

# Antiblocking Agent SIPERNAT®

Technical Information 1206



## Evonik Industries AG

Evonik is the world's largest producer of synthetic silicas, which are sold under the trade names SIPERNAT®, ULTRASIL®, SIDENT®, AEROSIL®, and ACEMATT®. Evonik owns production sites and applied technology facilities in Europe, Asia, and America and has further expanded its infrastructure with a joint venture in Japan.

For antiblocking applications, Evonik offers a great variety of products that satisfy diverse requirements.

### SIPERNAT® improves your film product

Plastic films tend to block during processing and use: film layers adhere together and are difficult to separate. SIPERNAT® particles that have been worked into the film material project slightly from the surface, reducing the contact area between the films. This reduces blocking, making the films easier to separate and film products easier to open. SIPERNAT® antiblocking agents are highly effective, even at very low concentrations.

### SIPERNAT® offers these advantages:

- low coefficient of friction
  - outstanding transparency
  - fine particle grades for thin films
  - low absorption of lubricants
  - good dispersibility and masterbatch loading
- By using SIPERNAT® in combination with such lubricants as oleic acid amide or erucic acid amide, it is possible to optimize and modify the desired properties even further. Lubricants reduce the coefficient of friction, a measure of the blocking, further still.

## Our service to customers

### We offer the following services to customers and prospective customers of our products:

- product samples
- comprehensive information about the physical-chemical data of our products
- continuous improvement of the performance and quality of our products
- production of masterbatches for testing – upon request and in accordance with customer specifications
- performance tests on masterbatches and final products in our laboratories
  - coefficient of friction (static and dynamic)
  - blocking of films
  - transparency, transmission
  - pressure filter test (on masterbatches)
  - Rheological tests and processing tests with measuring kneaders and extruders
  - CoF
  - blocking force
  - haze
  - dispersibility
- Expert advice regarding process technology: Predrying, screening, dispersing, and handling technology
- Joint development projects – by agreement

### SIPERNAT® antiblocking agents: performance in polyolefin films

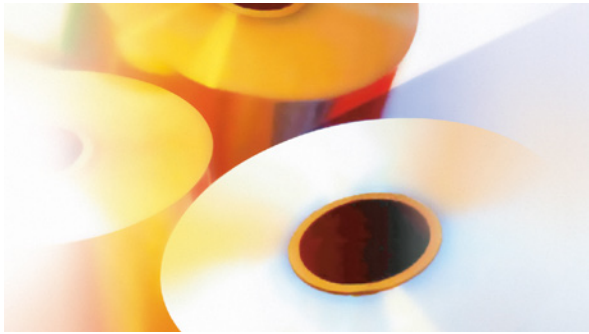
Below described antiblocking agents were incorporated into PE and PP films within the Applied Technology department of the Business Line Silica. Here in the first step masterbatches were manufactured by means of a twin screw extruder, which were rediluted in polyolefin blown and cast films to typical end concentrations. Subsequently fundamental film characteristics were determined using standardized methods.

The data listed in Table 1 provide an overview of the performance of different SIPERNAT® antiblocking agents and do not represent any qualifications on their use.

SIPERNAT® 44 MS, for example, is used for ultra-thin films. It gives them high transparency, is highly dispersible (high masterbatch loading), and shows almost no absorption of the lubricant.

Our Application Technology department can recommend other products for special cases and provide advice about processing and the final properties that can be attained.

**Figure 1**



Antiblocking agents are worked into the film material in small amounts (less than 0.5 wt.%). The particles project from the surface, making it easier to separate the films from one another.

Films are easier to wind if the coefficient of friction has been adjusted to an optimum value. Antiblocking agents are used for this purpose as well.

