

MATERIALS, APPLICATIONS AND PROPERTIES

Oxide 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-fin ceramics.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

ABOUT KYOCERA



The global Kyocera corporation - a strong partner.

- ▶ **Headquarters:** Kyoto, Japan
- ▶ **Foundation:** 1959
- ▶ **Employees:** over 80,000 worldwide
- ▶ **European headquarters:** Esslingen, Germany
- ▶ **European production sites:** Mannheim, Germany
Selb, Germany
(further subsidiaries in Europe)

 **KYOCERA** = **KYOTO CERAMICS**

KYOCERA – it all began with ceramics

KYOCERA Fineceramics Europe GmbH is a subsidiary of KYOCERA Europe GmbH, which has been successful in Europe for over 50 years. The Kyocera Group is one of the world's leading providers of high-performance ceramic components for the technology industry, offering over 200 different ceramic materials, as well as state-of-the-art technologies and services tailored to the specific needs of each market.

KYOCERA Fineceramics Europe GmbH has grown steadily in recent years – and is now a leading European supplier of customised solutions made of technical ceramics. Working in partnership, we develop and manufacture products that offer our customers added value in their respective markets and secure their technological lead in the long term. We are committed to this every day.

Throughout Europe, we are represented by two production and development sites in Mannheim and Selb, as well as six sales offices –

in Mannheim, Selb, Esslingen, Neuss, Rungis (France) and Frimley (United Kingdom).

Our hearts beat completely for ceramics. Our team provides comprehensive advice on the selection of ceramic materials, product design and project execution – from the development stage to prototyping. We supply system components for high-tech applications in numerous industries. Our products are characterised by high quality, precision and durability.

Our business partners benefit from the fact that we think and work across divisions within the Kyocera Group. Because innovations and real milestones can only be achieved together – across industries and national borders.

This is what we believe.

About the KYOCERA Group

KYOCERA Europe GmbH is a company of the KYOCERA Corporation headquartered in Kyoto/ Japan, a world leader in semiconductor, industrial and automotive components as well as electronic components, printing and multifunction systems, and communications technology. The technology group is one of the world's most experienced manufacturers of smart energy systems, with more than 45 years of industry expertise. The Kyocera Group comprises of around 300 subsidiaries.

Kyocera aims to create a better future for the world, using the power of technology to solve issues we face as a global society. This ambition is rooted in our Kyocera Management Rationale: to contribute to the advancement of society and humankind.

We will continue to work together with people around the world to solve issues critical to society leveraging all of the technologies and management capabilities we have accumulated during our 60-plus year history.

The company also takes an active interest in cultural affairs. The Kyoto Prize, a prominent international award, is presented each year by the Inamori Foundation established by Kyocera founder Dr Kazuo Inamori to individuals worldwide who have contributed significantly to the scientific, cultural, and spiritual betterment of humankind.





KYOCERA Fineceramics Europe GmbH

Steinzeugstrasse 92
68229 Mannheim / Germany
Tel: +49 621 40547-300
E-mail: info@kyocera-fineceramics.de
www.kyocera-fineceramics.de/en

Plant Selb

Lorenz-Hutschenreuther-Strasse 81
95100 Selb / Germany
Tel: +49 9287 807-0

Sales office Esslingen

Fritz-Müller-Strasse 27
73730 Esslingen / Germany
Tel: +49 711 93 93 4-0

Sales office Neuss

Hammfelddamm 6
41460 Neuss / Germany
Tel: +49 2131 16 37-0

Sales office Great Britain

Prospect House, Archipelago, Lyon Way
Frimley, Surrey
GU16 7ER / Great Britain
Tel: +44 1276-69 34 50

Sales office France

Parc Icade Orly - Rungis
21 rue de Villeneuve
94150 Rungis / France
Tel: +33 1 41-73 73 30