

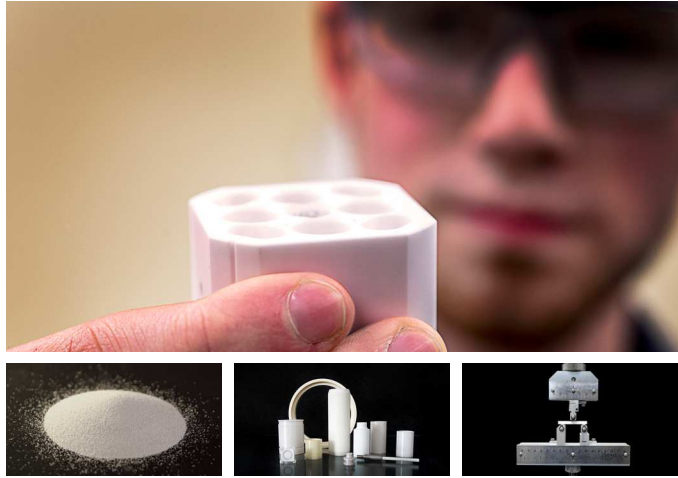
Materials Property Chart

Contact us:

STC looks forward to working closely with you on your quest for a ceramic material solution to any challenging application you may have. We are certain that you will find STC's full service staff an ideal partner to undertake your ceramic component projects.

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Property	ASTM Method	Units	MSZ (Magnesia Stabilized) MSZ-300	Zirconia			Zirconia Toughened Alumina			
				MSZ (Magnesia Stabilized) MSZ-300	YTZP 2000 (Yttria Stabilized)	YTZP 4000 (Yttria Stabilized)	CSZ (Ceria Stabilized)	ZTA-02 US Patent 8679995	ZTA-14	ZTA-20
Crystal Size (Average)	Thin Section	Microns	30	30	1	1	3	< 2	6	3
Color	--	--	Ivory	Yellow	Ivory	Ivory	Yellow	Off White	White	White
Gas Permeability	--	atms-cc/sec	gas tight <10 ⁻¹⁰	gas tight <10 ⁻¹⁰	gas tight <10 ⁻¹⁰	gas tight <10 ⁻¹⁰	gas tight <10 ⁻¹⁰	gas tight <10 ⁻¹⁰	gas tight <10 ⁻¹⁰	gas tight <10 ⁻¹⁰
Water Absorption	C 20-97	%	0	0	0	0	0	0	0	0
Density	C 20-97	g/cc	5.72	5.72	6.02	6.07	6.20	3.96	4.17	4.30
Hardness	Vickers 500 gm	GPa (kg/mm ²)	11.7 (1200)	11.7 (1200)	12.5 (1250)	12.5 (1250)	11.7 (1200)	14 (1440)	14.5 (1478)	14.4 (1470)
Hardness	--	R45N	78	78	80	80	78	81	82	82
Fracture Toughness	Notched Beam	MPam ^{1/2}	12	12	10	10	12	5	6	6
Flexural Strength (MOR) (3 point) @ RT°	F417-87	MPa (psi x 10 ³)	620 (90)	586 (85)	951 (138)	1380 (200)	551 (80)	448 (65)	586 (85)	621 (90)
Tensile Strength @ RT°	--	MPa (psi x 10 ³)	310 (45)	310 (45)	550 (80)	690 (100)	337 (49)	259 (38)	344 (50)	350 (51)
Compressive Strength @ RT°	--	MPa (psi x 10 ³)	1862 (270)	1862 (270)	2485 (360)	2485 (360)	2000 (290)	2413 (350)	2758 (400)	2758 (400)
Elastic Modulus	C848	GPa (psi x 10 ⁶)	206 (29.8)	206 (29.8)	210 (30)	210 (30)	200 (29)	358 (52)	338 (49)	338 (49)
Poisson's Ratio	C848	--	0.28	0.28	0.30	0.30	0.25	0.23	0.23	0.23
C.T.E. 25 - 100° C	C 372-96	x 10 ⁻⁶ /C	8.9	8.9	6.9	6.9	6.9	6.7	6.0	6.0
C.T.E. 25 - 300° C	C 372-96	x 10 ⁻⁶ /C	9.7	9.7	8.1	8.1	8.1	8.1	7.0	7.0
C.T.E. 25 - 600° C	C 372-96	x 10 ⁻⁶ /C	10.0	10.0	10.5	10.5	10.5	8.3	7.1	7.1
Thermal Conductivity @ RT°	C 408	W/m K	3	3	2.2	2.2	3.5	27	24	24
Max Use Temp (non-loading) (at high strength)	--	Fahrenheit (°F)	2200	2200	932	932	1000	2732	2730	2730
	--	Celsius (°C)	1200	1200	500	500	537	1500	1500	1500
Dielectric Strength (.125" Thick)	D 149-97A	V/mil	300	300	240	240	250	230	250	250
Dielectric Constant @ 1 MHz	D 150-98	--	22.7	22.7	30.0	30.0	30.0	10.5	12.5	12.5
Dielectric Constant @ Gigahertz	D 2520-95	--	29.2	29.2	--	--	--	--	--	12.4
Dielectric Loss @ 1 MHz	D 150-98	--	0.0016	0.0016	0.0010	0.0010	0.0010	0.0003	0.0006	0.0006
Dielectric Loss @ Gigahertz	D 2520-95	--	0.0018	0.0018	--	--	--	--	0.0005	0.0005
Volume Resistivity, 25° C	D 257	ohms-cm	> 1 x 10 ¹³	> 1 x 10 ¹³	> 1 x 10 ¹³	> 1 x 10 ¹³	> 1 x 10 ¹³	> 1 x 10 ¹⁴	> 1 x 10 ¹⁴	> 1 x 10 ¹⁴
Volume Resistivity, 300° C	D 1829	ohms-cm	5 x 10 ⁷	5 x 10 ⁷	1 x 10 ¹⁰	1 x 10 ¹⁰	1 x 10 ¹⁰	3 x 10 ¹²	1 x 10 ¹⁰	1 x 10 ¹⁰
Volume Resistivity, 500° C	D 1829	ohms-cm	1 x 10 ⁷	1 x 10 ⁷	1 x 10 ⁹	1 x 10 ⁹	1 x 10 ⁹	6 x 10 ¹⁰	2 x 10 ⁹	2 x 10 ⁹
Volume Resistivity, 700° C	D 1829	ohms-cm	2 x 10 ⁶	2 x 10 ⁶	5 x 10 ⁸	5 x 10 ⁸	5 x 10 ⁸	6 x 10 ⁹	2 x 10 ⁸	4 x 10 ⁸
Volume Resistivity, 1000° C	D 1829	ohms-cm	--	--	--	--	--	--	--	--



