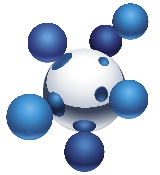


SASOL
reaching new frontiers



DISPERAL®/DISPAL®

High purity dispersible aluminas

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High purity dispersible aluminas

DISPERAL® and DISPAL® are the trade-names for the high purity, highly dispersible, boehmite alumina powders and sols/dispersions manufactured by Sasol in Brunsbüttel, Germany and in Lake Charles, Louisiana, USA. These aluminas, which are nano-sized in the dispersed phase, exhibit a unique combination of purity, consistency and dispersibility that make them excellent materials for use in colloidal applications. The Sasol range of dispersible boehmites has traditionally been used in applications such as sol-gel ceramics, catalysis, refractory materials, rheology control and surface frictionizing.

Other more recently developed uses include surface coating as well as paint detackification.

Advantages of DISPERAL® and DISPAL® aluminas

Sasol pioneered processes utilizing alkoxide chemistry to convert primary aluminum metal into synthetic boehmite aluminas of exceptional purity. Unlike other alumina manufacturing processes that start with less pure materials, Sasol's processes yield aluminas with significantly lower levels of common impurities such as iron, sodium and silica (table 1). Additionally, our 30 years of experience, in combination with other proprietary production techniques, allows us to produce highly dispersible aluminas with a wide range of physical properties such as dispersed particle size (figure 2) resulting in translucent to opaque dispersions (figure 1). Thus, you do not

Table 1

Chemical purity of DISPERAL® and DISPAL® alumina powders	
Impurity	ppm (typical)
Na ₂ O	20
Fe ₂ O ₃	100
SiO ₂	120

need to be limited in your thinking and development of novel alumina-containing products.

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Features of Sasol dispersible aluminas

The unique product characteristics of Sasol dispersible aluminas can lead to many advantages for use in different systems. Some key features are:

- The aluminas are synthetic. Being synthetic, these high purity materials are produced under careful control to yield products with consistent quality and reliable performance.
- Both powders and pre-dispersed alumina are available. Thus, you can choose the form that is most appropriate for your processing needs.
- The powders are highly dispersible. Low viscosity nano-particle sols can be prepared at room temperature in 10 to 30 minutes.
- The aluminas are versatile. They can be employed under a variety of application conditions, including low or high pH and low or high shear.
- Sasol also offers aluminas which are dispersible in organic media, eg alcohols, dimethylformamide (DMF) etc.



Figure 1
Translucent to opaque alumina sols, each with a concentration of 10 wt.% Al_2O_3

