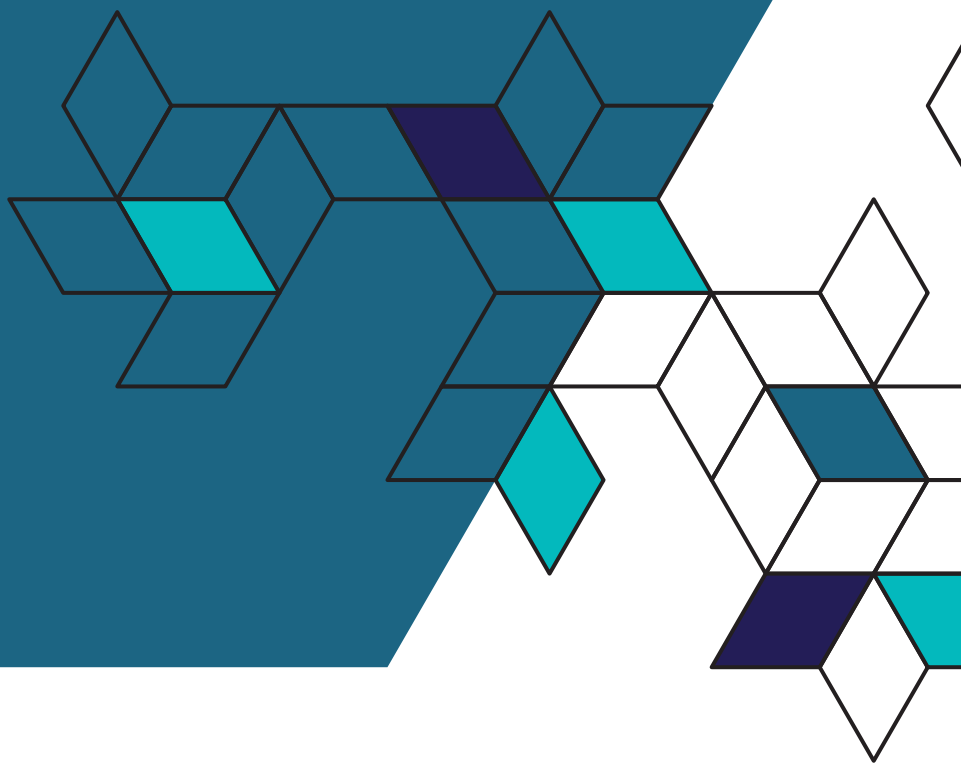
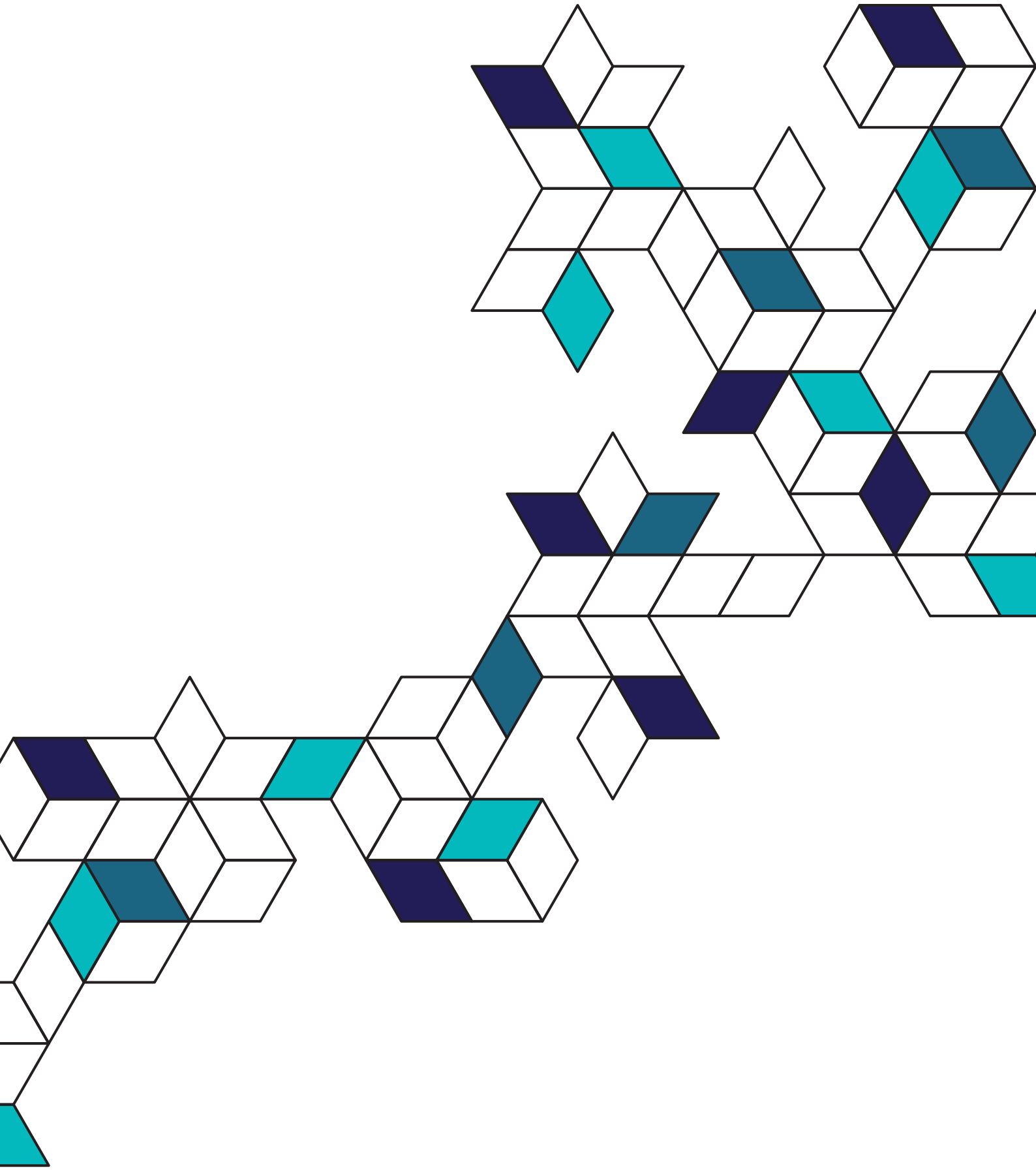
Polishing aluminas

