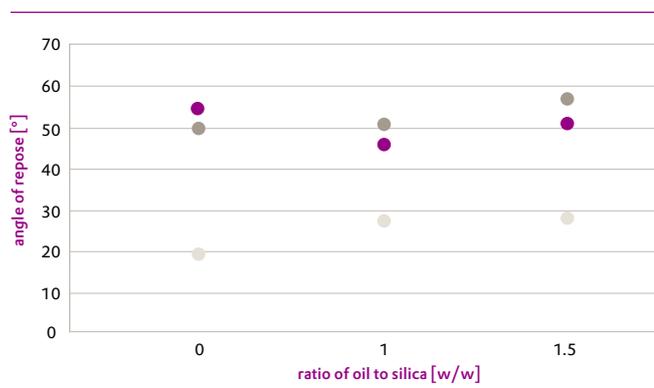


Figure 10
Pegasus® paddle mixer; © Dinnissen BV, Horsterweg 66,
NL-5975 NB Sevenum



Figure 11

Flow behavior of silica carriers loaded with a model substance (MIGLYOL® 840 from Sasol Germany GmbH). An angle of repose <30° indicates good to very good powder flow, whereas an angle of repose >40° points toward poor flow performance.



● AEROPERL® 300/30 ● AEROSIL® 300 ● Silica gel

4.2 AEROPERL® granulated fumed oxides for cosmetic applications

AEROPERL® 300/30 granulated fumed oxides can be used to convert liquids and pastes into free-flowing and easily manageable powders for cosmetic issues. AEROPERL® 300/30 is the carrier of choice for these applications. The total pore volume of this material is excellent for carrier applications. The processing can be achieved the same way as for pharmaceutical use.

4.3 AEROPERL® 300 Pharma: A pharmaceutical excipient

AEROPERL® 300 Pharma is a carrier which has been especially adapted to fit the requirements of the pharmaceutical industry. The suffix “Pharma” indicates that in production the strict guidelines of excipient GMP as defined by the International Pharma Excipient Council (IPEC) are observed. Furthermore, the material is tested according to the European (Silica Colloidal Anhydrous) as well as the United States (Colloidal Silicon Dioxide) pharmacopeia monographs.

The most popular pharmaceutical forms today are tablets and filled capsules. Both of these solid dosage forms are manufactured from precursor powders. In order to maximize output on high speed machinery while fulfilling regulatory requirements for uniformity of unit weight (and therefore of dosage), it is essential that the precursor powder has excellent flow properties. Liquids and pasty ingredients are often difficult to blend with other powdered ingredients for tablet pressing. AEROPERL® 300 Pharma granulated colloidal silicon dioxide can be used to convert liquids and pastes into free-flowing and easily manageable powders.

Moisture assisted dry granulation (MADG) is an innovative new process in pharmaceutical production. Compared to conventional granulation techniques this process needs much less moisture, thus removing the need for any drying steps. In this process AEROPERL® 300 Pharma plays an important role to adsorb excess moisture which may still be present after granulation. [7, 8]

4.4 AEROPERL® granulated fumed oxides as catalyst carrier

For the manufacture of catalyst supports often silica or metal oxides of high purity are needed. These products may be compacted or granulated to form the final catalyst support. In addition, they can be used as raw materials for the synthesis of catalytically active zeolites which require highly pure starting materials. In both cases AEROSIL® fumed silica and AEROXIDE® fumed metal oxides are ideally suited as raw materials. However, handling of these fumed materials is often challenging as they are very low in density and flow not very well. In zeolite synthesis AEROSIL® fumed silica tend to wet into the reaction slurry slowly and increase the viscosity once mixed. With AEROPERL® granulated fumed oxides these difficulties are easy to overcome. AEROPERL® products have an excellent flowability and are easy to handle and dose. They wet into a slurry more rapidly than standard fumed silica and metal oxides and do not increase the viscosity significantly. At the same time they have the same high purity of fumed oxides. For more information please see our Industry Information 2242 “Inorganic materials for catalyst innovation”.

[7] I. Ullah, J. Wang, S.-Y. Chang, G.J. Wiley, N. B. Jain, S. Kiang, Pharm. Technol. 33/11 (2009) 62.

[8] I. Ullah, J. Wang, S.-Y. Chang, H. Guo, S. Kiang, N. B. Jain, Pharm. Technol. 33/12 (2009) 42.

5 Handling, packaging and storage

AEROSIL® fumed silica and AEROPERL® fumed silica granulates are delivered in multi-layer paper 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 1231 “Packaging forms for AEROSIL®” or the Technical Information 1219 “Semi-bulk packaging for AEROSIL®”. 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”. Please contact a sales agent in your area for detailed product / packaging / handling specific information.

Although AEROSIL® fumed silica and AEROPERL® fumed silica granulates 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 the case of moisture, this adsorption is reversible). For this reason, we recommend storing all AEROSIL® fumed silica and AEROPERL® fumed silica granulates in a dry place, protected from moisture and organic vapors. For more detailed information regarding the storage of the mentioned products, please request our Technical Information 1373 “How to store AEROSIL®” and for more information regarding the stability of silica please request the corresponding Product Information. During prolonged periods of storage, AEROSIL® fumed silica and AEROPERL® fumed silica granulates may become slightly compacted. This can lead to a minor increase in tamped density, affecting the related product properties.

