

# How to store AEROSIL®

Technical Information 1373



**AEROSIL®**

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# 1 Introduction

AEROSIL® is delivered in different types of packaging, such as bags and semi-bulk packaging, and in bulk by silo trucks (Figures 1, 2, and 3). Although bags and semi-bulk packaging types are protected by secondary packaging, such as polyethylene shrink or stretch wrapping, you should store AEROSIL® in a dry, roofed place. Furthermore, paper bags and FIBCs lose their primary moisture protection if the shrink wrap is removed. You should keep this in mind when storing pallet stacks that have already been opened. When designing your warehouse layout for products that come in bags or semi-bulk packaging, store them under the conditions described below. The same goes for bulk storage.



Figure 1 Shipment of AEROSIL® in bags



Figure 2 Shipment of AEROSIL® in FIBC



Figure 3 Shipment of AEROSIL® in a silo container

## 2 Storage conditions and shelf life of AEROSIL®

Because of its colloidal properties, AEROSIL® can be compromised by the adsorption of vapors or gases. This may affect the application properties of the product, so we recommend that you always store AEROSIL® away from sources of contamination.

The storage temperature should not exceed 50 °C, or 35 °C for AEROSIL® R 7200 (See also the section on safety aspects in storage). If properly stored, AEROSIL® can in principle be stored for a long time, without aging or decomposing. We recommend, however, that the above products be used within two years of the production date. The production date can be obtained from the control number printed on every bag.

### Key to the control number, for example:

pp	y	mm	dd	xx
plant	year	month	day	internal number

For example, the lot number **153050614** shows that the date of production was 6<sup>th</sup> Mai 2013. Compaction, adsorption, or other processes can adversely affect application properties. This applies to storage in **FIBCs** (flexible intermediate bulk containers), silos, and other closed containers, too. Before using AEROSIL® that has been stored for an extended period, check whether it is still usable.

### 2.1 Compaction

Pallets with bags or FIBCs should not be stacked on top of each other, since the load can increase tamped density and cause compacted agglomerates to form. These compacted agglomerates may cause problems in certain applications. Therefore, it is highly recommended that shelf systems be used to stack pallets above each other. **Figure 4** shows a high bay rack system as an example of this.



**Figure 4** Warehouse with high bay racking to store bags and FIBC

### 3 Packaging and delivery forms of AEROSIL®

AEROSIL® is used worldwide in many different application areas and industries, notably the plastics industry, but also in the food and pharmaceutical industries. To preserve the product characteristics and ensure transport safety, the packaging must satisfy these requirements. Further information is available in the Technical Information TI 1231, "Types of Packaging for AEROSIL® and AEROXIDE®."

The current standard packaging is a multilayer paper bag, which is suitable for all modes of transport, whether by truck, rail, air, or ship. AEROSIL® is also supplied in other packaging forms such as FIBCs (flexible intermediate bulk containers) for simple and, most importantly, dust-free handling by our customers.

A large proportion of fumed silica is now shipped in bulk by silo trucks.

**Evonik Industrie AG offers the following packaging and shipping modes:**

- bags on pallets with load securing
- semi-bulk deliveries in flexible containers (FIBCs) with content of about 2 m<sup>3</sup> on pallets.
- bulk deliveries in silo trucks or silo containers

### 4 Silo storage of AEROSIL®

Certain standard AEROSIL® grades are shippable by silo vehicle. To store these products, you need to have the right silo. If you are using several grades of bulk AEROSIL®, you must have a storage silo installed for each product. **Figure 5** shows one such silo system for AEROSIL®. The following information applies to storage silos and smaller containers such as intermediate or day silos.

The silos must be designed to suit the product characteristics of AEROSIL®. This refers in the first instance to the silo's geometry (height, diameter, cone angle) and discharge aids. Detailed information on this subject is available in the Technical Bulletin Fine Particles No. 28, "Handling of Synthetic Silicas and Silicates."

The volume of the storage silo is determined by the quantity delivered and the consumption. The volume of AEROSIL® delivered in silo trucks is approx. 60 m<sup>3</sup>. Because of the enormous loosening effect that unloading has on AEROSIL®, it expands to about twice its volume, plus a residual volume for uninterrupted production, yielding a net volume of approximately 140 m<sup>3</sup> to 200 m<sup>3</sup> for one storage silo. High-use customers have significantly larger storage silos.

The most commonly used materials for building silos are aluminum alloys such as AlMg3 or stainless steel 1.4571 (in exceptional cases 1.4301, too). If regular steel is used, the silos should be provided with an internal coating to protect them against corrosion. Coatings have the disadvantage, however, that they need to be checked regularly to see what condition they are in and need to be reapplied if necessary.



