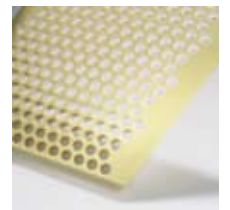


FRIALIT®-DEGUSSIT® Ceramics

Products - Properties - Areas of Application



A FEW WORDS ABOUT GLYNWED SCANDINAVIA AND FRIATEC AG:

Glynwed Scandinavia is part of the Aliaxis-conglomerate along with Friatec AG. Friatec AG belongs to the oldest and most renowned companies in the Mannheim area in Germany. Founded in 1860, the company has since been working with ceramics and the improvement of the material. At your disposal is our vast experience of customer specific manufacturing for the industry, including choice of materials and product design. This makes us an excellent choice for partner already in the design phase of a new product or application. Get in touch with us to assure highest quality and function of your products and applications.



Main Office, Mannheim

Sales office, Spånga

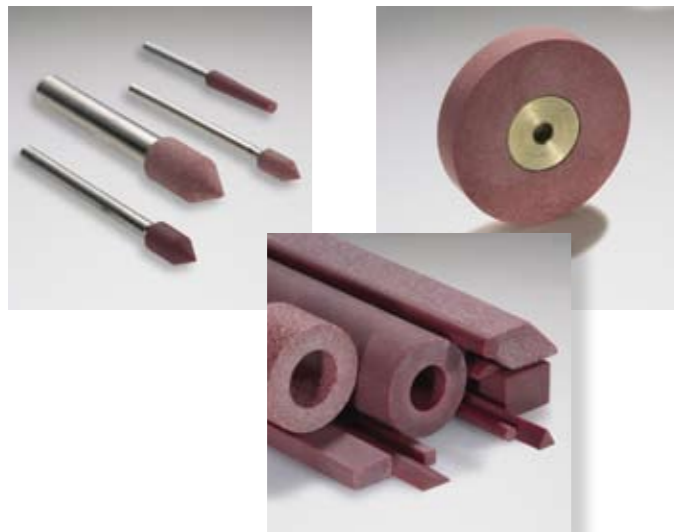
Factory grounds, Mannheim

FRIALIT-DEGUSSIT Ceramics and our experienced team is the solution to your problems. Regardless of whether you are looking for durability, a more economically viable solution or striving for a universal application, you can count on our vast experience. Kindly get in touch with us for the particulars of each prospect.



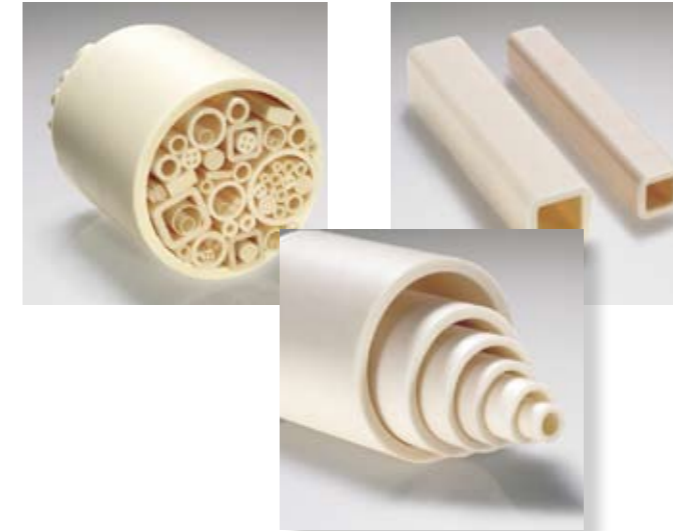
Mechanical Engineering

FRIALIT® pistons and plungers for dosage and high pressure pumps, dosing units, precision balls, seal rings, slide and ball bearings, bushings, axial sleeves, valve components, nozzles, guidings, wear parts, transforming tools, extrusion dies and custom made components.



Surface Finishing

DEGUSSIT® fine grinding tools, e.g. whetstone, files, fine grinding discs, fine grinding rods and rolling discs for machining metal, glass and porcelain.



High Temperature Technology

DEGUSSIT® tubes, insulating rods and insulators for protection and insulation of thermo couples, for the supply of gas and exhaust. Rippled tubes and furnace tubes for electrically heated furnaces and diffusion tubes for the semi-conductor industry. **DEGUSSIT®** laboratory products, e.g. crucibles, boats, annealing bowls and plates for annealing and melting at high temperatures.