NABALOX®

Nabaltec

Our **know-how** for your **safety**





NABALOX® aluminas

Nabaltec is a worldwide leading producer of synthetic raw materials. These are: Aluminas (**NABALOX**®), ready-to-press ceramic bodies (**GRANALOX**®) and aluminas for polishing (**NABALOX**®). The special types of **NABALOX**® aluminas are successfully utilised worldwide as both abrasive and polishing media. The **NABALOX**® polishing oxide range offers a broad spectrum of soft and hard calcined aluminas for a variety of applications for industrial surface finishing. A multitude of **NABALOX**® polishing aluminas are used for the production of polishing pastes and emulsions for almost any material group, such as metals, stone, plastics, car paints, semiconductors, special glasses and many others. The properties of the agglomerates and primary crystals of the aluminas have a direct influence on the quality of the to be finished surfaces and are determined by the following parameters:

The primary crystal size

is mainly determined by the degree of calcination of the polishing alumina. This size will influence the dimension and type of the material abrasion and is thus primarily responsible for the achievable surface quality. Small primary crystals lead to minor surface roughness with only minor material abrasion and therefore lead to a high surface quality. When large primary crystals are used, the surface roughness and material abrasion will be correspondingly higher.

The secondary grain

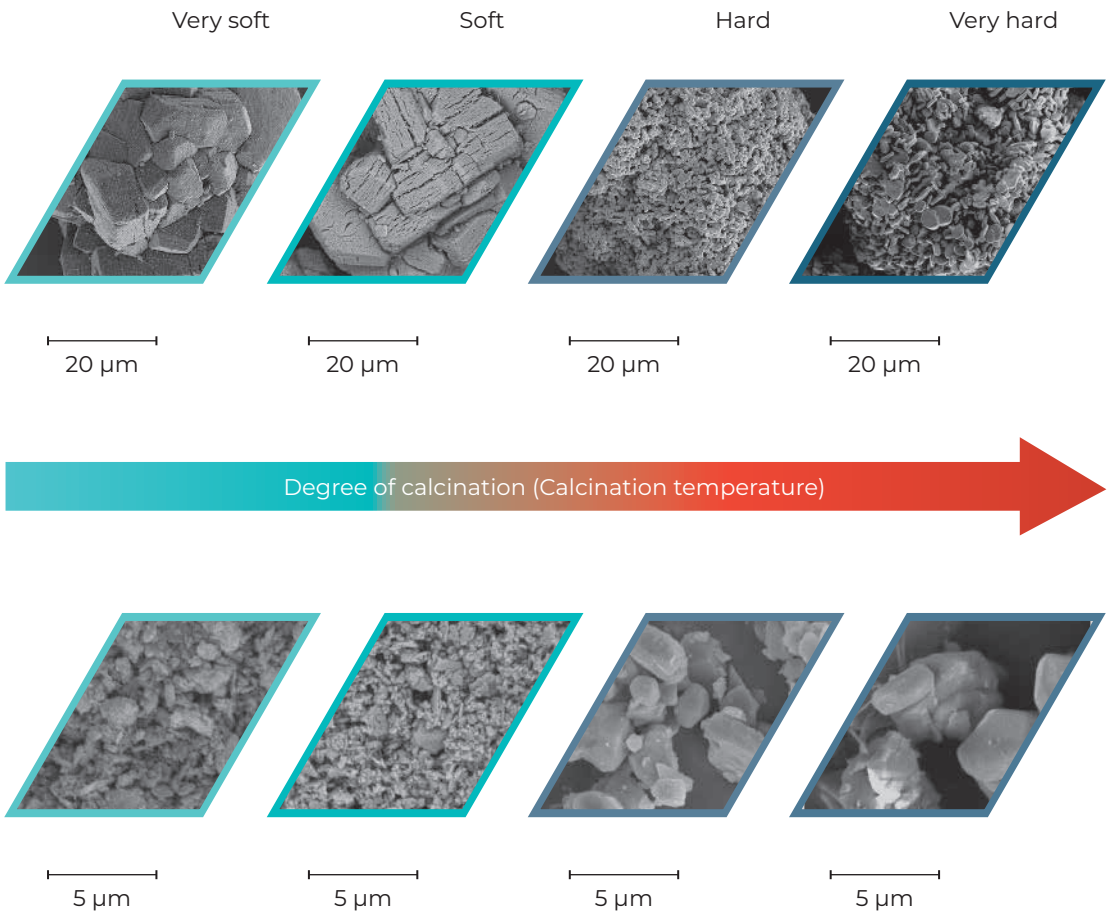
represents a cluster (agglomerate) of primary crystals. During the polishing process the secondary grain will be destroyed by mechanical action, leading to the release of primary crystals which range from several hundred nanometers to micrometer size. A defined abrasion rate will be initially induced due to the secondary grains and polishing begins on release of primary grains. The initial abrasion rate is reduced by the decomposition of the agglomerate and a polishing action begins, which relates to the final surface quality. In addition to the grain size, the structure of the grain cluster will also influence the oil absorption value.

The grain size distribution

reflects the distribution of the different grain size classes (fractions), relative to the secondary grains. With regard to the polishing behavior, the portion and dimension of the coarsest fraction are crucial. For applications with a low tolerance for coarse grains Nabaltec AG has developed an additional product group of soft calcined polishing aluminas. Using our innovative and state of the art processing steps we can ensure that oversized secondary grains are significantly reduced compared to other conventional polishing agents.

Our task

By tailoring the production process it is possible to manufacture a broad spectrum of different polishing aluminas which can be readily adjusted to the various finishing requirements of a wide variety of materials. The following tables are intended to provide an overview of the available alumina types.