In addition, for safety reasons it should be noted that all dry powders such as AEROPERL® granulated fumed oxides can build up static electrical charges when subjected to friction during conveyance and/or mixing. When handling AEROPERL® products near flammable or explosive liquids, be sure to take proper safety precautions, such as electrical grounding, inert atmosphere, etc. For further information, please request our Technical Bulletin Pigments No. 62 “Synthetic silica and electrostatic charge”.

In order to plan dust-free, and automated handling plants for AEROSIL® fumed silica, fundamental product knowledge together with necessary procedural experience is necessary. Because it can not be taken for granted that the suppliers of the machines and equipment in question provide this combination, the technicians and engineers of our handling technology advise and assist our customers personally – as needed either at our location in the Wolfgang Industrial Park or at the client.

6 Product safety

Even though AEROPERL® granulated fumed oxides are inert and non-hazardous materials, there are certain precautions that we recommend:

- The work area should be properly ventilated. In the laboratory, work with AEROPERL® products in a fume hood. Where ventilation is not available, a dust respirator is recommended at higher dust concentrations.
- Avoid continued excessive inhalation by using personal protective equipment.
- Wear appropriate eye protection.
- Wash hands after handling AEROPERL® products as the product may leave a dry feeling on the skin. Use of protective skin cream and/or gloves is recommended when working with AEROPERL® granulated fumed oxides.
- See the Material Safety Data Sheet for information relevant to maximum work area concentrations and other safety aspects of our products.

Before working with any product, read its Material Safety Data Sheet (MSDS) carefully. MSDS for AEROPERL® products are available for many countries and in different languages. They may be obtained from our website (www.aerosil.com).

7 Additional information

Besides this Technical Information, other publications on AEROPERL® granulated fumed oxides are available upon request through our website www.aerosil.com.

From the navigation point “Services” you may request or download additional literature.

8 References

- 1 I. Ullah, J. Wang, S.-Y. Chang, G. J. Wiley, N. B. Jain, S. Kiang, *Pharm. Technol.* 33/11 (2009) 62.
- 2 I. Ullah, J. Wang, S.-Y. Chang, H. Guo, S. Kiang, N. B. Jain, *Pharm. Technol.* 33/12 (2009) 42.
- 3 Technical Information No. 1213:
"Performance silica as flow agent and carrier substance—Recommended mixing procedures for powders and granulates".
- 4 Technical Information 1231:
"Packaging forms for AEROSIL®".
- 5 Technical Information 1219:
"Semi-bulk packaging for AEROSIL®"
- 6 Technical Information No. 1243:
"AEROXIDE® and AEROPERL® titanium dioxide as photocatalyst".
- 7 Technical Information 1373:
"How to store AEROSIL®".
- 8 Technical Bulletin—Fine Particles No. 11:
"Basic characteristics of AEROSIL® fumed silica".
- 9 Technical Bulletin—Fine Particles No. 28:
"The handling of synthetic silicas and silicates".
- 10 Technical Bulletin Pigments No. 62:
"Synthetic silica and electrostatic charges".
- 11 Industry Information No. 2128:
"AEROSIL® fumed oxides for ceramics".
- 12 Industry Information No. 2242:
"Inorganic materials for catalyst innovation"
- 13 AEROSIL® Invented to Improve brochure No. 197:
"Silicone rubber".

9 Appendix

Product overview on AEROPERL® granulated fumed oxides including characteristic physico-chemical parameters:

Table 3

Overview on various product characteristics of AEROPERL® grades.

AEROPERL® grades	specific surface area [m ² /g]	pH-value	loss on drying [%]	loss on ignition [%]	tamped density [g/l]
AEROPERL® 300/30	300 ± 30	4.0 – 6.0	≤ 3.5	≤ 2.5	~ 280
AEROPERL® 300 Pharma*	300 ± 30	3.5 – 5.5	≤ 2.5	≤ 2.0	~ 280
VP AEROPERL® 50/25	50 ± 15	4.5 – 6.5	≤ 2.5	≤ 2.5	~ 360
VP AEROPERL® Alu 100/30	100 ± 15	3.6 – 5.6	≤ 2.5	≤ 3.5	~ 500
VP AEROPERL® P 25/20	50 ± 15	3.0 – 4.5	≤ 2.5	≤ 2.0	~ 700
VP AEROPERL® R 806/30**	200 ± 25	6.0 – 8.0	≤ 1.5	4.0 – 8.0	~ 300

* tested according to USP/NF & Ph.Eur.;

** Carbon content is 3.0 to 6.0%

The values given in this table represent typical data and are not part of the specification.

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.

AEROPERL® is a registered trademark of Evonik Industries AG or its subsidiaries.



EVONIK
INDUSTRIES

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

TI 1341-1 JUL15

Evonik. Power to create.