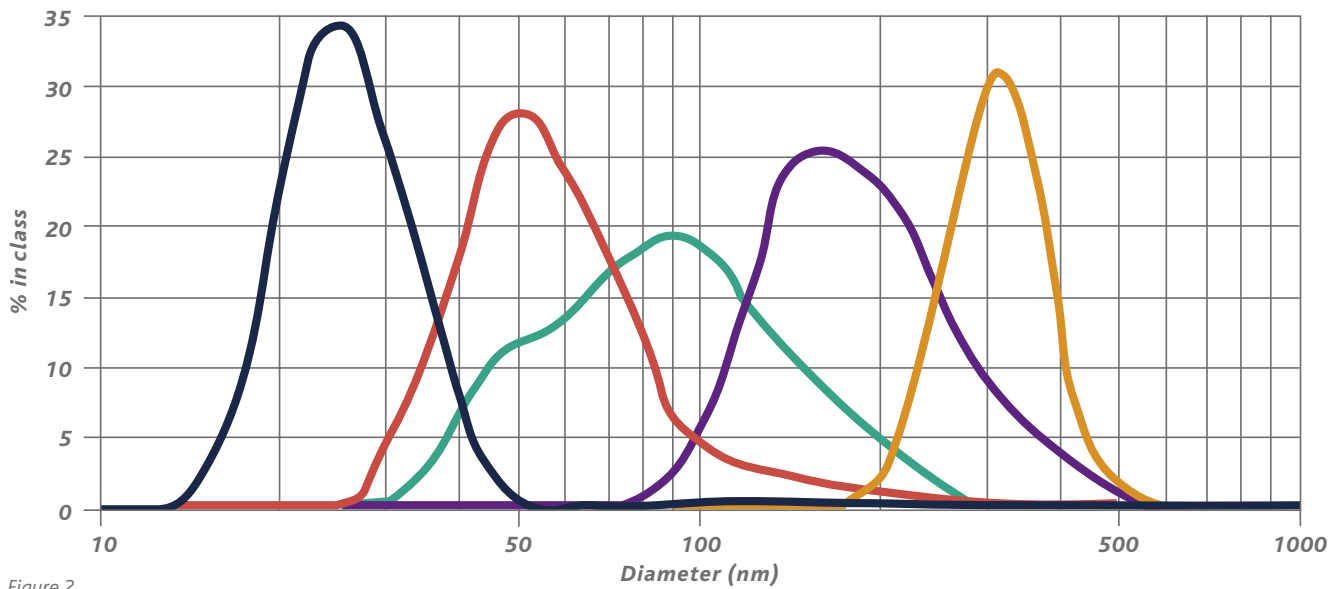


Figure 2
Dispersed particle size distributions of selected products

How to disperse and use DISPERAL® and DISPAL® aluminas

DISPERAL® and DISPAL® powders may be dispersed by following the descriptions below. Figure 3 shows a schematic representation of what occurs to the powder during dispersion using chemical attack and mechanical energy.

Water dispersible alumina

To form a colloidal sol or dispersion from a water dispersible DISPERAL® or DISPAL® alumina powder, simply stir the powder in deionized water with moderate to intense agitation at room temperature for 20–30 minutes. The maximum achievable solids loading will vary according to the specific alumina product selected (figure 4). For most applications, the aluminas perform best when completely dispersed prior to further formulation.

Acid dispersible alumina

Dispersions of acid dispersible products may be formed in a similar fashion described above by dispersing in dilute aqueous monovalent acids such as nitric, hydrochloric, formic or acetic (typically < 1 wt.% acid).

