MACOR®

Machinable Glass Ceramic
For Industrial Applications



CORNING

A unique material

MACOR® Machinable Glass Ceramic

MACOR® machinable glass ceramic is recognized worldwide to be a major technological innovation, as well as a technical solution for a wide range of industrial applications.

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.

As a result, MACOR® is an outstanding engineering material which can quickly be designed into highly complex shapes, using conventional metalworking tools.

Unique composition

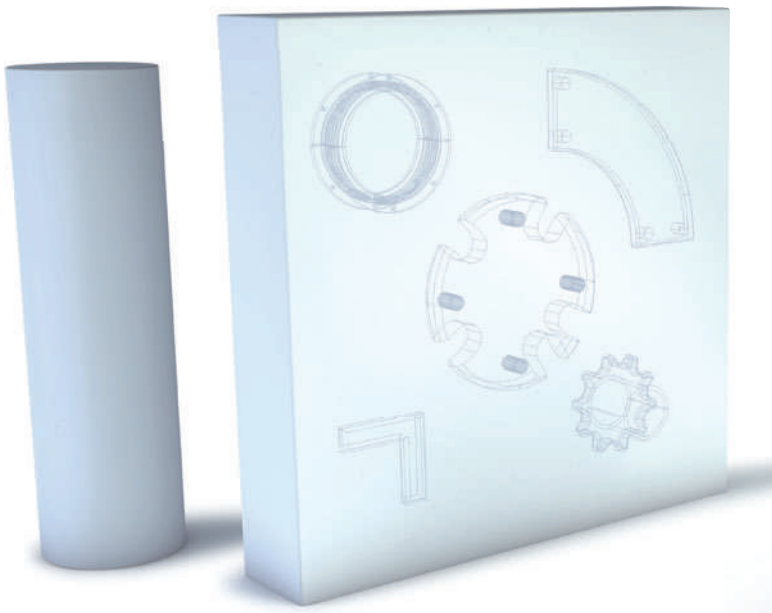
MACOR® can be considered unique as its composition comprises 55% fluorophlogopite mica and 45% borosilicate glass. Corning's unique production process results in Macor's microstructure that is a key to its versatile properties.

General properties

MACOR® offers a unique combination of properties, unlike any other technical material.

It is a white, nonwetting, odorless and non outgassing material that exhibits zero porosity.

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).



MACOR® remains continuously stable at 800 °C, with a maximum peak at 1000 °C under no load, and unlike ductile materials, doesn't creep or deform.

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.

Material Forms

Corning supplies MACOR® as slab and rod.

High precision finished parts are manufactured by our specialist partners.

Key Benefits

Product

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

Process

Short production process

Raw Material → Machining → Finished parts shipment

- Ordinary machining tools
- Complex design shapes
- No post firing required
- Fast turnaround and cost effective
- Quick end-user delivery time

Unrivalled properties combination - A wide range of possibilities
Quickly - Accurately - Economically

Industry Applications

MACOR® builds value in every field :

- Constant and ultra-high vacuum environments
- Laser technology
- Semiconductor / Electronic
- Aerospace / Space
- Medical/ Laboratory equipment
- Fixtures
- Chemical
- Automobile
- Military
- Nuclear...

Properties

I. Thermal

	SI/Metric	Imperial
Coefficient of Expansion		
CTE -100°C → 25°C	81 x 10^{-7} /°C	45 x 10^{-7} /°F
CTE 25°C → 300°C	90 x 10^{-7} /°C	50 x 10^{-7} /°F
CTE 25°C → 600°C	112 x 10^{-7} /°C	62 x 10^{-7} /°F
CTE 25°C → 800°C	123 x 10^{-7} /°C	68 x 10^{-7} /°F
Specific Heat, 25°C	0,79 kJ/kg°C	0.19 Btu/lb°F
Thermal Conductivity, 25°C	1,46 W/m°C	10.16 Btu.in/hr.ft²°F
Thermal Diffusivity, 25°C	7,3 x 10^{-7} m²/s	0.028 ft²/hr
Continuous Operating Temperature	800°C	1472°F
Maximum No Load Temperature	1000°C	1832°F