Electrical Engineering

FRIALIT® electrical feed-throughs, insulators and insulator tubes for vacuum operated plants, research equipment, high-tech electronics, probe technology, furnace construction, flow meters and level gauges, sensors and nuclear reactors.

Material	FRIALIT®-DEGUSSIT®	Properties	Areas of Application
Al₂O₃ Aluminium Oxide	F99.7	Pure Al ₂ O ₃ , dense sintered, excellent corrosion and abrasion resistance, highest electrical insulation, extreme longevity.	Machine components, pump units, components for chemical plants e.g. bearings, valves, seal rings and soldered ceramic to metal seals for feed-throughs.
	F99D	Pure Al ₂ O ₃ , doted, different surface finishes possible.	Sealing and valve discs for fittings in different machines and devices.
	DD57	Pure Al ₂ O ₃ , dense sintered, wear resistant and durable, excellent form and edge stability, red in colour, also known as sinter ruby.	Fine grinding tools for various fine grinding operations on hard materials.
	AL23	Pure Al ₂ O ₃ , dense sintered, excellent thermal, electrical and chemical high temperature properties.	Tubes and multi-bore tubes for thermo couples, rods, components for furnace construction and laboratory ware (crucibles, boats, discs and plates).
	AL24	Pure Al ₂ O ₃ , low porosity, handles temperature changes well, very good creep resistance.	Tubes, laboratory ware, components for furnace constructions.
	AL25	Pure Al ₂ O ₃ , high porosity, good thermal insulation, highest resistance to thermal shock of all the Al ₂ O ₃ materials.	Tubes, laboratory ware, components for furnace constructions.
Al₂O₃ (+ZrO₂) Aluminium Oxide, fine grain stabilized	FZT	Al ₂ O ₃ stabilized with ZrO ₂ , high stability, handles temperature changes well, very high corrosion and wear resistance, fine grain structure.	Wear protection, linings, components for mechanical and chemical engineering equipment.

Material	FRIALIT®-DEGUSSIT®	Properties	Areas of Application
ZrO₂ Zirconium Oxide	FZM	Partially stabilized with MgO, dense sintered, high wear resistance, very good resistance to corrosion and thermal shock, very durable, pressure resistant, high mechanical stability even at high temperatures.	Parts for chemical engineering equipment and for the food & drug industry e.g. bearings, valves, extrusion dies, pressing dies, grinding technology and thermal insulation.
	FZY	Partially stabilized with Y ₂ O ₃ , dense sintered, high purity ZrO ₂ , high temperature and corrosion resistance.	Solid state electrolyte for oxygen and Ph-measurement.
	FZM/K	Tetragonally stabilized with Y ₂ O ₃ , dense sintered, fine crystalline structure, highest bending and fracture resistance, wear resistant.	Machine and engine components for demanding applications, cutting tools for paper, plastics, foil, textile, food industry etc.
	FZM/KS	Tetragonally stabilized with Y ₂ O ₃ , dense sintered, HIP treated, fine crystalline structure, highest bending, fracturing and pressure resistance and the very best edge stability.	Valves and fittings for demanding constructions. The very best material for products with an extremely mechanically demanding profile like high load valve seats.
	SiC Silicon Carbide	SiC198	SiSiC, high wear and corrosion resistance. Excellent sliding properties, electrically conductive.
SiC198D		SsiC, high wear resistance, very good corrosion resistance, excellent sliding properties.	Machine components like seal rings, slide bearings, axial sleeves, bushings.
Si₃N₄ Silicon Nitride	HP79	Hotpressed silicon nitrid, high wear resistance, excellent bending and fracture stability, highest thermal shock resistance.	Machine and engine components for demanding areas of application, fusion pins, casings for welding, attachment pins etc.