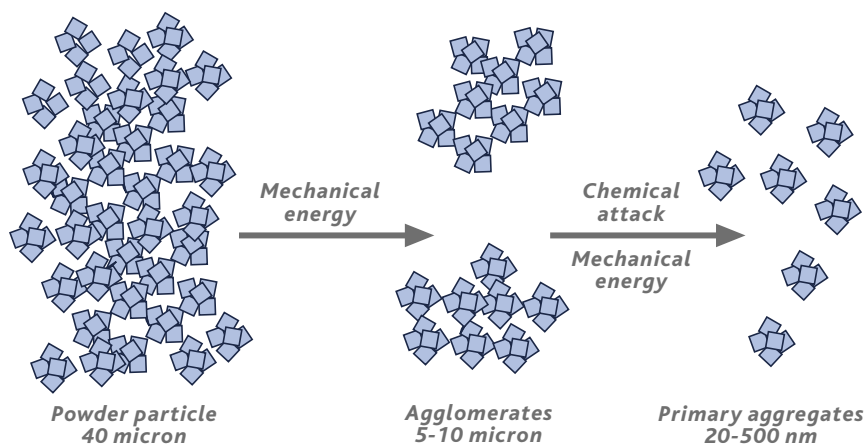


Figure 3
Schematic mechanism of dispersion

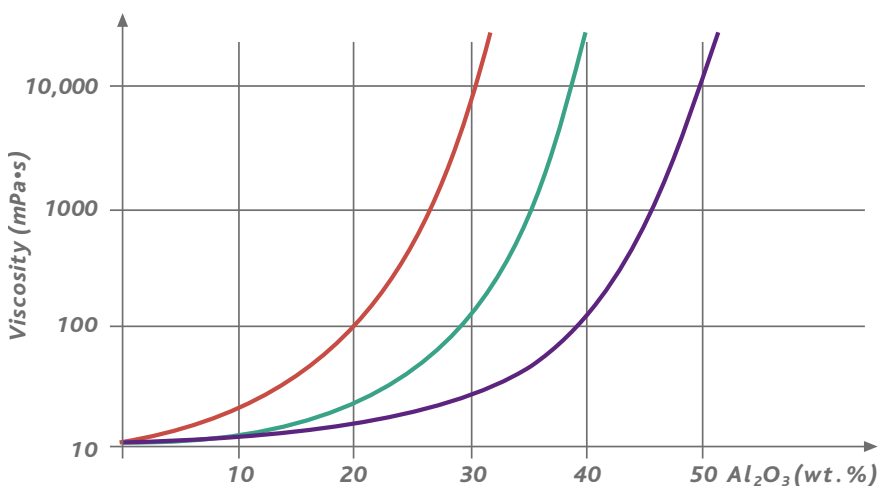


Figure 4
Viscosity versus alumina concentration for different products

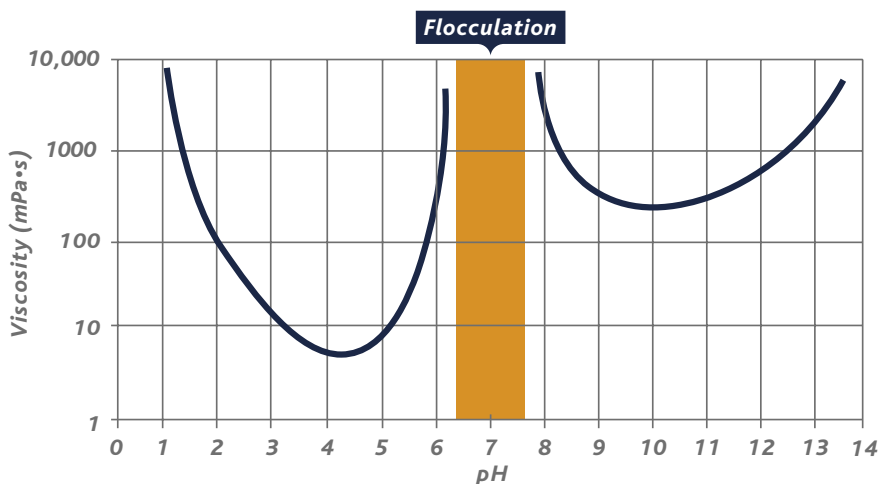


Figure 5
Viscosity versus pH

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Detailed descriptions of the dispersing procedure are available on request.

Organic dispersible alumina

Sasol dispersible aluminas may be dispersed in organic solvents, for example, a dispersion in DMF may be prepared by dispersing the alumina powder, under intense mixing, into DMF containing 0.4 wt.% nitric acid. Information on dispersions in more sophisticated organic systems are available, please contact one of our representatives.

Rheology

Rheological characteristics of alumina dispersions can be affected by numerous factors. These include product used, solid content, crystallinity, water quality, pH and other formulation components. Figure 4 gives example curves of viscosity versus alumina concentration for some typical Sasol products. Also low viscosity dispersions can be "thickened" by the addition of acids, bases or salts to form thixotropic, shear-thinning systems (figures 5 and 6). This, for example, allows alumina to function as a thickener for many types of either acidic or basic formulations.

