DATA SHEET

Rev. N° 0 - 22.05.2023

1AS.009
Macor® Ceramic

Applications

- Ultra-High Vacuum Environments
- Laser Technology
- Equipment:
  - Electronic
  - Medical
  - Automobile
  - Aerospace
  - Military
  - Nuclear

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Overview

Macor® is an outstanding engineering material which can quickly be designed into highly complex shapes, using conventional metalworking tools. Opening a wide range of possibilities, Macor® gives the performance of a technical ceramic with the versatility of a high-performance polymer, while providing the machinability of a soft metal.

Macor® remains continuously stable at 800 °C, with a maximum peak at 1,000 °C. Its coefficient of thermal expansion readily matches most metals and sealing glasses. As an electric insulator, particularly at high temperatures, it is excellent at high voltages and a broad spectrum of frequencies. Macor® is a white, nonwetting, odourless and non-outgassing material that exhibits zero porosity. Macor® is also radiation resistant. Macor® is of a pure white and can be polished to a high gloss. It can be metallized, welded and bonded to a thick or thin epoxy film. Another main advantage of this unique material is that, even in small quantities, it can be manufactured in an economic way

Final Advanced Materials can supply ceramic rods or plates for your own use, but it is also possible for us to undertake the complete execution of your project.

Machining

Extremely machinable, Macor® offers tight tolerances capabilities, allowing complicated shape design (optimal performances up to 0.013 mm for dimensions, < 0.5 µm for finished surface and up to 0.013 µm for polished surface).

Alternative to Macor®

The use of Macor® is restricted by the dimensions of the product. Vitro800 is an equivalent material to Macor® and is available in larger dimensions.

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Applications

Fields	Examples
Ultra-High Vacuum Environments	Insulator, coil support, vacuum feed-throughs
Constant Vacuum Applications	Spacers, headers and windows for microwave tube devices, sample holders in field ion microscopes
Aerospace Industry	retaining rings, mechanical joints on the orbital probes
Nuclear-Related Experiments	Reference piece to measure dimensional change in other materials (Macor® is not dimensionally affected by irradiation)
Welding	Nozzle on the tips of oxyacetylene torches (nonwetting characteristic of Macor®)
Fixtures	electrode support and burner block in several industrial high heat, electrical cutting operations
Medical Equipment	Medical components are integrated by Macor®'s inertness

Benefits

- Easily machinable
- Withstands high temperatures
- Low thermal conductivity
- Holds tight tolerances
- Electrical insulator
- Zero porosity and no outgassing
- Strong and rigid
- Highly polishable
- Can be soldered to a wide range of material
- Radiation resistant
- Lead free

Available Products

Type	Dimensions
Plate	up to 300x300x55 mm
Rod	round section: up to Ø55x300 mm square section: 60x60x300 mm
We also machine your parts according to your drawings.	

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FINAL ADVANCED MATERIALS

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Technical Data

Property		Unit	Macor®
Item N°			166-0001
Density		g/cm³	2.52
Porosity		%	0
Elastic Modulus (Young) at 20 °C		GPa	66.9
Hardness on Knoop's scale for 100 g		MPa	25
Poisson Coefficient			0.29
Shear's Modulus at 20 °C		GPa	25.5
Compressive Strength		MPa	345 to 900
Flexural Strength		MPa	94
Max. Peak Temperature		°C	1,000
Max. Operating Temperature		°C	800
Specific Warmth at 20 °C		J/kg.K	795.5
Thermal Conductivity at 20 °C		$W.m^{-1}.K^{-1}$	1.46
Expansion Coeff.	from -100 °C to 20 °C	10^{-6}/°C	8.1
	from 20 °C to 300 °C		9.0
	from 20 °C to 600 °C		11.2
	from 20 °C to 800 °C		12.3
Electrical Resistivity at 20 °C		Ω.m	10^{15}
Dielectric Constant at 20 °C	for 1 MHz		6.01
	for 8.5 GHz		5.64
Loss Tangent at 20 °C for 1 kHz			0.004
Dielectric Strength at 20 °C, < 0.3 mm thickness	alternating current	kV/mm	45
	direct current		129
Corrosion Resistance at 20 °C			good
Alkali Resistance at 20 °C			very good

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Chemical Properties

Chemical Composition

Macor® can be considered unique as its composition comprise 55 % fluorophlogopite mica and 45 % borosilicate glass.