Material	Aluminium Oxide Al ₂ O ₃							Zirconium Oxide ZrO ₂				Silicon Carbide SiC	Silicon Nitride Si ₃ N ₄	
	F99.7	F99D	DD 57	AL 23	AL 24	AL 25	FZT	FZM	FZY	FZM/K	FZM/KS	SiC 198	HP 79	GP 79
Structural properties:														
Density (g/cm ³)	3.9–3.95	3.7–3.8	3.8–3.95	3.7–3.95	3.4–3.6	2.8–3.1	4.1–4.15	5.7–5.8	5.5–5.8	6.0–6.1	6.0–6.1	3.1	3.2	3.2
Open porosity (%)	0	0	0	0	0–5	20–30	0	0	0	0	0	< 1	0	0
Grain size (µm)	10	10	10	10	40	70	5	50	50	0.5	0.5	–	–	1–5
Mechanical properties:														
Hardness (Knoop) (N/mm ²) (MPa)	23 000	20 000	23 000	23 000	–	–	23 000	17 000	17 000	18 000	18 000	21 000	17 000	17 000
Compressive strength (N/mm ²) (MPa)	3 500	3 000	3 500	3 500	1000	300	3 000	2 000	2 000	2 200	2 200	1 200	3 000	3 000
Bending strength (N/mm ²) (MPa)	350	300	300	300	150	70	450	500	350	1 100	1 700	350	750	750
Weibull modulus	> 10	> 10	> 10	> 10	–	–	> 10	> 20	–	> 15	> 15	> 10	> 20	> 20
E-modulus E (GPa)	380	350	380	380	–	–	360	200	165	200	200	330	320	300
Poisson ratio ν	0.22	0.22	0.22	0.22	–	–	0.23	0.30	–	0.30	0.30	0.20	0.26	0.25
Thermal properties:														
Max. operating temperature (°C)	1 950	1 700	1 950	1 950	1 950	1 950	1 700	900	1 500	1 200	1 000	1 400	1 400	1 400
Specific heat 20 °C (J/kgK)	900	900	900	900	–	–	850	400	400	400	400	900	800	800
Thermal conductivity 100 °C (W/mK)	30	25	30	30	–	–	25	2.5	2.5	2.5	2.5	90	40	30
Coefficient of expansion 20-1000 °C (10 ⁻⁶ /K)	8.5	8.5	8.5	8.5	8.5	8.5	9	10	10.5	11	11	4.4	3.2	3.2
Electrical properties:														
Specific resistance 20 °C Ωcm	10 ¹⁵	10 ¹⁴	10 ¹⁴	10 ¹⁴	–	–	–	10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ⁻¹	10 ¹⁴	10 ¹⁴
500 °C Ωcm	10 ¹¹	10 ¹⁰	10 ¹⁰	10 ¹⁰	–	–	–	10 ⁴	5 • 10 ¹¹	10 ²	10 ²	–	–	–
1000 °C Ωcm	10 ⁷	10 ⁶	10 ⁷	10 ⁷	–	–	–	–	5 • 10 ¹	–	–	–	–	–
Colour:	ivory	white	red	ivory	ivory	ivory	white	yellow	white	white	white	black	black	black

The data shown in the table above is valid according to German industrial standard DIN 40685, where the given values only pertain to the measured test specimen. The given values must be taken as a guideline value and may not be applicable to other shapes of the same material.

FRIALIT®-DEGUSSIT® Oxide Ceramics for:
Electrical Engineering
High Temperature Technology
Mechanical Engineering
Surface Finishing



COMPETENCE PLUS RESPONSIBILITY

Our customers rightly expect first class performance with lasting value.
With our competence we assume the responsibility for achieving that.
Please ask for references. FRIALIT®-DEGUSSIT® is the technology and market leader in ceramic materials of the 21st Century.

In the nordic countries:

FRIATEC AG

FRIALIT®-DEGUSSIT® Division
Postfach 710261, D-68222 Mannheim
Steinzeugstraße 50, D-68229 Mannheim

Phone: +49 (0) 621/4 86-0
Fax: +49 (0) 621/4 77-999
E-Mail: info-frialit@friatec.de
Internet: www.friatec.de

For Norway, Sweden and Finland:

GLYNWED AB

Division Ceramics
Stormbyvägen 6,
SE 163 55 Spånga

Phone: +46 (0) 8 44 66 910
Fax: +46 (0) 8 44 66 911
E-mail: frialit-degussit@glynwed-se.com
Internet: www.glynwed.se

For Denmark:

GLYNWED A/S

Division Ceramics
Sandvadsvej 1,
DK-4600 Køge

Phone: +45 46 77 25 75
Fax: +45 46 75 54 30
E-mail: salg@glynwed-dk.com
Internet: www.glynwed.dk