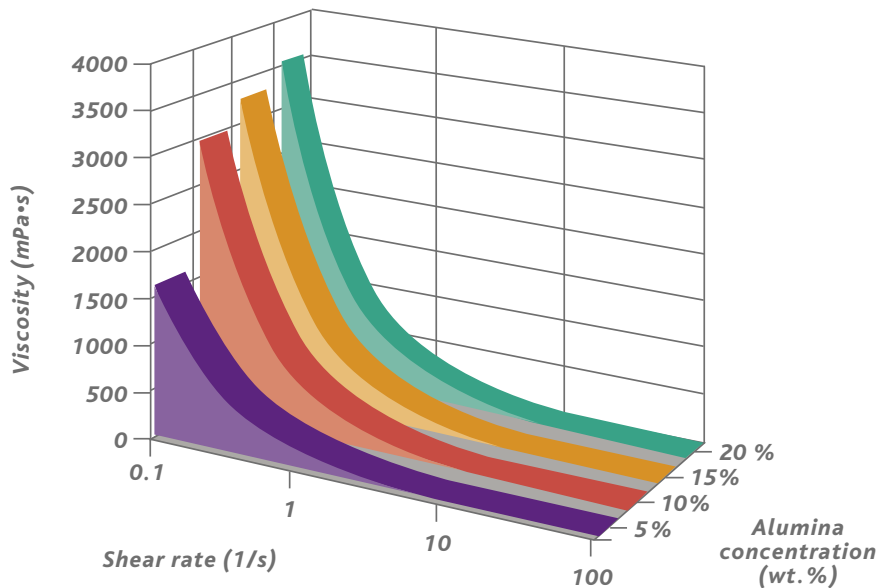


Figure 6
Effect of alumina concentration on viscosity versus shear rate

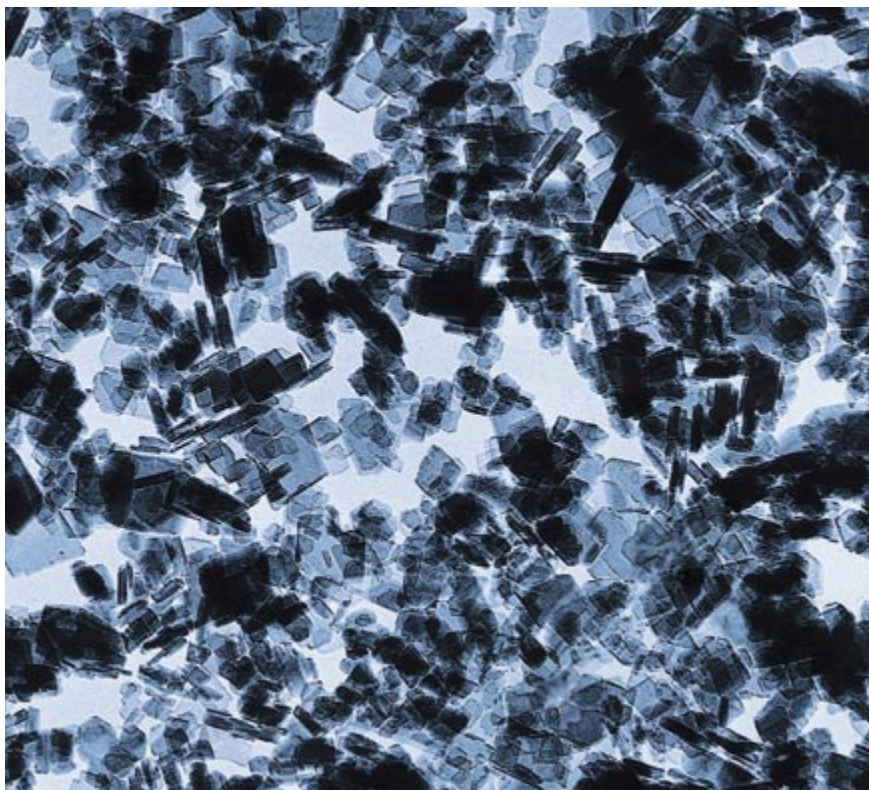


Figure 7
Transmission electron micrograph of a dispersible alumina (magnification: 180,000x)

Storage and transfer

DISPERAL® and DISPAL® alumina powders are mildly abrasive materials having a Mohs hardness of 3.5 to 4.0. Therefore, handling and storage equipment should be designed for such materials. Examples are aluminum, abrasion resistant carbon steel and polypropylene or epoxy-lined steel. Blower or vacuum systems can be used to move the powders. A minimum of 4,000 ft/min fluidizing velocity is recommended. Alumina powders will absorb atmospheric moisture and facilities should be designed appropriately. The liquids are readily pumpable using standard centrifugal or positive displacement pumps. Due to the pH range of available products, recommended materials for process equipment include aluminum, stainless steel, or polymeric lined steel.

Safety and handling

DISPERAL® and DISPAL® alumina powders are classified as non-toxic nuisance dusts. Exposure to high concentrations of dust may cause physical irritation and drying of skin and eye tissues. Repeated or prolonged contact with alumina sols may cause irritation as well. Handling and shipping procedures should be designed to avoid such contact and to minimize the inhalation of airborne dust. Normal good laboratory practices and operating procedures should ensure personnel safety.

Technical support

The Sasol alumina organization is committed to offering the technical service necessary to ensure customer satisfaction. Technical support is available worldwide to aid you in choosing the best alumina for your needs, as well as for providing advice on safe and efficient use. The products described in this brochure give some indications of our total capability. We look forward to discussing specific technical requirements with you.

Analytical methods

Crystallite size Crystallite plane dimensions in powdered alumina samples are analyzed using X-ray diffraction techniques on X-ray diffractometers supplied by Siemens or Philips.

Dispersed particle size The particle size distribution of diluted alumina sols and dispersions is measured using laser diffraction or photon correlation spectroscopy techniques on Malvern or Cilas instruments.