II. Mechanical

	SI/Metric	Imperial
Density	2,52 g/cm³	157 lbs/ft³
Porosity	0%	0%
Young's Modulus, 25°C (Modulus of Elasticity)	66,9 GPa	9.7 x 10^6 PSI
Poisson's Ratio	0,29	0.29
Shear Modulus, 25°C	25,5 GPa	3.7 x 10^6 PSI
Knoop Hardness, 100g	250 kg/mm²	
Modulus of Rupture, 25°C (Flexural Strength)	94 MPa (Minimum specified average value)	13 600 PSI
Compressive Strength (After polishing)	345 MPa up to 900 MPa	49 900 PSI 130 000 PSI

III. Electrical

	SI/Metric	Imperial
Dielectric Constant, 25°C		
1 kHz	6,01	6.01
8,5 GHz	5,64	5.64
Loss Tangent, 25°C		
1 kHz	0,0040	0.0040
8,5 GHz	0,0025	0.0025
Dielectric Strength (AC) avg. 25°C, under 0,3 mm thickness.	45 kV/mm	1143 V/mil
Dielectric Strength (DC) avg. 25°C, under 0,3 mm thickness	129 kV/mm	3277 V/mil
DC Volume Resistivity, 25°C	10^{17} Ohm.cm	10^{17} Ohm.cm

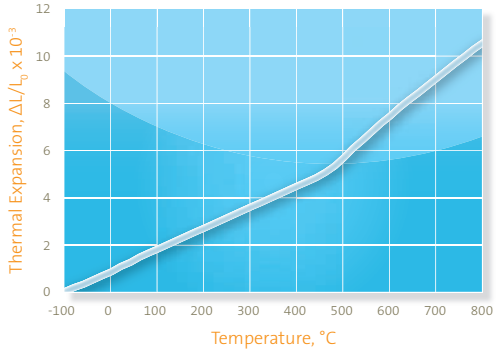
IV. Chemical

				Weight Loss (mg/cm²)
Solution	pH	Time	Temp.	Gravimetric
5% HCl (Hydrochloric Acid)	0,1	24 hrs	95°C	~100
0,002 N HNO_3 (Nitric Acid)	2,8	24 hrs	95°C	~0,6
0,1 N $NaHCO_3$ (Sodium Bicarbonate)	8,4	24 hrs	95°C	~0,3
0,02 N Na_2CO_3 (Sodium Carbonate)	10,9	6 hrs	95°C	~0,1
5% NaOH (Sodium Hydroxide)	13,2	6 hrs	95°C	~10

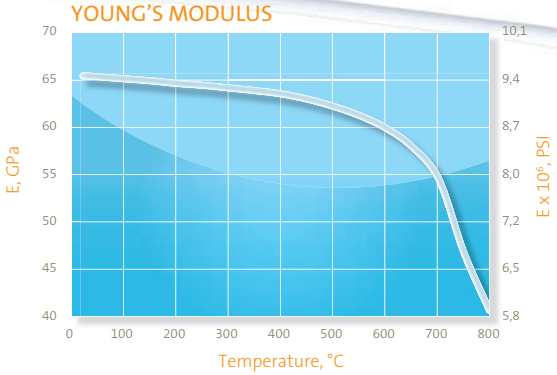
Chemical durability		Class
DIN 12111 / NF ISO 719	Water	HGB2
DIN 12116	Acid	4
DIN 52322 / ISO 695	Alkali	A3

