



MATERIALS, APPLICATIONS AND PROPERTIES

High-performance ceramics

MATERIALS AND APPLICATIONS

Material	Kyocera trade name	Description	Typical applications
Al ₂ O ₃ Aluminium oxide	F99.7	Pure Al ₂ O ₃ , dense, extremely resistant to wear and corrosion, very high electrical insulating properties	Matched piston/cylinder units, bearings, shafts and valve components, electrical feedthroughs, brazed ceramic to metal seals for x-ray-technology and ionic accelerators for medical technology, dielectrics for fuel cells, sensor caps
	DEGUSSIT DD57	Pure Al ₂ O ₃ , dense, red colour, wear resistant and tough, also called „sintered ruby“	Fine grinding tools for finishing hard materials for precision engineering, knife sharpener
	DEGUSSIT AL23	Pure Al ₂ O ₃ , dense, excellent thermal and electrical resistance properties, corrosion resistant, permeable for microwaves	Protection tubes for thermocouples, furnace construction parts, laboratory ware e.g. crucibles, boats and plates, reactor lining in the chemical industry, microwave-technology
	DEGUSSIT AL24	Pure Al ₂ O ₃ , slightly porous, good resistance to thermal shock, extremely good creep strength	Tubes, laboratory ware, furnace construction parts
	DEGUSSIT AL25	Pure Al ₂ O ₃ , very porous, good thermal insulation, highest resistance to thermal shock of all the Al ₂ O ₃ materials	Tubes, laboratory ware, furnace construction parts
Al ₂ O ₃ (+ZrO ₂) Aluminium oxide, fine grain stabilized	FZT	Al ₂ O ₃ toughened with ZrO ₂ , dense, high strength, good resistance to thermal shock, extremely resistant to wear and corrosion, fine grain size	Vacuum plates for paper-making, flow meter tubes for chemical industry, positioning pins for automotive industry

Material	KYOCERA trade name	Description	Typical applications
ZrO ₂ Zirconium Oxide	FZM	ZrO ₂ partially stabilized with MgO, dense, high strength and highly wear resistant, extremely resistant to corrosion and thermal shock	High pressure pistons, pressing dies, components for mills, ceramic isolation shells for magnetic drive centrifugal pumps, metal forming tools
	DEGUSSIT FZY	Partially stabilized with Y ₂ O ₃ , dense, high purity ZrO ₂ , high temperature and corrosion resistance, ion conducting for measuring oxygen	Crucibles, heat-treatment bowls, oxygen measurement
	FZM/K	Tetragonally stabilized with Y ₂ O ₃ , dense, very fine grain size, highest breaking strength and wear resistance	Cutting elements, wear protection plates
	ZR 25	ZR 25 is a porous material consisting of magnesium-stabilised zirconium oxide. It is characterised by its high thermal shock resistance and good chemical resistance.	Crucibles, kiln furniture, annealing dishes

MATERIALS AND PROPERTIES

Material	Al ₂ O ₃ Aluminium oxide					
Kyocera trade name	F99.7	DEGUSSIT DD57	DEGUSSIT AL23	DEGUSSIT AL24	DEGUSSIT AL25	FZT

Properties of microstructure

Apparent density	g/cm ³	≥ 3.90	≥ 3.90	3.70 - 3.95	> 3.40	> 2.80	≥ 4.10
Open porosity	%	0	0	0	≤ 5	20 - 30	0
Mean grain size	µm	10	10	10	40	70	5

Mechanical properties 20 °C

Hardness (HV1)	-	1,760	1,660	1,740	-	-	1,880
Compressive strength	N/mm ² (MPa)	3,500	3,000	3,500	1,000	300	3,000
Bending strength	N/mm ² (MPa)	350	300	300	150	70	460
Modulus of elasticity	GPa	380	380	380	-	-	360

Thermal properties

Maximum operating temperature	°C	1,950	1,950	1,950	1,950	1,950	1,700
Specific heat 20 °C	J/(kg*K)	900	900	900	-	-	900
Thermal conductivity 100 °C	W/(m*K)	30	30	30	-	-	25
Expansion coefficient 20 - 1,000 °C	10 ⁻⁶ /K	8.5	8.5	8.2	8.2	8.2	8.3

Electrical properties

Specific resistance 20 °C	Ω•cm	10 ¹⁵	-	10 ¹⁴	-	-	-
Specific resistance 500 °C	Ω•cm	10 ¹¹	-	10 ¹⁰	-	-	-
Specific resistance 1,000 °C	Ω•cm	10 ⁷	-	10 ⁷	-	-	-
Typical colour		ivory	red	ivory	cream white	white	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 go to www.kyocera-solutions.de.