**Figure 5** Storage of AEROSIL® in a storage silo

## 5 Safety considerations for the storage of special, surface-treated AEROSIL® qualities

The information contained herein applies exclusively to the following products: AEROSIL® R 7200, AEROSIL® R 711, and AEROSIL® R 805. Surface modifications to these products (that is, organic substances on their surfaces) alter their stability and thus significantly change their self-ignition behavior. These products therefore need to be stored under special conditions. Given the risk that surface-treated AEROSIL® products could spontaneously heat up as a result of oxidation, it is imperative that extra safety measures be heeded for their storage. The information contained herein follows the specifications issued in the related safety data sheets.

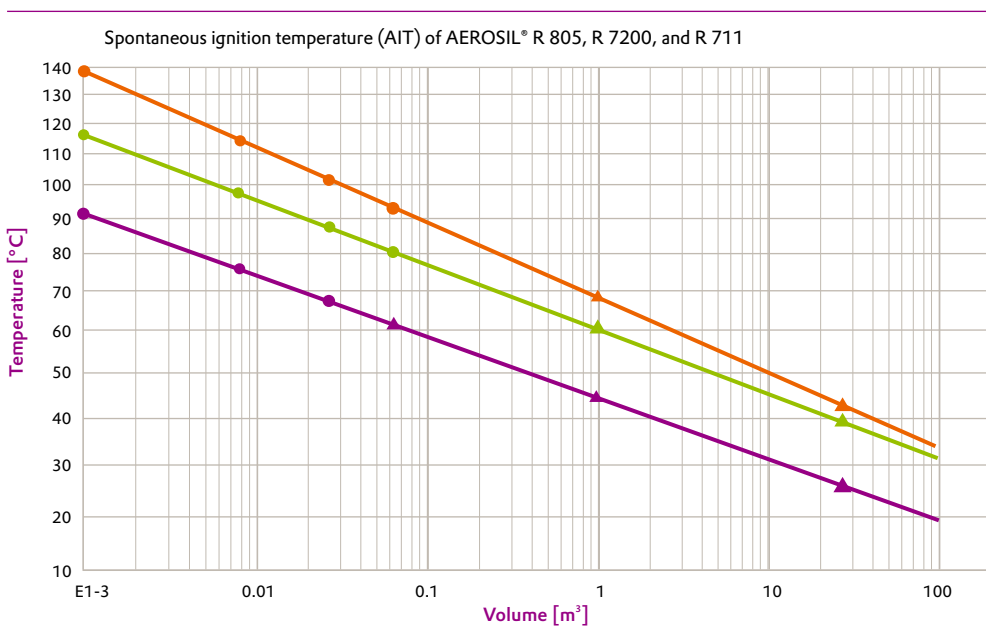
The temperature at which self-ignition occurs in a material is not the interior temperature of its bulk solids, but rather the ambient temperature at which heat dissipation from the bulk is barely able to offset the generated interior heat. In this balance, the self-ignition temperature is dependent on the volume of the bulk or the ratio of volume to surface.

The self-ignition of solid bulk in an environment of consistent all-round temperature conditions (isoperibolic storage) can only occur if

- the bulk volume is big enough to ignite in the given temperature of a storage facility (ambient temperature) and under the given conditions of heat dissipation;
- the reaction zone allows for the discharge of combustion gases and the in-feeding of atmospheric oxygen;
- storage duration at the given temperature is greater than the real induction time (that is, the period from the time the storage temperature is reached to the time of self-ignition).

When transporting and warehousing larger quantities of product, it is important to always take the volume dependency of the self-ignition temperature into account. As previously stated in "Storage conditions / storage life," the ambient temperature in storage facilities housing AEROSIL® should not exceed 50°C. The aforementioned AEROSIL® grades have been shown, in laboratory examinations carried out to determine the volume-dependent self-ignition temperature and extrapolated for greater quantities, to self-ignite even in summery ambient temperatures (see Figure 6, above). It is important to understand that the actual duration of storage is often significantly briefer than the induction time to self-ignition.

**Figure 6** Volume-dependency of the self-ignition temperature of some surface-treated types of AEROSIL®



- AEROSIL® R 805    — AEROSIL® R 711    — AEROSIL® R 7200
  - Measured self-ignition temperature
  - ▲ Extrapolated self-ignition temperature
  - Extrapolation (regression based on measured values)
- For AEROSIL® R 709, refer to AEROSIL® R 711

According to the UN recommendation (UN Manual of Tests & Criteria, Test N. 4), AEROSIL® R 7200—which has a self-ignition temperature of 92 °C, as based on a 1-liter measure—needs to be categorized as a Class 4.2 hazardous good (self-heating substances).