Primary crystal size

< 0.05 µm	< 0.5 µm	2 µm	3 µm

Specific surface area (BET)

75 m^2/g	8 m^2/g	0.7 m^2/g	0.5 m^2/g

Crystal modification

< 5 % α-Al_2O_3	> 70 % α-Al_2O_3	98 % α-Al_2O_3	98 % α-Al_2O_3

Calcination temperature

Size of primary crystals, specific surface areas, α-Al_2O_3-content of different calcination degrees.

The polishing process

The result of the polishing process is determined by several factors. Since the polishing tool and work piece are often defined by the customer's needs the selection of the correct polishing grain plays a crucial role.

Due to its excellent price to performance ratio the alumina is well known and is widely used as a raw material in almost all industrial applications such as grinding or polishing.

Polishing grain Al_2O_3

- Hardness: 9 (α-Phase)
- Grain size (-distribution): 0.5 µm - 80 µm wide or narrow, with or without topcut
- Grain shape: roundish or plateletlike

Polishing tool

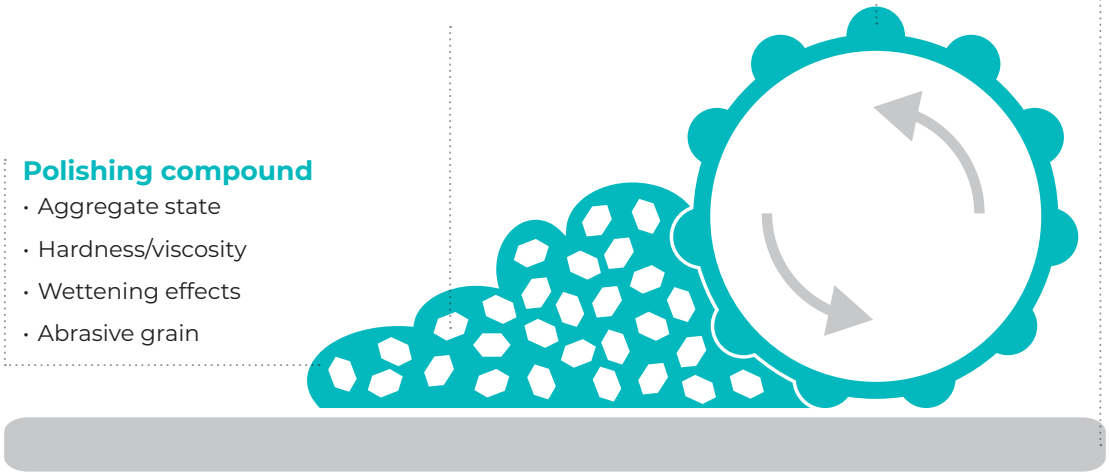
- Hardness
- Speed
- Pressure
- Material (brush, sponge, ...)

Work piece

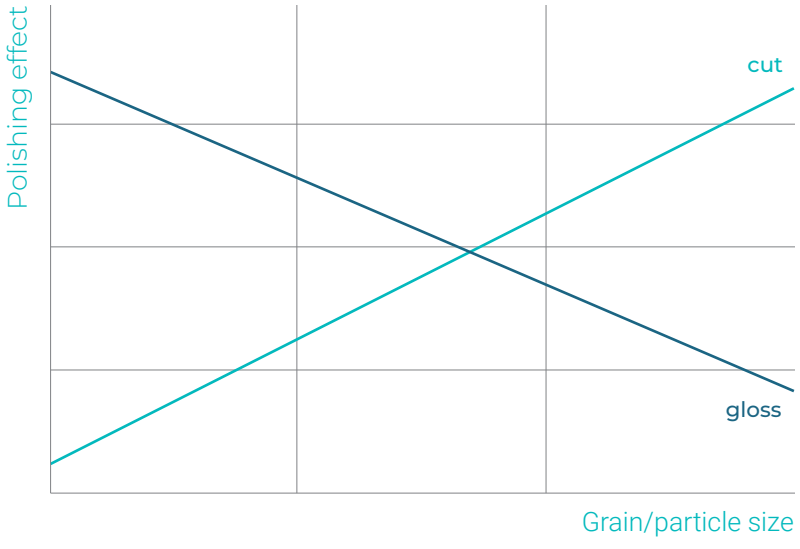
- Material
- Hardness
- Surface quality

Polishing compound

- Aggregate state
- Hardness/viscosity
- Wettening effects
- Abrasive grain



A variety of parameters influence the result of the polishing process

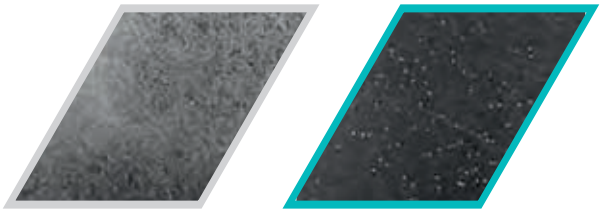


Schematic correlation between grain size and polishing effect

NABALOX® NO 383

is part of a new and pioneering family of soft calcined polishing aluminas with particle size distributions, characterized by a "top cut" and with reproducible processing properties, which enable our customers to develop sustainable products for new, high-quality applications.

Conventional polishing alumina:
Sieve residue > 45 µm: approximately 2 %



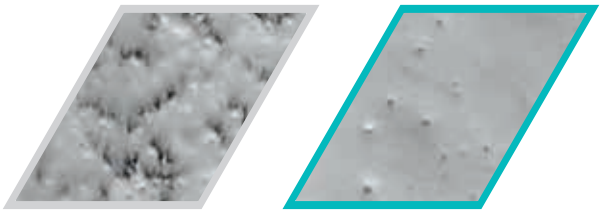
NO 383

Sieve residue > 45 µm: approximately 0.05 %

Agglomeration and dispersibility

Another aspect is the behavior of the alumina during the production and preparation of the polishing compounds. In particular, for highly sensitive polishing applications, such as polishing of automotive paints, a good dispersion is needed. Nabaltec's progressive preparation methods provide the customer with raw materials of controlled, well defined and low levels of re-agglomeration. As a result, a homogeneous distribution of polishing grains on the work piece can be achieved.

