



**CERAMIC PRODUCTS
FOR GLASS INDUSTRY**

ABOUT KYOCERA

Headquartered in Kyoto, Japan, Kyocera is one of the world leaders in the manufacturing of ceramic components and products, with an extensive range of applications. Our long-standing experience in the field of ceramics is applied in the production of very precise, high quality products used in multiple fields. With the acquisition of two Fine Ceramics manufacturing assets in 2019, Kyocera is able to respond quickly to clients in Europe, satisfying the growing market demand for Fine Ceramic components.



FINECERAMICS FOR HIGHEST PERFORMANCE

The quality of materials used in high-temperature applications is important. For decades, products made out of DEGUSSIT® and StarCeram® have proved efficient in many demanding branches of the glass processing industry as well as in process and analysis technology. High-purity ceramic materials and excellent manufacturing quality provide exceptional corrosion resistance and outstanding shape stability of our products - even at maximum temperatures. Our success is based on a combination of these properties allowing higher product functionality, process safety and enhanced service life.

DEGUSSIT® and StarCeram® materials have been specially developed for use in high-temperature technology. They are particularly convincing, when exposed to combined stress from high temperatures and corrosive atmospheres.

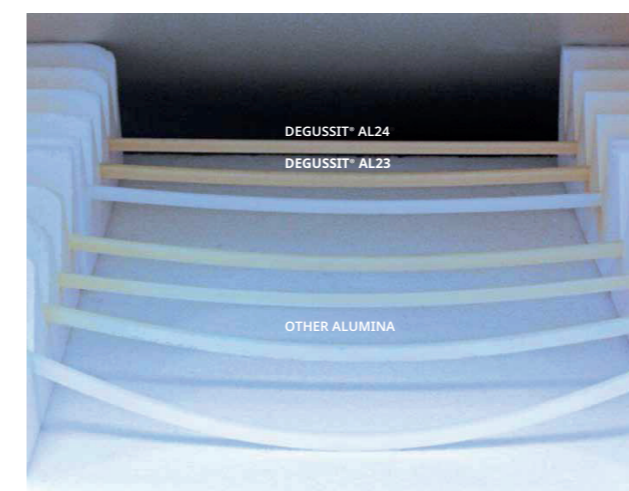
HIGH PURITY ALUMINIUM OXIDE

IMPRESSIVE PROPERTIES FOR DEMANDING APPLICATION

DEGUSSIT® high performance ceramics are characterized by exceptional properties, such as extremely high dimensional stability at high temperatures, very high operating temperatures and very good corrosion resistance.

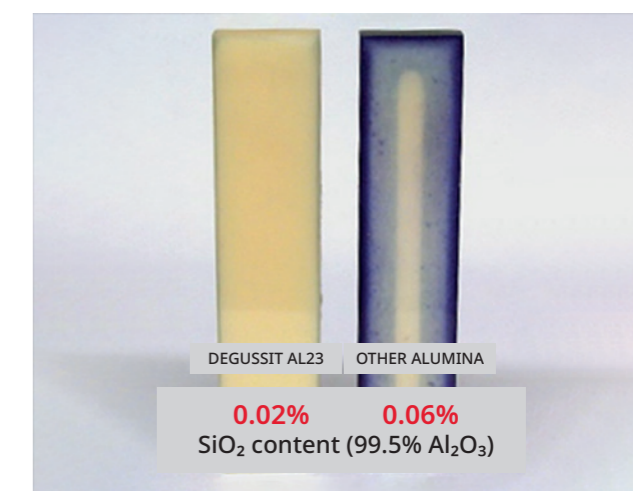
Comparative test used to determine Al₂O₃ high-temperature strength: In contrast to conventional materials DEGUSSIT® AL23 guarantees a high dimensional stability due to sintering temperatures > 1,800 °C

DIMENSIONAL STABILITY



Comparison of different aluminium oxide materials. Thanks to uncommonly high sintering temperatures at Kyocera our materials show increased mechanical strength in high temperature range.

CORROSION RESISTANCE



Comparison of two alumina materials with the same purity of 99.5%. Composition of the rest 0.5% has a major effect on material's corrosion resistance, especially SiO₂ share.