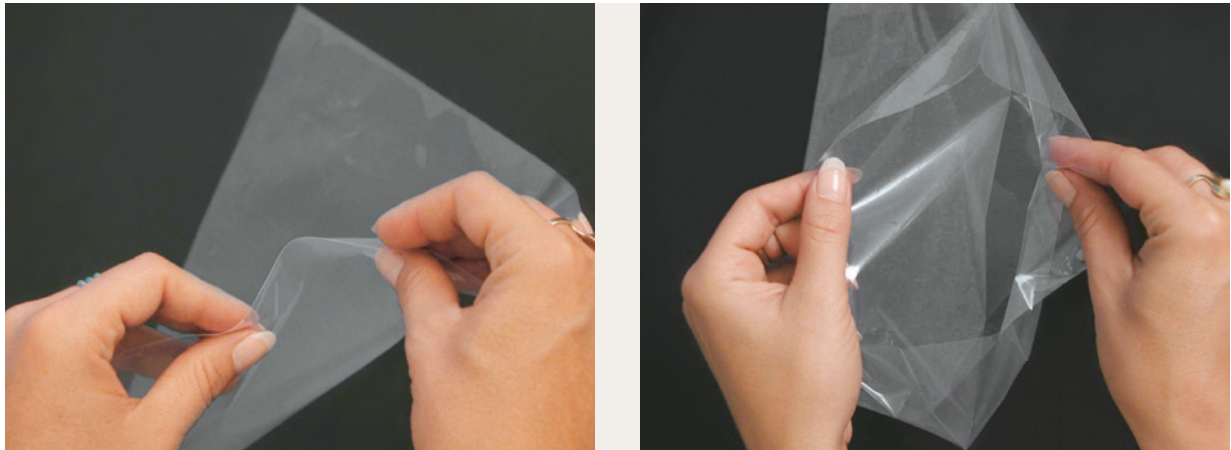
**Tabelle 1**

Product	Coefficient of friction	Transparency/Haze	Masterbatch concentration	Thin films	Interaction with lubricants
SIPERNAT® 44 MS	+	++	+++	++	++
SIPERNAT® 880	+	++	++	+	++
SIPERNAT® 310	++	+	+	+	-
SIPERNAT® 350	+	++	+	++	+

++=excellent    +=very good

## Antiblocking agents change the surfaces of plastic films

**Figure 2**



Packaging bags are easier to open if small amounts of SIPERNAT® are present in their surfaces. The minute helper particles cause the films to have smaller contact surfaces. Tiny air cushions next to the particles make the bag easier to open.

## Products

Table 2 shows the products from our program that have proven best as antiblocking agents. Important analytical parameters of these silicas can be deduced from these tables. The given characteristic data are guide values. Binding specifications are available upon request.

**Table 2**

Product	Particle size d 50 <sup>(1)</sup>	Mean particle size Multisizer <sup>(10)</sup>	Overs >45- $\mu$ m (spray) <sup>(4)</sup>	Specific surface area, Areameter	DBP absorption	Drying loss	Tamped density
	[ $\mu$ m]	[ $\mu$ m]	[%]	[m <sup>2</sup> /g]	[g/100g]	[%]	[g/l]
SIPERNAT® 44 MS <sup>(7,8)</sup>	3,5	–	0,005 <sup>(9)</sup>	n. a.	50 <sup>(3)</sup>	n. a.	550
SIPERNAT® 880 <sup>(7)</sup>	9,0	8,0	0,05 <sup>(5)</sup>	35	185	6,0	300
SIPERNAT® 310 <sup>(6)</sup>	7,5	5,5	0,01	750	210	2,5	150
SIPERNAT® 500 LS <sup>(6)</sup>	6,0	4,5	0,01	450	325	3,0	75
SIPERNAT® 350 <sup>(7,6)</sup>	4,5	3,0	0,05	50	210	5,0	110

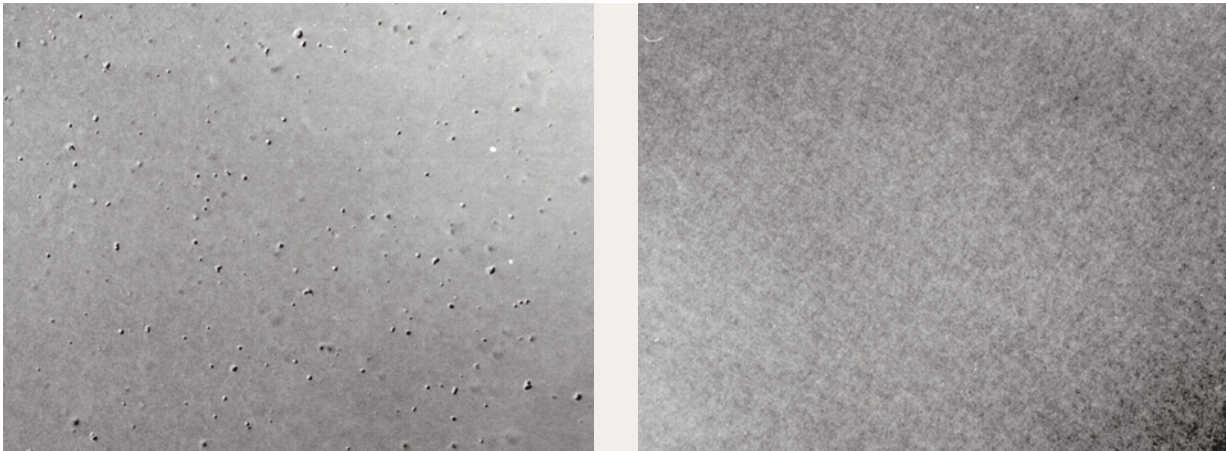
Additional data regarding measuring methods is as follows:

(1) Laser diffraction  
ISO 13320-1  
Particle size varies with the measuring  
method and depends on boundary  
conditions.

(2) Multipoint BET, ISO 9277  
(3) Relative to original substance  
(4) ISO 3262-19  
(5) Mocker, ISO 787-18  
(6) SiO<sub>2</sub> content: approx. 99 %

(7) alkaline pH value  
(8) Finely ground grade  
(9) Immersed, ISO 787-7  
(10) Multisizer 100 $\mu$ m  
Kapillare, ASTM C690-1992

**Figure 3**



SIPERNAT® 44 MS, enlarged 200 times

Film surface without antiblocking agents

The picture on the left shows how the antiblocking particles project from the film surface.