According to the UN recommendation (UN Manual of Tests & Criteria, Test N. 4), AEROSIL® R 711—which has a self-ignition temperature of 115 °C, as based on a 1-liter measure—does not need to be categorized as a Class 4.2 hazardous good (self-heating substances) if packaged in container sizes of  $\leq 450$  liters. Because individually packaged units of AEROSIL® R 711 are smaller than 450 l, it is not required to classify this product as a Class 4.2 hazardous good. It is, however, important to make sure that the storage temperature for the received packages (bagged product) is kept at 50 °C.

According to the UN recommendation (UN Manual of Tests & Criteria, Test N. 4), AEROSIL® R 805—which has a self-ignition temperature of 135 °C, as based on a 1-liter measure—does not need to be categorized as a Class 4.2 hazardous good if the packaging volume is  $\leq 3$  m<sup>3</sup>. Since both bagged product and the offered FIBC packaging are of a lesser volume, AEROSIL® R 805, too, does not need to be classified as a hazardous good. The maximum storage temperature for goods packaged in this way (palletized bagged goods or FIBC packaging) is 50 °C.

If, subsequent to its delivery, AEROSIL® R 711 or AEROSIL® R 805 is transferred to and stored in other containers (storage silos, day bins, weighing bins, etc.) with a holding capacity of more than 3 m<sup>3</sup>, different maximum storage temperatures will apply. The maximum storage temperature must then be ascertained based on the volume (refer to **Figure 6**, above) minus “safety margin” of 10 °C. It is additionally important to take its induction time in relation to the maximum storage duration into account.

As a rule, in storage it is necessary to make an initial approximation based on the correlation between self-ignition temperature and volume. The volume concerned could be bulk stored in a silo or it could be individual packages packed closely together.

Palletized units should therefore always be stored with spacing between each pallet. A space of approximately 10 cm has proven to be sufficient in practice to safeguard convection and thus the dissipation of any generated heat (**Figure 7**, below). If these requirements are observed, it is possible to use the product volume for individual pallets or FIBC units as the basis for determining the maximum storage temperature even if multiple units are stored together.

Palletized goods and FIBC units must not be exposed to direct sunlight (choose shaded areas), since external energy input will be conducive to the oxidation process and increase the temperature on the product.



**Figure 7**  
Storing of special, surface-treated types of AEROSIL® with sufficient spacing between pallets

To ensure safe transportation of AEROSIL® R 805 and AEROSIL® R 711 (neither classified as hazardous goods) to overseas destinations, Evonik always makes arrangements to have these products transported together with other non-critical types of cargo. Should it ever be unavoidable to fill entire shipping containers exclusively with AEROSIL® R 805 or AEROSIL® R 711, we use temperature-controlled containers where necessary. That way, even a hold-up in the vicinity of any sources of heat cannot cause self-ignition of the product. This is how we ensure safe long-haul transportation. For the safe shipping of AEROSIL® R 7200, which is classified as a hazardous good, appropriate arrangements with the freight companies are mandatory.

It is important to understand that induction times (that is, the period from the time of receipt into storage to the time of self-ignition) may vary considerably depending on the storage quantity, the temperature at the time of filling, and the storage temperature.

A volume of 1 m<sup>3</sup> of AEROSIL® R 7200, determined to have a temperature of 30 °C at the time of filling and a storage temperature of consistently 50 °C, was measured to have an induction time of 27 days. It follows, therefore, that temporary exposure to the maximum storage temperature will not necessarily cause immediate self-ignition. That circumstance does not, however, imply that this induction time may be exploited in full in storage planning for this product.

When storing the products discussed herein in a storage silo, perform calculations to determine the critical ambient temperature. Those calculations take temperature-based heat generation (as caused by the oxidation process) and the actual rate of heat dissipation in a given storage environment into account. Safety considerations must also take factors such as the filling temperature, possible container isolation, the product's heat conductivity, and the influence of external sources of heat (such as sunlight) into account.

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**EVONIK**  
INDUSTRIES

**Evonik Resource Efficiency GmbH**

Business Line Silica  
Handling Technology  
Rodenbacher Chaussee 4  
63457 Hanau  
Germany

PHONE +49 6181 59-4743

FAX +49 6181 59-4201

[aerosil@evonik.com](mailto:aerosil@evonik.com)

[www.aerosil.de](http://www.aerosil.de)

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