Technical Data

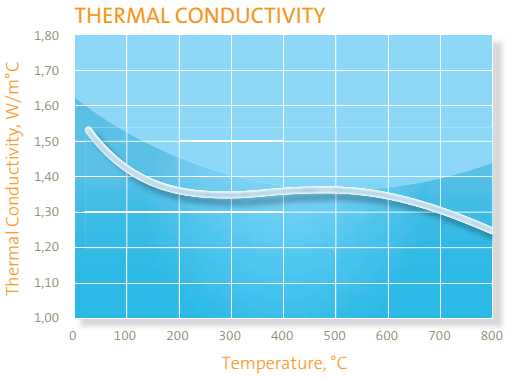
THERMAL EXPANSION



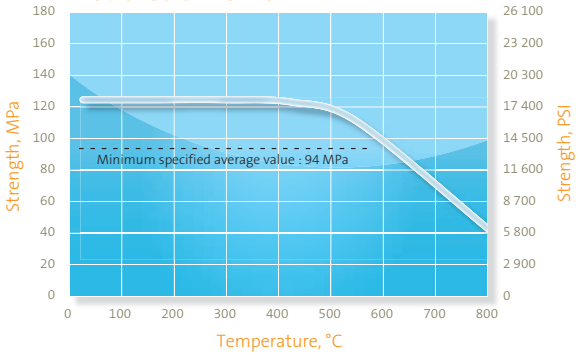
YOUNG'S MODULUS



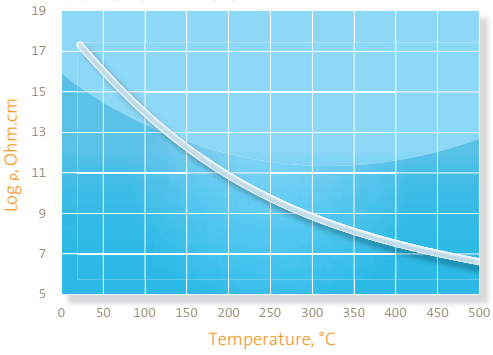
THERMAL CONDUCTIVITY



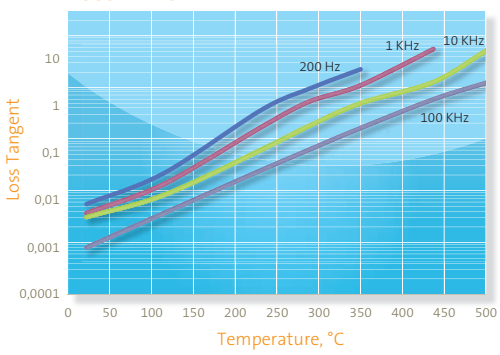
MODULUS OF RUPTURE



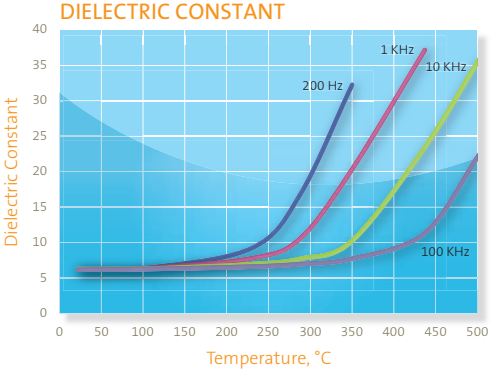
DC VOLUME RESISTIVITY



LOSS TANGENT

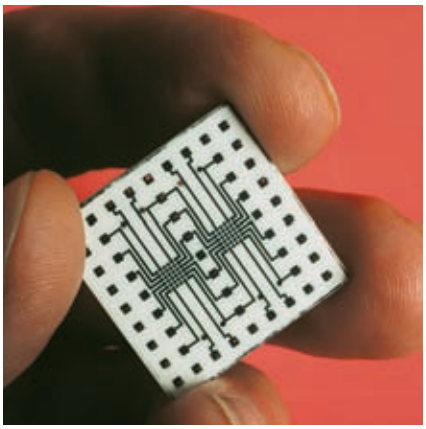


DIELECTRIC CONSTANT



Actual properties of specific production batches may vary.
Stated general properties reflect results from regular tests on sample quantities in Corning labs.







Your Application

© 2012 Corning Incorporated. All rights reserved

ISO 9001
ISO 14001
OHSAS 18001

For more information:

www.corning.com/specialtymaterials/macor
macor@corning.com

Corning SAS - 7 bis avenue de Valvins, CS 70156 Samois-sur-Seine,
77215 AVON Cedex, France - Tel +33 1 64 69 70 39

MACOR® is a registered trademark of Corning Incorporated, Corning, NY

CORNING