Conventional polishing alumina:
Stirred slurry



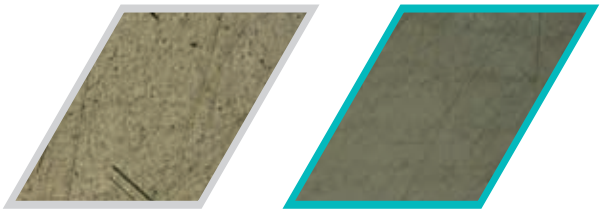
NO 383

Stirred slurry

The polishing result

Through a systematic development of the conventional manufacturing process for soft calcined aluminas we can achieve a further significant reduction in abrasiveness. This has resulted in the development of new high-gloss polishing aluminas NO x8x. The optimized method allows the production of high quality polishing aluminas with a grain size range of 1 - 10 microns (D50).

Conventional polishing alumina:
Stainless steel 20 min polished Removal 0.08 µm / min



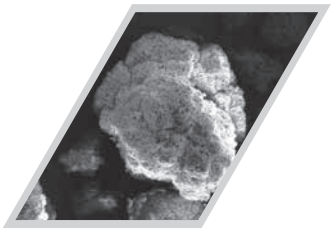
NO 383

Stainless steel 20 min polished Removal 0.04 µm / min

NABALOX® different grades of polishing aluminas

Hard calcined

Hard - coarse

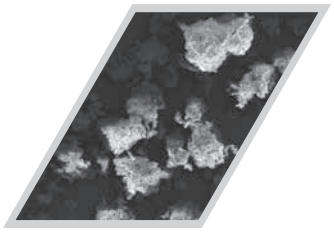


50 µm

- High cut on all materials
- Rough grinding of metals, natural stone, glass
- Mattening

NO 201-71 **NO 205 G**

Hard - medium

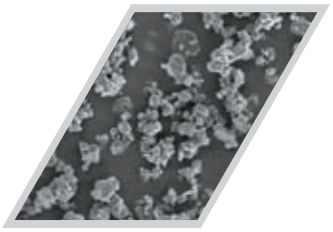


50 µm

- High cut on all materials
- Precise pregrinding of metals
- Mattening

NO 230 **NO 255** **NO 255 F** **NO 250** **NO 225**

Hard - fine



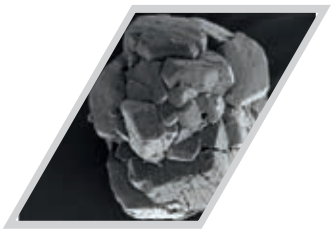
10 µm

- High cut on soft materials
- Pregrinding of non-iron metals
- Polishing of stone and ceramics

NO 115-71 **NO 235** **NO 275** **NO 295** **NO 215 G**

Soft calcined

Soft - coarse

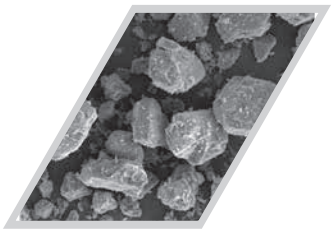


20 µm

- High cut on soft materials
- Low cut on hard materials
- Gloss on iron and steel
- Polishing of stone

NO 202 II **NO 201** **NO 221-30** **NO 221-40**

Soft - advanced

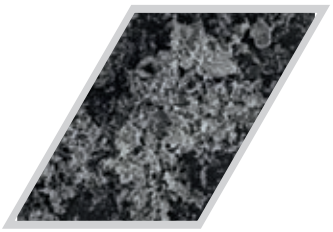


20 µm

- High cut combined with high gloss
- Blue shine finish on stainless steel
- Car paint polish

NO 183 **NO 183 F** **NO 283** **NO 283 F** **NO 383** **NO 683** **NO 684** **NO 681**

Soft - milled



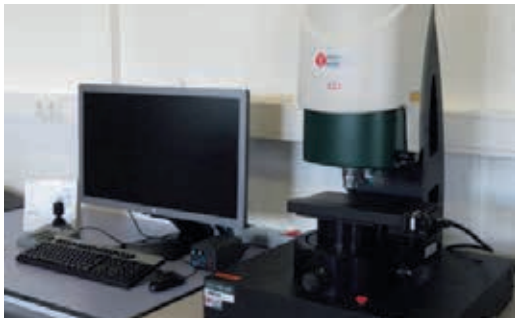
20 µm

- High cut on soft materials
- Pregrinding of plastics and coatings
- Household polishers
- Household cleaners

NO 212 **NO 265** **NO 313**

Defined measurement of surface finishing qualities (White Light Interferometry)

Interferometry enables 3D-profiling of (polished) surfaces up to highest resolutions (300 nm laterally and 0.1 nm vertically). Polishing properties of different abrasives can be compared with high accuracy. Development of customer specific abrasives is our mission.



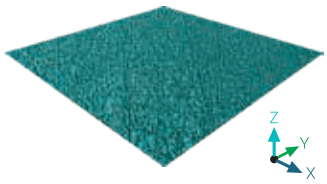
White Light Interferomety 3D profiles

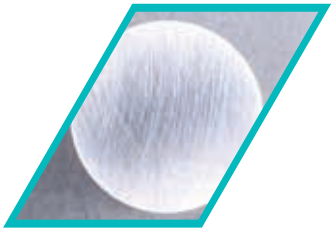
Optical Photographies

Stereoscopic pictures:

