



MATERIALS, APPLICATIONS AND PROPERTIES

FRIALIT®-DEGUSSIT® High-Performance Ceramics

MATERIALS AND APPLICATIONS

Material	FRIATEC 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	FRIATEC Trade Name	Description	Typical Applications
ZrO₂ 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
Si₃N₄ Silicon Nitride	FRIALIT HP 79	High purity Silicon Nitride, high wear resistance, excellent bending strength, highest thermal shock resistance	Metal forming tools, rollers, plates

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Material	Al ₂ O ₃ Aluminium Oxide						
FRIATEC 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

Material	ZrO ₂ Zirconium Oxide			Non-Oxides		
	FRIALIT FZM	DEGUSSIT FZY	FRIALIT FZM/K	FRIALIT SiC 198D	FRIALIT HP 79	
Properties of Microstructure						
Apparent Density	g/cm ³	≥ 5,70	≥ 5,60	≥ 6,0	≥ 3,08	3,18 - 3,41
Open Porosity	%	0	0	0	0	0
Mean Grain Size	µm	50	30	0,8	10	10
Mechanical Properties 20°C						
Hardness (HV 1)	N/mm ² (MPa)	1 220	1 400	1 420	2 650	1 630
Compressive Strength	N/mm ² (MPa)	2 000	2 000	2 200	> 2 500	3 000
Bending Strength	N/mm ² (MPa)	500	400	1 000	460	900
Modulus of Elasticity	GPa	185	200	200	420	310
Thermal Properties						
Maximum Operating Temperature	°C	900	1 700	1 000	1650 - 1900	1 200
Specific Heat 20°C	J/kg/K	400	400	400	672	700
Thermal Conductivity 100°C	W/m/K	2,5	2,5	2,5	125	30
Expansion Coefficient 20 - 1 000°C	10 ⁻⁶ /K	11,1	10,9	10,5	4,5	3,2
Electrical Properties						
Specific Resistance 20°C	Ω•cm	10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ⁷	10 ¹¹
Specific Resistance 500°C	Ω•cm	10 ⁴	5 * 10 ³	10 ²	-	-
Specific Resistance 1 000°C	Ω•cm	25	15	15	-	10 ⁷
Typical Colour		yellow	white	white	black	black

The data indicated in this table is in line with the introductory German Industrial Standard DIN 60672-2 and relates to the specimens from which it was obtained and is not unconditionally applicable to other

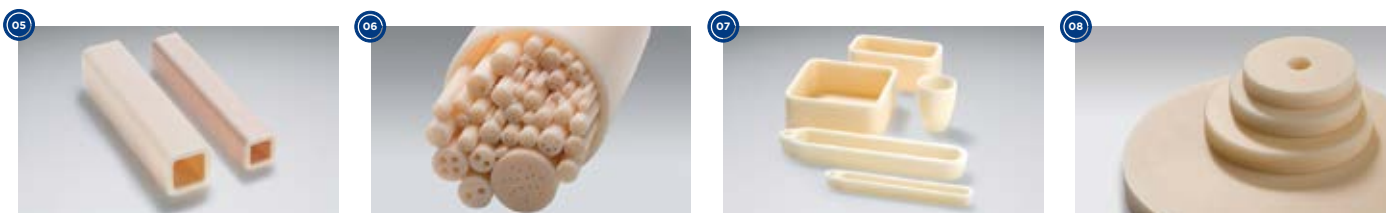
forms of the same material. The data must, therefore, be regarded as indicative only.

FRIALIT®-DEGUSSIT® HIGH-PERFORMANCE CERAMICS CERAMIC INNOVATIONS SINCE 1863

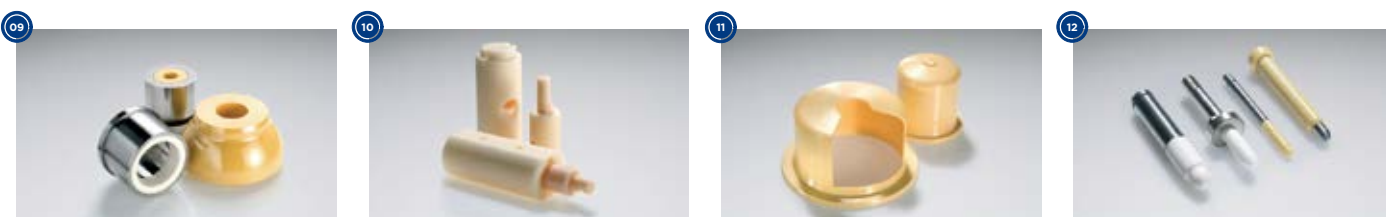
ELECTRICAL ENGINEERING



HIGH TEMPERATURE TECHNOLOGY



MECHANICAL ENGINEERING



SURFACE FINISHING



- 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. Spacer cans for the pump industry
- 12. Welding pins used in body construction

- 13. Midget file
- 14. Grinding tools used in metal processing
- 15. Mounted points used in metal processing
- 16. Grinding wheel for the glass-processing industry

FRIATEC

INNOVATIVE SOLUTIONS FOR THE GLOBAL MARKET

INNOVATIONS FOR MORE THAN 150 YEARS

The company was founded in 1863 in Mannheim, Germany, as a brickyard and succeeded in developing its first pathbreaking innovation, chemical stoneware, in 1888. Numerous new developments followed. Among other things, the company started in the mid of the past century processing plastics and combined modern and traditional materials when producing chemical devices and facilities. The following years were characterised by the expansion in the core business and the opening up of more and more new business segments. As Deutsche Steinzeug and later as Friedrichsfeld GmbH, the company, which has been operating under the name FRIATEC since 1993, continuously developed to become an internationally active, diversified company.

SPECTRUM OF INNOVATIVE SOLUTIONS

As such, FRIATEC today offers a spectrum of innovative solutions for many industries, e.g. jointing technology for pipe systems, special pumps for aggressive, volatile or explosive media, but also ceramic components which are used in laboratory and electrical engineering but also in medical engineering. With its sophisticated solutions, FRIATEC is not only among the most well-known and well-established companies in the metropolitan region Rhine-Neckar but is also one of the global market leaders of its industry.

PARTNER OF A POWERFUL COMMUNITY

Since 2003, FRIATEC has been a member of the ALIAXIS group of companies with headquarters in Brussels. ALIAXIS is the worldwide largest producer of plastic pipe systems for the construction industry, the industry and utilities.

**FRIATEC is a specialist
company for products made
of non-corroding and
wear-resistant materials.**

O **Aliaxis**

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