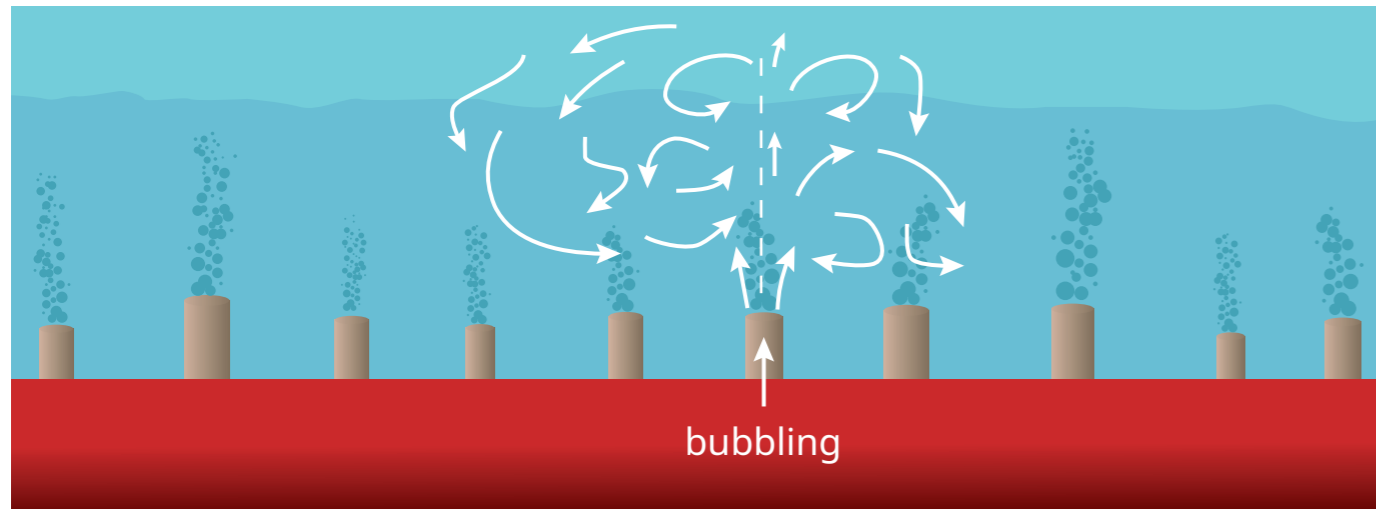
Kyocera material has only 0.02% SiO₂.

MAIN ADVANTAGES

- ▶ Extreme resistance to heat up to **1,950 °C**
- ▶ High dimensional stability
- ▶ Excellent resistance to corrosion
- ▶ Resistant to wear
- ▶ Good resistance to high electrical voltage

KYOCERA PRODUCTS IN GLASS INDUSTRY

Our materials are not only the basis for reliable products, they also ensure a very long working life. A valid economic advantage for your application.



In order to stimulate convective movement in the glass tank, air is forced through DEGUSIT® ceramic bubbler tubes. Our ceramic tubes can also be used in electric boosting systems where high voltage is implied to melted glass to stabilize convection flow.



ON STOCK PORTFOLIO PRODUCTS

The majority of the products from our standard programme is available ex stock within 2 weeks.



PRODUCTS AND COMPONENTS

- ▶ Tubes
- ▶ Tubes one end closed
- ▶ Capillaries
- ▶ Thermocouple protection tubes
- ▶ Bubbler tubes