rough surface,
50x – objective

X = 325 µm
Y = 326 µm
Z = 1.42 nm

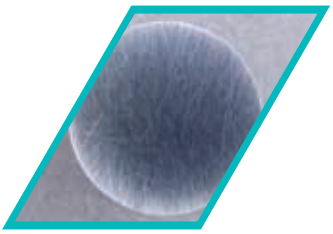




NO 205 G

polished surface
with scratches,
50x - objective

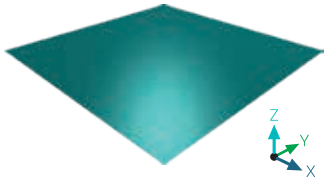
X = 325 µm
Y = 326 µm
Z = 216 nm

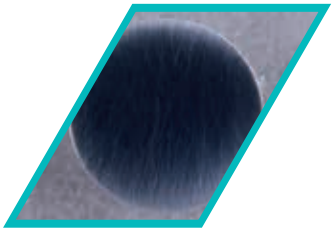


NO 295

finished surface,
50x - objective

X = 325 µm
Y = 326 µm
Z = 83 nm





NO 183

Polished surfaces of stainless steel

Car paint polishing

Introduction

Alumina based car paint polishing pastes are commonly used for car care and reconditioning, as well as quick repair of flaws in fresh painted coats.

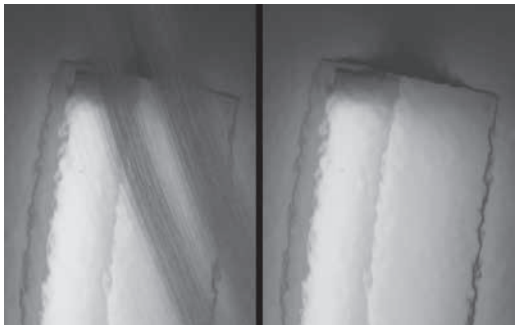
Most important feature of a good polishing paste is a high cutting power combined with a good, scratch-free surface.

Car paint polishing process

Heavy cut paste

Some applications, such as quick repair (paint shop) or scratch removal (retailer) require polishing pastes with:

- focus on very high cutting rate
- the ability to remove scratches or sanding marks



Car paint before (left) and after (right) scratch removal

Two step process:

- After prepolish with heavy cut paste, a finshing step is required to achieve the desired gloss level.

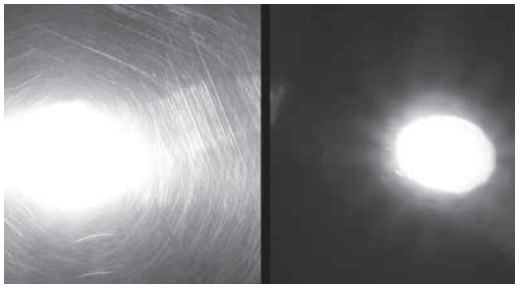
Two-in-one step process:

- Scratch removal and finishing achieved just in one polishing step.
- Only sophisticated heavy cut pastes allow this grade of efficiency.

Anti hologram paste

As a finishing step after prepolishing, or to regain gloss of aged surfaces, a paste with more gentle polishing properties and low cutting rate is required. Focus is on:

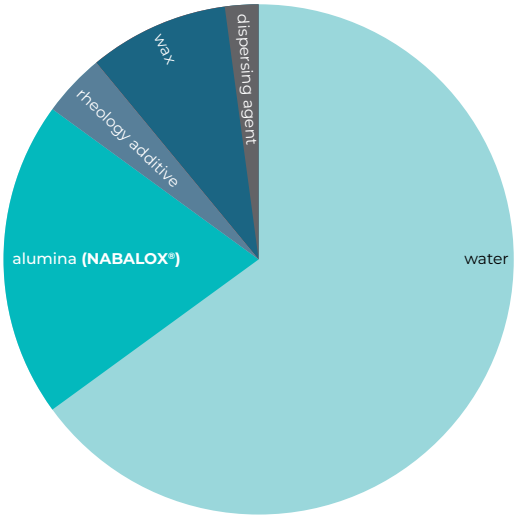
- surface quality without micro scratches
- removal of swirl mark holograms (but not deeper scratches)
- barely noticeable clear coat damage



Car paint before (left) and after (right) finishing

Formulation

Besides water alumina is the main ingredient in polishing paste formulations. Other, minor additives may be included to improve workability and storage stability. Others like wax or similar provide a temporary sealing coat. Alumina as the abrasive is the most influencing and determining factor for many parameters like: cut, gloss and scratches, but also for viscosity, sedimentation, etc. The choice of the right alumina determines the character of the resulting polishing paste. Consequently, aluminas can be arranged in groups such as heavy cut, intermediate or finishing aluminas, according to the properties of the resulting pastes. Sophisticated polishing aluminas can have the effect of secondary grain disaggregation enabeling even two-in-one step polishing pastes.

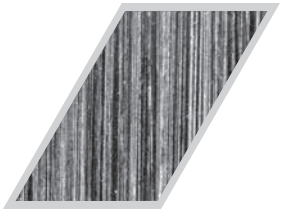


Exemplary formulation of a typical car paint polishing paste

Testing

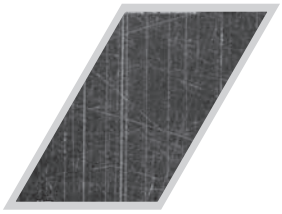
Defined, parallel scratches of F2000 sanding pads are generated on black painted test panels. After that polishing cycles of 30 sec, each are applied until the sanding marks are totally removed. After each cycle the gloss is measured by a gloss meter and surface is captured by microscopic camera. Number of cycles when sanding marks are fully removed is representative for the cutting rate of the tested paste.