### Principle of the antiblocking effect

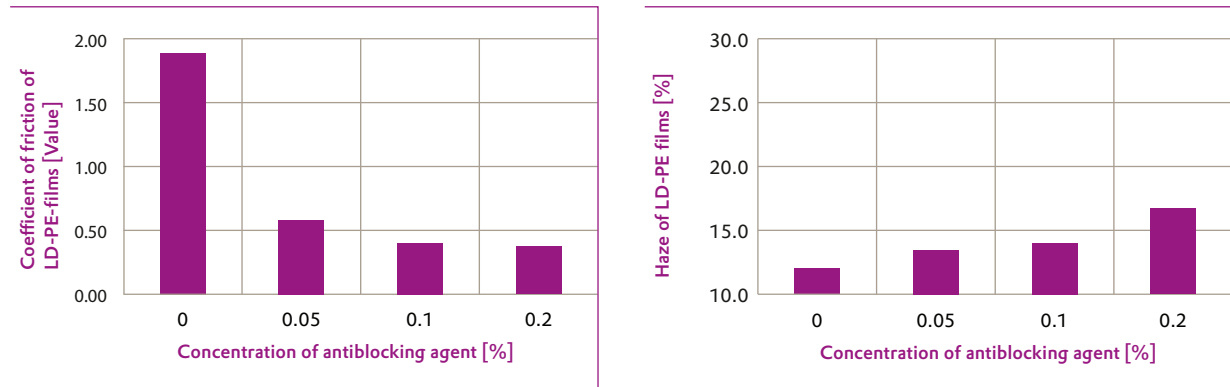
Physically, the antiblocking effect is described by the coefficient of friction (CoF). The graph on the left shows how an antiblocking agent significantly reduces the coefficient of friction of films when used in small quantities.

On the other hand, the incorporated silica reduces the transparency (graph, right). Metrologically, the transparency is measured as haze.

In general, the coefficient of friction and haze are adjusted to the product and manufacturing procedure concerned. But other additives, for example, lubricants, also affect the coefficient of friction.

The amounts and grades of the antiblocking agents and lubricants must be precisely matched to each other.

Abbildung 4



The graphs show how the properties of films are modified.

## Evonik antiblocking agents in films/plastics

Evonik antiblocking agents are used very successfully in a large variety of polymers – e. g., PE, PP, PVC, polyester, cellulose.

SIPERNAT® 500 LS, AEROSIL® OX 50, AEROSIL® TT 600 and AERODISP® G 1220 are often used to impart antiblocking properties to polyester films. In these cases, the antiblocking agents are usually added directly when the polyester is produced (in the polycondensation process stage).

## The interaction antiblocking agent/lubricant

Lubricants and antiblocking agents both reduce the coefficient of friction (CoF). The interaction antiblocking agent/lubricant is therefore very important for the endeavored properties of a film product. Applied Technology will be happy to provide advice about how to optimize the properties of the finished films and the processing process using the data in Table 1 as a starting point.

## Processing SIPERNAT® with plastics

Evonik antiblocking agents make it possible to produce high-grade films in different processing machines.

We recommend that processing be carried out in two stages.

- First produce a masterbatch (also concentrate) out of the antiblocking agent and base polymer (e. g. polyethylene). The concentration of anti-blocking agent may be varied over a wide range. Application Technology will be happy to provide details.
- The masterbatch is worked into the film material in the second step

The amount of antiblocking agent in the film is based on the desired property profile. This working-in, also called redilution, may again be performed in many different types of processing machines: extruders, calanders, and planetary mixers. For processing SIPERNAT® 44 MS, we recommend the use of extruders equipped with a vent zone.

Antiblocking agents may be worked into plastics either directly or as additive concentrates ("one pack").

## Notes

More comprehensive discussion about the physical and chemical properties of a given silica can be found in our Product Information (PI) for the product in question. These Product Information guides can be found at [www.evonik.com](http://www.evonik.com). The PIs may also be obtained from Evonik directly. Contact addresses are in the enclosure. The PIs also contain the test methods that were used.

More detailed information regarding the AEROSIL® anti-blocking agents can also be found in the corresponding Product Information and in the internet.

## Safety and contact with food

The SIPERNAT® product grades given in the table are listed in the EU Directive 2002/72/EC in Appendix III, Section A. These products may therefore be used in food commodities within the European Union. All of the products listed in Table 2 with the exception of SIPERNAT® 44 MS, are included in the positive lists of the 21st Code of Federal Regulation (CFR), Part 175-177, and may therefore come into contact with food.

If for the final product containing SIPERNAT® 44 MS, FDA-conformity is necessary, we recommend an individual testing of the final product.

The products cited are registered in the inventories of existing chemical substances EINECS (Europe), TSCA (USA), AICS (Australia), ECL (South Korea), PICCS (the Philippines), DSL/NDSL (Canada) and IECS (China).



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