Dispersibility of alumina powder A specified amount of alumina powder is added to water or dilute acid under stirring. The mixture is then stirred for a specified period of time to form a dispersion. The dispersion is centrifuged, and the undispersed residue is isolated, dried, and weighed to determine the percent non-dispersed material.

Surface area The boehmite aluminas are first calcined at 550°C for

three hours in preparation for analysis. Alumina surface area is then measured using BET nitrogen adsorption techniques on instruments supplied by Quantachrome (Nova series) or by Micromeritics (Gemini series).

Trace element analysis Trace element analysis is performed by using several methods, including X-ray fluorescence of pressed alumina disks and wet techniques (ICP/OES).

We reserve the right to make any changes according to technological progress or further developments.

No guaranty or warranty is implied or intended as to any particular properties of our products.

The customer is not released from the obligation to conduct careful inspection and testing of incoming goods. Reference to trademarks used by other companies is neither a recommendation, nor is it intended or suggested that similar products could not be used.

All our business transactions shall be governed exclusively by our general business conditions.

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Product information

DISPERAL® , DISPAL® Acid dispersible boehmite alumina systems

High purity aluminas

Typical chemical and physical properties	DISPERAL® 77	DISPERAL® 20	DISPERAL® 40	DISPERAL® 60	DISPAL® 18HP	DISPERAL® HP 14	DISPERAL® HP 18
Al ₂ O ₃ [%]	77	77	80	80	80	77	77
Na ₂ O [%]	0.002	0.002	0.002	0.002	0.020	0.002	0.002
Loose bulk density [g/l]	400–600	500–700	500–700	400–600	400–600	300–500	300–500
Particle size (d ₅₀)* [µm]	25	30	50	50	35	35	35
Surface area (BET)** [m ² /g]	180	150	100	95	175	160	140
Pore volume** [ml/g]	0.5	0.7	0.8	0.9	0.95	1.1	1.2
Crystallite size [120] [nm]	10	20	40	60	14	14	18
Dispersed particle size*** [nm]	80	150	300	350	170	170	200

Chemical purity: C: 0.25 %, SiO₂: 0.01–0.015%, Fe₂O₃: 0.005–0.015 %, TiO₂: 0.01–0.15 %

* Particle size as measured on the powder

** Activation at 550°C for 3 hours

*** 10 wt. % Al₂O₃ in 0.4 wt. % HNO₃

Dispersions of acid dispersible products may be formed by dispersing in dilute aqueous monovalent acids (typically 1 wt% acid) such as nitric, hydrochloric, formic, lactic or acetic acid

Further speciality grades are available upon request

Product information

DISPERAL® , DISPAL®

Water dispersible boehmite alumina systems

High purity aluminas

Typical chemical and physical properties	DISPERAL® P2	DISPERAL® 25F4	DISPERAL® 23N4-80	DISPERAL® HP 14/2	DISPERAL® 18N4-80	DISPERAL® 14N4-80	DISPERAL® 11N7-80	DISPERAL® 10F4	DISPERAL® 8F4
Al ₂ O ₃ [%]	72	78	80	75	80	80	80	83	83
Na ₂ O [%]	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NO ₃ ⁻ [%]	4.0	—	1.6	1.3	1.1	0.7	0.1	—	—
H ₃ COO ⁻ [%]	—	2.0	—	—	—	—	—	0.25	0.2
Loose bulk density [g/l]	850	820	980	500	870	850	620	550	500
Particle size(d ₅₀)* [µm]	45	30	50	35	50	50	40	30	30
Surface area (BET)** [m ² /g]	260	250	200	170	180	140	100	100	95
Pore volume** [ml/g]	0.5	0.4	0.4	1.0	0.5	0.5	0.8	0.8	0.7
Crystallite size [120] [nm]	4.5	8	9	13	15	18	30	40	53
Dispersed particle size*** [nm]	25	70	90	100	110	120	220	240	350

Chemical purity: C: 0.25 %, SiO₂: 0.01–0.015 %, Fe₂O₃: 0.005–0.015 %, TiO₂: 0.01–0.15 %

* Particle size as measured on the powder

** Activation at 550°C for 3 hours

*** 10 wt.% Al₂O₃ in H₂O

To form a colloidal sol or dispersion simply stir the powder in deionized water with moderate agitation at room temperature for 10–20 minutes

Further specialty grades are available upon request

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