Microscopic camera



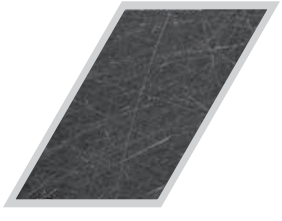
1 mm

After sanding: Deep, parallel sanding marks



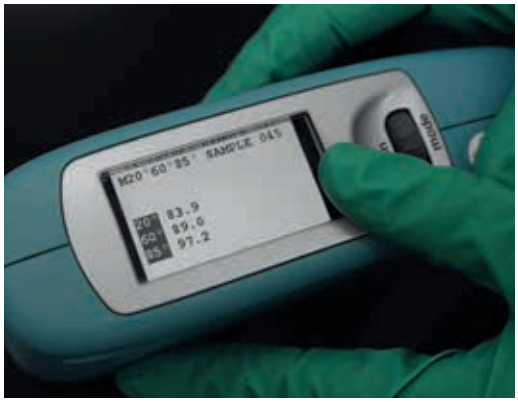
1 mm

After two cycles with NO 383: Sanding marks removed to great extend

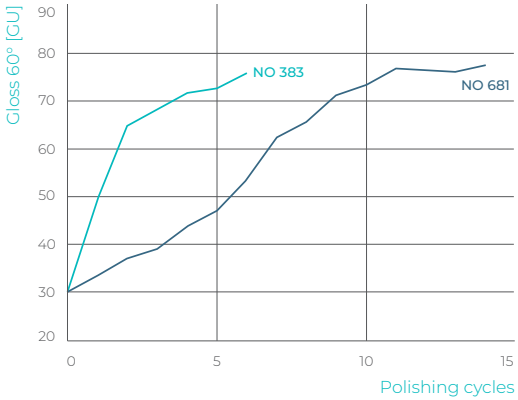


1 mm

After six cycles with NO 383: Sanding marks removed completely



Gloss meter (GU: Gloss Units; Measuring angle 60°)



Gloss-cycle-chart of **NABALOX® NO 681** and **NO 383**

NABALOX® NO 383 combines heavy cut with high gloss. This alumina is able to remove sanding marks or scratches efficiently. Nevertheless, it generates a high glossy finish.

NABALOX® NO 681 can be used for hologram removal. Due to the low cutting rate, the clear coat is barely damaged.

Recommended **NABALOX®** grades for different car polishing tasks

	Application			Polishing properties*	
	Cut	Intermediate	Finish	Cycles	Gloss 20°
NO 212	•			6	67.3
NO 183 F	•			7	69.9
NO 383	•	(•)		5	74.5
NO 684		•	•	9	78.4
NO 681			•	16	81.1

*Internal polishing test
Different conditions than above. Items of difference can be multiple, such as measurement angle, polishing pads, batch number of paint, etc.

NABALOX® polishing aluminas survey of types

Very hard calcined aluminas

α-Al_2O_3[1]: 98 % · Primary crystal size[2]: 3 µm, platelets

	Abrasivity[3]	D50 [µm][4]	D90 [µm][4]	BET [m²/g][5]	Oil absorption [%][6]
NO 205-71	*****	60	110	0.6	35
NO 230	****	20	70	0.7	20
NO 115-71	***	8	40	0.8	17
NO 235	**	6	20	0.8	15

Hard calcined aluminas

α-Al_2O_3[1]: 98 % · Primary crystal size[2]: 2 µm

	Abrasivity[3]	D50 [µm][4]	D90 [µm][4]	BET [m²/g][5]	Oil absorption [%][6]
NO 205 G	****	80	130	0.7	35
NO 255	***	65	110	0.8	35
NO 255 F	***	60	100	0.8	35
NO 250	**	55	90	0.8	30
NO 225	**	15	40	0.8	25
NO 275	**	8	30	0.8	20
NO 295	**	7	25	0.9	20
NO 215 G	**	7	30	0.9	17

Soft calcined aluminas

α-Al_2O_3[1]: > 70 % · Primary crystal size[2]: < 0.5 µm

	Abrasivity[3]	D50 [µm][4]	D90 [µm][4]	BET [m²/g][5]	Oil absorption [%][6]
NO 202 II	***	80	130	8	45
NO 265	**	13	50	9	30
NO 212	**	12	45	10	30
NO 313	*	5	30	10	25

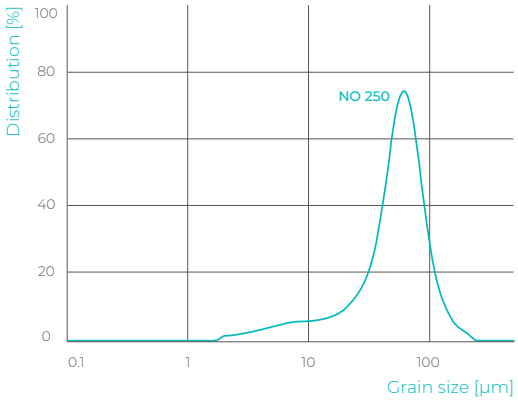
Very soft calcined aluminas

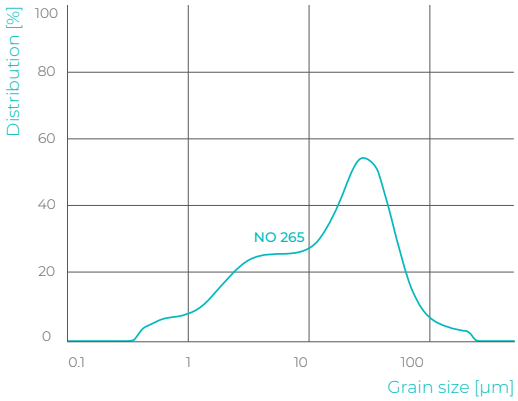
α-Al_2O_3[1]: < 0.5 % · Primary crystal size[2]: < 0.05 µm

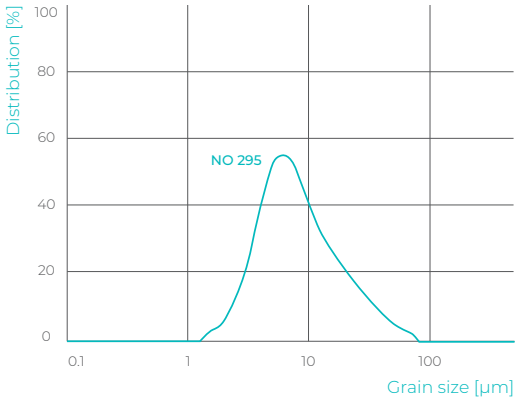
	Abrasivity[3]	D50 [µm][4]	D90 [µm][4]	BET [m²/g][5]	Oil absorption [%][6]
NO 201	***	80	130	75	55
NO 221-40	**	40	80	75	50
NO 221-30	*	30	60	75	50