Material	ZrO ₂ Zirconium oxide				
Kyocera trade name	FZM	DEGUSSIT FZY	FZM/K	ZR25	

Properties of microstructure

Apparent density	g/cm ³	≥ 5.70	≥ 5.60	≥ 6.0	> 4.30
Open porosity	%	0	0	0	ca. 24
Mean grain size	µm	50	30	0.8	-

Mechanical properties 20 °C

Hardness (HV1)	-	1,220	1,400	1,420	-
Compressive strength	N/mm ² (MPa)	2,000	2,000	2,200	-
Bending strength	N/mm ² (MPa)	500	400	1,000	80
Modulus of elasticity	GPa	185	200	200	-

Thermal properties

Maximum operating temperature	°C	900	1,700	1,000	2,200
Specific heat 20 °C	J/(kg*K)	400	400	400	770
Thermal conductivity 100 °C	W/(m*K)	2.5	2.5	2.5	-
Expansion coefficient 20 - 1,000 °C	10 ⁻⁶ /K	11.1	10.9	10.5	4.51

Electrical properties

Specific resistance 20 °C	Ω•cm	10 ¹⁰	10 ¹⁰	10 ¹⁰	-
Specific resistance 500 °C	Ω•cm	10 ⁴	5 * 10 ³	10 ²	-
Specific resistance 1,000 °C	Ω•cm	25	15	15	-
Typical colour		yellow	white	white	sahara

KYOCERA FINECERAMICS SOLUTIONS GMBH THIS IS US. INNOVATION IN CERAMICS.

ELEVATOR MESSAGE

"Our extensive experience in high-performance ceramics and our alliance with Kyocera as a leading global technology group grant us access to innovation and resources that allow us to realize ambitious projects and take the lead for the future. We share our knowledge, and bring it together to create something new that goes beyond our company, beyond different industries and countries. As a team. Together with our customers."

Armin Kayser, General Manager of KYOCERA Fineceramics Solutions GmbH

KYOCERA Fineceramics Solutions GmbH - Summary

Location:	Mannheim, metropolitan Rhein-Neckar region
Founding year:	2019 - Spin-off from FRIATEC GmbH
Employees:	approx. 300 incl. approx. 30 trainees and apprentices
Subsidiaries:	KYOCERA Fineceramics Nordics AB (sales office for Northern Europe)
Brands:	DEGUSSIT, FRIDURIT

We look back on a long tradition in the manufacturing of ceramic products: Founded in Mannheim in 1863 as a brickyard known as "Deutsche Steinzeug", and later as "Friedrichsfeld GmbH", from 1993, the ceramics department continued its successful development under the brand FRIATEC GmbH. Since September 2019 we have been part of Kyocera Group, a leading global ceramics and technology company.

Kyocera companies benefit from the group's cross-department way of thinking and working. We share our knowledge and bring it together to create something new – something that goes beyond our company, beyond different industries and countries. Because innovation and real milestones can only be achieved together. This is what we believe.

With our brands DEGUSSIT and FRIDURIT, we provide innovative solutions for numerous industries: system components for high-tech applications in electrical and sensor technology, mechanical engineering, analysis technology, medical and semiconductor technology, as well as laboratory technology.

We possess internationally recognized know-how in the field of high-performance ceramics, especially for ceramic-to-metal assemblies. Our products are characterized by high quality, precision, and durability. Our production and development location in Central Europe and our customized supply-chain solutions make us extremely agile and ensure maximum reliability for our customers.

We see ourselves as a partner in the development of high-performance ceramics solutions that provide added value for our customers and ensure their technological advantage in their respective markets. Our focus today is on where we want to be tomorrow – together. We develop sustainable solutions that meet the demands of the future, supported by an experienced team of 50 highly qualified and quality-oriented engineers, scientists, technology experts, and masters.

ELECTRICAL ENGINEERING



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HIGH TEMPERATURE TECHNOLOGY



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MECHANICAL ENGINEERING



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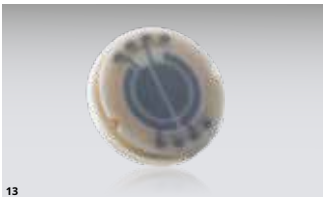


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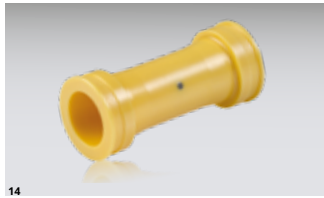


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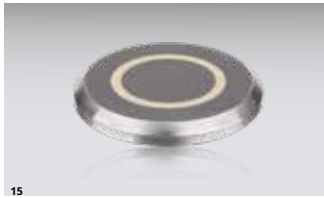
SENSOR AND MEASURING TECHNOLOGY



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- 01. UHV vacuum chamber
- 02. Special insulation tube for research institutes
- 03. Feedthroughs with ISO-KF flange
- 04. High-voltage feedthrough

- 05. Rectangular tubes
- 06. Multi-bore tubes
- 07. Crucibles, boats and annealing
- 08. Boxes
- 08. Plates with hole

- 09. Forming tools used in body construction
- 10. Dosing unit used in the pharmaceutical and cosmetic industry
- 11. Containment shells for the pump industry
- 12. Grinding tools used in metal processing

- 13. Pressure sensor for aerospace
- 14. Flow meters
- 15. Humidity sensor
- 16. Oxygen sensor



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