Composition	%	Composition	%
SiO_2	46	K_2O	10
MgO	17	B_2O_3	7
Al_2O_3	16	F	4

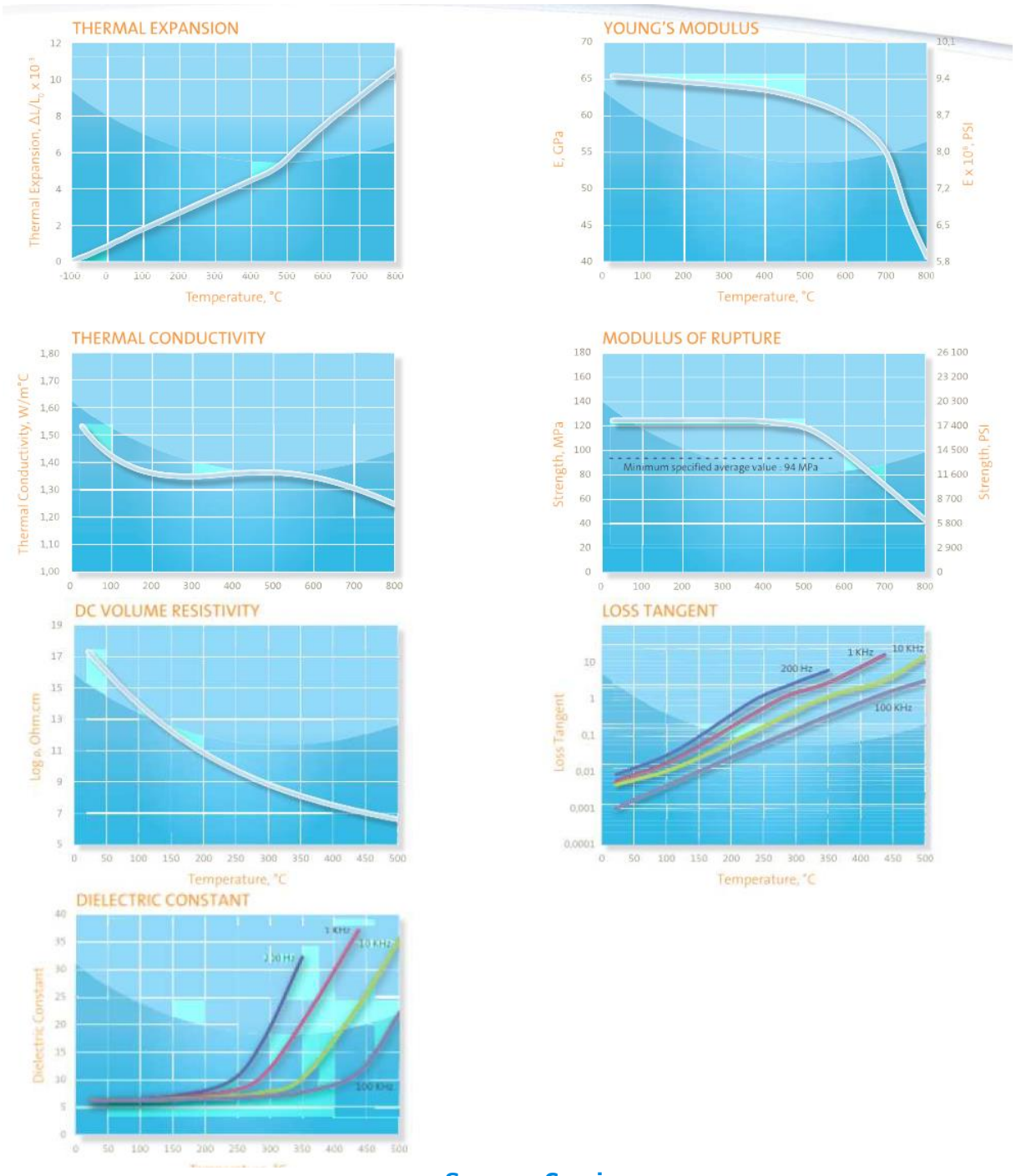
Chemical Durability

Standard		Class
DIN 12111 / NF ISO 719	water	HGB2
DIN 12116	Acid	4
DIN 52322 / ISO 695	Alkali	A3

Weight Loss at 95 °C (mg/cm³)

Solution	pH	Time	Gravimetric
5 % HCI	0.1	24 hrs	≈100
0.002 N HNO_3	2.8	24 hrs	≈0.6
0.1 N $NaHCO_3$	8.4	24 hrs	≈0.3
0.02 N Na_2CO_3	10.9	6 hrs	≈0.1
5 % NaOH	13.2	6 hrs	≈10

Graphs



Source : Corning