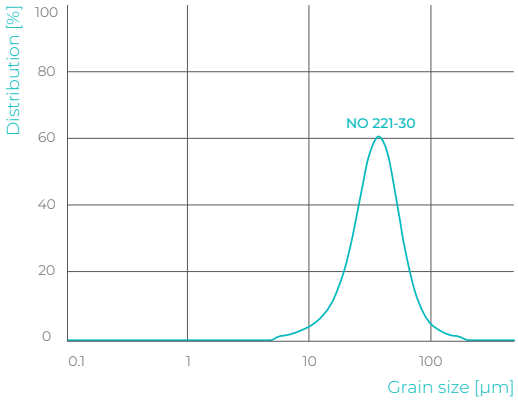
[1]XRD
[2]SEM
[3]comparative polishing test
[4]Laser granulometry Microtrac S 3500
[5]DIN ISO 9277
[6]DIN EN ISO 787 Part 5

Typical grain size distributions









NABALOX®	
Formula	Al_2O_3
CAS No.	1344-28-1
EINECS No.	215-691-6
Harmonized tariff No.	281820

Typical chemical analysis:	**[%]**
Al_2O_3	> 99
SiO_2	0.04
Fe_2O_3	0.03

NABALOX® advanced polishing aluminas

Very soft calcined aluminas

α-Al_2O_3[1]: < 5 % · Primary crystal size[2]: < 0.05 µm

	D50 [µm][3]	D90 [µm][3]	Sieve Ø [µm]	Residue [%]	BET [m²/g][5]	Oil absorption [%][6]
NO 681	1.9	3	45	0.05	75	40

Soft calcined aluminas

α-Al_2O_3[1]: > 70 % · Primary crystal size[2]: < 0.5 µm

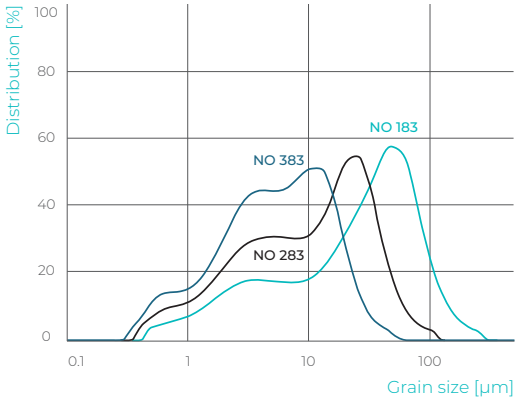
	D50 [µm][3]	D90 [µm][3]	Sieve Ø [µm]	Residue [%]	BET [m²/g][5]	Oil absorption [%][6]
NO 183	27	75	75	3.5	10	30
NO 183 F	18	55	63	2.5	10	30
NO 283	11	35	63	0.05	10	30
NO 283 F	5	18	63	0.05	10	30
NO 383	4	15	45	0.05	10	30
NO 683	1.5	3	45	0.05	11	26

Soft calcined soda aluminas

α-Al_2O_3[1]: 95 % · Primary crystal size[2]: 0.5 µm

	D50 [µm][3]	D90 [µm][3]	Sieve Ø [µm]	Residue [%]	BET [m²/g][5]	Oil absorption [%][6]
NO 684	1.5	3	45	0.05	6	20

Typical grain size distributions



1)XRD
2)REM
3)Laser granulometry Microtrac S 3500
5)DIN ISO 9277
6)DIN EN ISO 787 Part 5

Nabaltec
product portfolio

ACTILOX®

Boehmite, as flame retardant filler and catalyst carrier

APYRAL® AOH

Boehmite, as flame retardant filler and functional filler

APYRAL®

Aluminium hydroxides, as flame retardant and functional filler

GRANALOX®

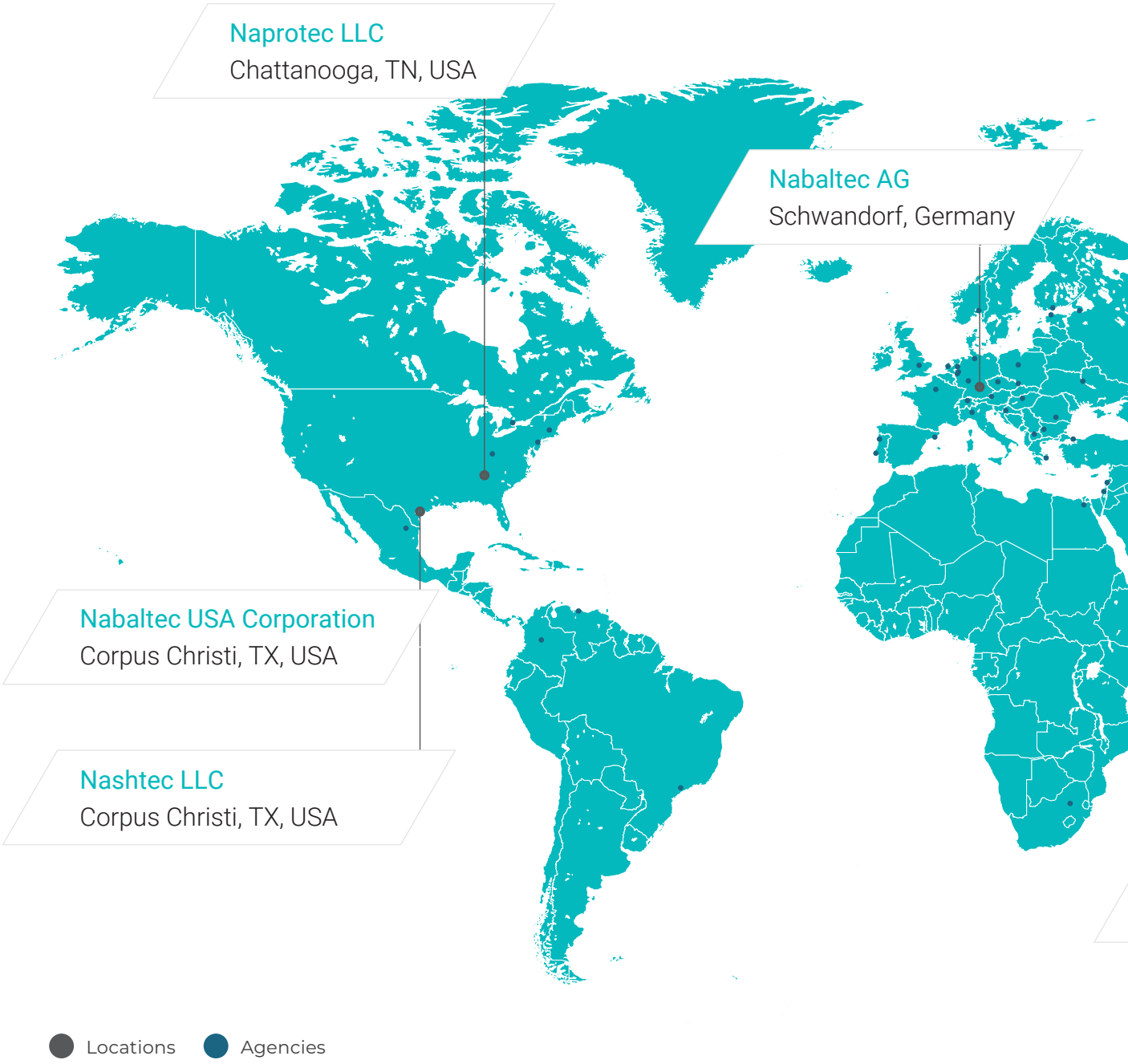
Ceramic bodies, for the production of engineering ceramics