MATERIAL PROPERTIES DEGUSIT® AL23 & AL24

Properties		Unit	Material DEGUSIT® AL23	Material DEGUSIT® AL24
Main components		-	$\alpha - \text{Al}_2\text{O}_3$	$\alpha - \text{Al}_2\text{O}_3$
Purity		wt-%	> 99.5	> 99.5
Density		g/cm	3.70 - 3.95	<3.40
Open porosity		vol.-%	0	≤12
Average size of crystallite		µm	10	40
Bending strength	DIN EN 843-1	MPa	300 - 350	150
Compressive strength		MPa	3500	1000
Young's modulus	static	GPa	380	-
Poisson's ratio		-	0.22	-
Hardness	Knoop, 100 g	GPa	23	-
Maximum service temperature in air		°C	1950	1950
Linear coefficient of expansion	-100 - 20 °C	$10^{-6}/\text{K}$	-	-
	20 - 100 °C		-	-
	20 - 500 °C		-	-
	20 - 1,000 °C		8.2	8.2
Specific heat	20 °C	J/(kg*K)	900	-
Thermal conductivity	20 °C	W/(m*K)	34.9	27.8
	100 °C		-	-
	1,000 °C		6.8	5.5
	1,500 °C		5.3	4.5
Dielectric strength	20 °C	kV/mm	20 - 30	-
Typical colour		-	ivory	creme white

The data indicated on this table are in line with the introductory German Industrial Standard DIN 60672-2 and relate to test specimens from which they were obtained. They are not unconditionally applicable to other forms of the same material. The data must be regarded as indicative only. All data refer to a temperature of 20 °C, unless otherwise specified.

To find information about characteristic values of other materials, please visit www.kyocera-solutions.de

CUSTOMIZED PRODUCTS AND COMPONENTS FOR INDIVIDUAL APPLICATIONS

EXAMPLES

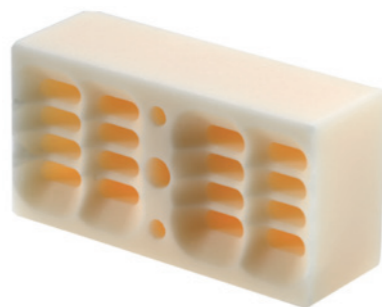
- ▶ Shape roller
- ▶ Glow block
- ▶ Slip-on crucible
- ▶ Shaping die for conical glass tubes
- ▶ Glass forming tools
- ▶ Tubes for exhaust probes

For special tasks Kyocera develops products together with the customer which meet the working conditions of the customers process. For example in transport of hot glass sheets special alumina bearings are used where high precision and mechanical strength under high load stresses is required. To ensure efficient operation of glass plant and comply with legally prescribed emission values, the exhaust gas emissions must be continuously measured and optimized at the furnace. Ceramic shields in 99.5% pure alumina ensure safe and reliable analysis in glass furnaces – even at the highest temperature range. In order to increase resistance to temperature shock we offer a DEGUSSIT® AL24 material with porosity > 5% with minimalized internal stresses.

OTHER PRODUCT EXAMPLES



SHAPE ROLLER



GLOW BLOCK



NOZZLE

MORE CERAMIC MATERIALS FOR YOUR SPECIAL NEEDS

- ▶ Magnesium stabilized Zirconia (FZM)
- ▶ Silicon Nitride (StarCeram® N7000)
- ▶ Sintered Silicon Carbide (StarCeram® S)
- ▶ Aluminium Titanate (StarCeram® AT)

MATERIAL PROPERTIES

Properties	Unit	FZM	StarCeram® N7000	StarCeram® S	StarCeram® AT A1201 / A1203
Main components	-	ZrO ₂ , MgO	Si ₃ N ₄	SiC	Al ₂ TiO ₅
Density	g/cm ³	> 5.70	3.22	3.13	3.35 / 3.32
Bending strength	MPa ³	500	800	375	40 / 25
Weibulls modulus	-	>15	25	15	40 / 60
Toughness K	MPa*m ^{0.5}	6.3	6.7	3.0	3-5
Young's modulus	GPa	185	300	395	16 / 10
Hardness	GPa	12	15	25	5
Maximum service temperature in air	°C	900	1,000	1,600	1,000
Coefficient of thermal expansion	10 ⁻⁶ /K	11.1 (20 - 1000 °C)	3.4 (RT-1,000 °C)	4.5 (RT-1,000 °C)	1.6 / 1.25 (RT-1,000 °C)
Thermal conductivity	W/(m*K)				
	(20 °C)	3	25	125	1.4
	(500 °C)	2.3	-	-	-
	(800 °C)	2	20	-	1.6 / 1.4
Typical colour	-	yellow	light/dark grey	black/anthracite	white

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