General information

Designation

Cordierite

Typical uses

Low thermal expansion applications, thermal shock resistant applications.

Composition overview

Compositional summary

Mg2Al4Si5O18

Material family	Ceramic (technical)
Base material	Other

Composition detail (metals, ceramics and glasses)

Al2O3 (alumina)	40			%
MgO (magnesia)	16			%
SiO2 (silica)	44			%

Price

Price	* 6,21	-	10,4	CHF/kg
Price per unit volume	* 1,48e4	-	2,51e4	CHF/m^3

Physical properties

Density	2,38e3	-	2,42e3	kg/m^3
Porosity (closed)	* 0	-	0,05	%
Porosity (open)	0			%

Mechanical properties

Young's modulus	107	-	113	GPa
Specific stiffness	44,5	-	47,1	MN.m/kg
Yield strength (elastic limit)	* 48	-	53	MPa
Tensile strength	* 48	-	53	MPa
Specific strength	* 20	-	22,1	kN.m/kg
Elongation	* 0,04	-	0,05	% strain
Compressive strength	* 480	-	530	MPa
Flexural modulus	* 107	-	113	GPa
Flexural strength (modulus of rupture)	* 57,6	-	63,6	MPa
Shear modulus	* 43	-	45	GPa
Bulk modulus	* 71,3	-	75,3	GPa
Poisson's ratio	* 0,23	-	0,27	
Shape factor	15			
Hardness - Vickers	* 144	-	159	HV
Elastic stored energy (springs)	* 10,5	-	12,8	kJ/m^3
Fatigue strength at 10^7 cycles	* 40,9	-	47,7	MPa

Impact & fracture properties

Fracture toughness	* 2	-	3	MPa.m^0.5
Toughness (G)	0,0376	-	0,0791	kJ/m^2

Thermal properties

Melting point	* 1,5e3	-	1,7e3	°C
Maximum service temperature	* 1,08e3	-	1,23e3	°C
Minimum service temperature	-273			°C
Thermal conductivity	1,9	-	2,1	W/m.°C
Specific heat capacity	931	-	969	J/kg.°C
Thermal expansion coefficient	2,9	-	3,1	µstrain/°C
Thermal shock resistance	* 143	-	163	°C
Thermal distortion resistance	* 0,628	-	0,707	MW/m
Latent heat of fusion	* 1,02e3	-	1,15e3	kJ/kg

Electrical properties

Electrical resistivity	1e17	-	1e18	µohm.cm
Electrical conductivity	1,72e-16	-	1,72e-15	%IACS
Dielectric constant (relative permittivity)	4,8	-	5,2	
Dissipation factor (dielectric loss tangent)	0,00214	-	0,00236	
Dielectric strength (dielectric breakdown)	17,3	-	18,7	MV/m

Magnetic properties

Magnetic type	Non-magnetic

Optical, aesthetic and acoustic properties

Color	Cream			
Transparency	Opaque			
Acoustic velocity	6,67e3	-	6,87e3	m/s
Mechanical loss coefficient (tan delta)	* 1e-5	-	2e-5	

Critical materials risk

Contains >5wt% critical elements?	Yes
Notes	Al (aluminum) added to the 2018 US critical minerals list

Durability

Water (fresh)	Excellent
Water (salt)	Excellent
Weak acids	Excellent
Strong acids	Acceptable
Weak alkalis	Excellent
Strong alkalis	Acceptable
Organic solvents	Excellent
Oxidation at 500C	Excellent
UV radiation (sunlight)	Excellent

Halogens	Unacceptable			
Metals	Acceptable			
Flammability	Non-flammable			

Primary production energy, CO2 and water

Embodied energy, primary production	* 48,8	-	53,9	MJ/kg
CO2 footprint, primary production	* 2,63	-	2,91	kg/kg
Water usage	* 30,3	-	33,5	l/kg

Processing energy, CO2 footprint & water

Grinding energy (per unit wt removed)	* 40,4	-	44,7	MJ/kg
Grinding CO2 (per unit wt removed)	* 3,03	-	3,35	kg/kg

Recycling and end of life

Recycle	✗	
Recycle fraction in current supply	0,1	%
Downcycle	✓	
Combust for energy recovery	✗	
Landfill	✓	
Biodegrade	✗	

Liens

ProcessUniverse

Producers

Reference

Shape