NABALOX®

Aluminium oxides, for the production of ceramic, refractory and polishing products

Nabaltec
worldwide

Visit us at our website www.nabaltec.de where you will find the latest company updates and recent versions of all available certificates free for download as PDF-documents.



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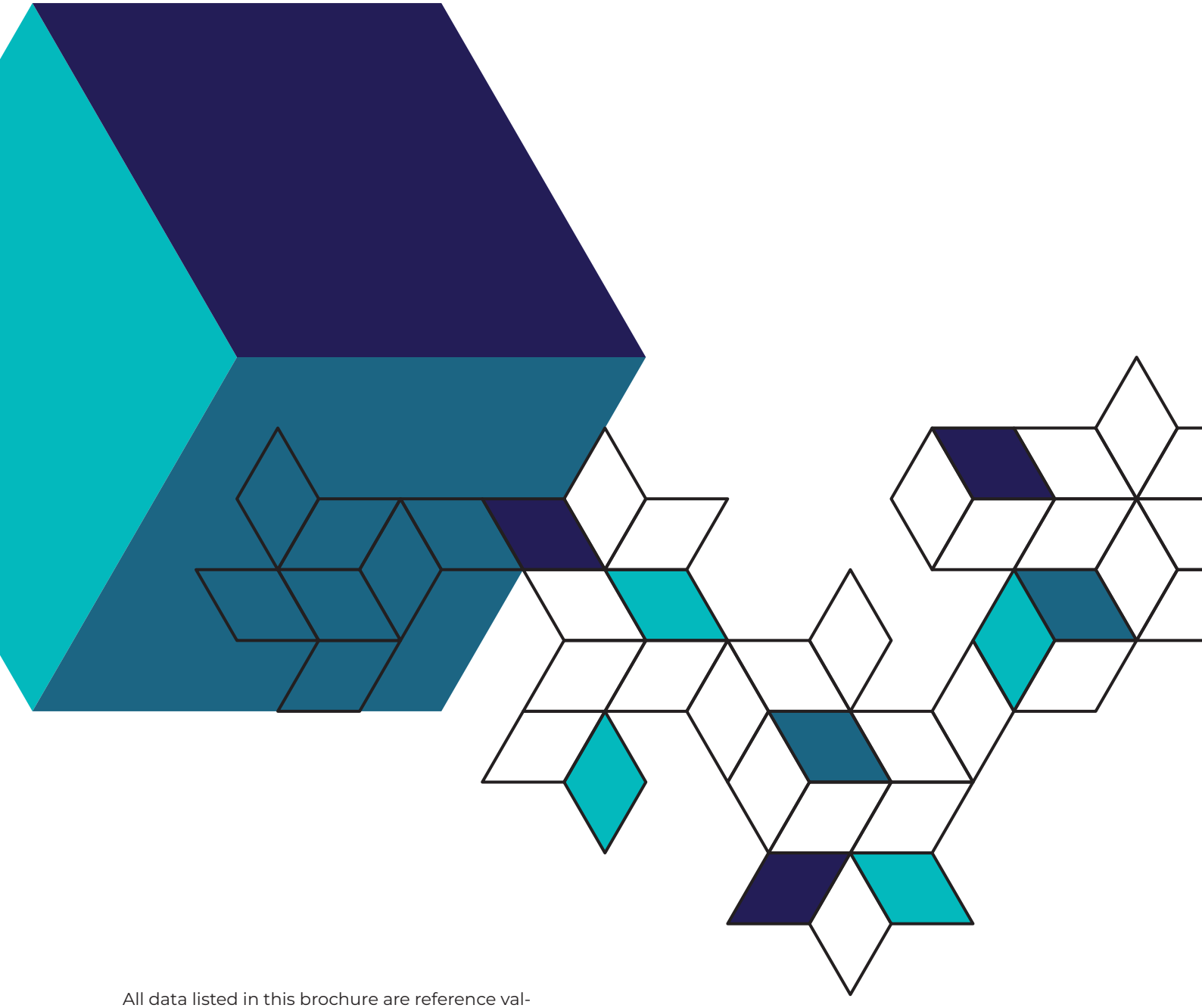

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