



MATERIALS, APPLICATIONS AND PROPERTIES

FRIALIT®-DEGUSSIT® High-Performance Ceramics

www.kyocera-solutions.de

MATERIALS AND APPLICATIONS

Material	KYOCERA Trade Name	Description	Typical Applications
Al ₂ O ₃ Aluminium Oxide	FRIALIT 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	FRIALIT 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	FRIALIT 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
	FRIALIT 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
SiC Silicon Carbide	FRIALIT SIC 198D	SSiC, highly wear resistant, good corrosion resistance, excellent sliding properties	Slide rings, bearings, slide bushings, axial sleeves
Si ₃ N ₄ Silicon Nitride	FRIALIT HP 79	High purity Silicon Nitride, high wear resistance, excellent bending strength, highest thermal shock resistance	Metal forming tools, rollers, plates

MATERIALS AND PROPERTIES

Material	Al ₂ O ₃ Aluminium Oxide					
KYOCERA Trade Name	FRIALIT F99.7	DEGUSSIT DD57	DEGUSSIT AL23	DEGUSSIT AL24	DEGUSSIT AL25	FRIALIT 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 (HV 1)	-	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	FRIALIT FZM	DEGUSSIT FZY	FRIALIT FZM/K

Properties of Microstructure

Apparent Density	g/cm ³	≥ 5.70	≥ 5.60	≥ 6,0
Open Porosity	%	0	0	0
Mean Grain Size	µm	50	30	0.8

Mechanical Properties 20 °C

Hardness (HV 1)	-	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
Modulus of Elasticity	GPa	185	200	200

Thermal Properties

Maximum Operating Temperature	°C	900	1 700	1 000
Specific Heat 20 °C	J/(kg*K)	400	400	400
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

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

FRIALIT®-DEGUSSIT® HIGH-PERFORMANCE CERAMICS

ELECTRICAL ENGINEERING



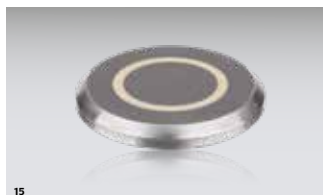
HIGH TEMPERATURE TECHNOLOGY



MECHANICAL ENGINEERING



SENSOR AND MEASURING TECHNOLOGY



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

05. Rectangular tubes
06. Multi-bore tubes
07. Crucibles, boats and annealing 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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Founded in 1863 in Mannheim as brickyard, known as “Deutsche Steinzeug” and later as “Friedrichsfeld GmbH”, the business area Ceramics continued its successful development. Since September 2019, we are part of the KYOCERA Corporation, a world-leading ceramic and technology company.

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