Zirconia Ceramic Materials

- Yttria Stabilized Zirconia (YTZP)
- Magnesia Stabilized Zirconia (MSZ)
- Ceria Stabilized Zirconia (CSZ)
- Zirconia Toughened Alumina (ZTA)

Note: The information in this data sheet is for design guidance only. STC does not warrant this data as absolute values. Forming methods and specific geometry could affect properties. Slight adjustments can be made to some of the properties to accommodate specific customer...

...requirements. Most of the dense materials in the table are resistant to mechanical erosion and chemical attack. STC has performed ASTM testing qualification for certain compositions, in accordance with ASTM D2442. Please consult our technical staff for appropriate material and specific test results.

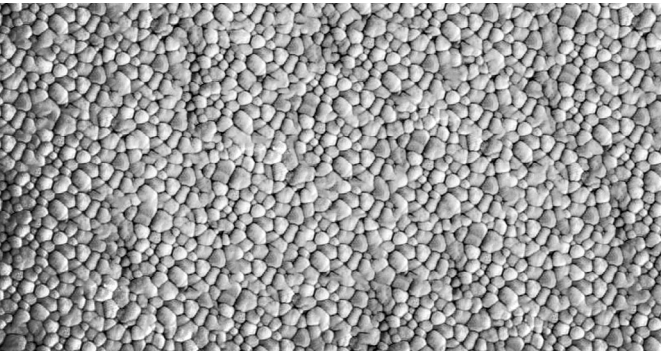


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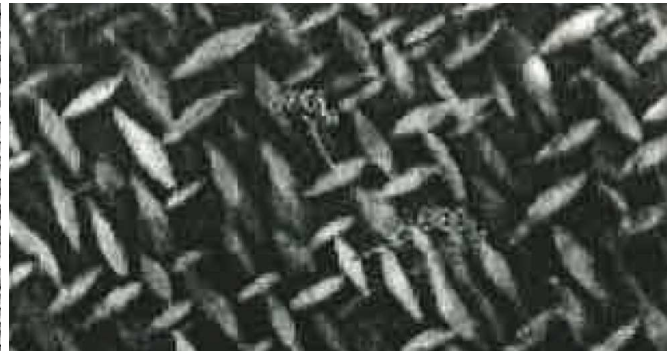


For a complete version of the Materials Property Chart, visit ceramics.net





Electron Microscope image of YTZP



Electron Microscopic image of MSZ

Zirconia Ceramics

Stabilized Zirconia's are among the strongest ceramic materials we offer. Each one offers different specific properties that can be applied to meet the demands of extreme applications across many industries. Offering very high strength, high toughness, wear/abrasion resistance, and corrosion resistance they can be used in operating environments that plastics, metals and other ceramic materials cannot withstand. Visit our website to review the properties of each material and call us to discuss if they are the solution you are looking for.

Properties

Our understanding of materials helps us guide you through the selection process:

- High strength, hardness & fracture toughness
- Non-magnetic & wear resistant
- Good frictional behaviour
- Electrical insulation
- Low thermal conductivity
- Corrosion resistance in acids and alkalis
- Modulus of elasticity similar to steel
- Coefficient of thermal expansion similar to iron.



Ceramic Engineering Insight

Our 117 years of ceramics engineering experience allows us to provide guidance in material selection, design-to-manufacture geometry and cost effective production.



Total Process Control

How do we control quality? By controlling every aspect of manufacturing in-house, from raw material through to finished component. All aspects of our manufacturing processes are governed by the same principles of total quality management, including powder preparation, forming, green machining, sintering and diamond grinding.



Customer Service Focus

In the larger world of ceramics, we're a mid-sized firm located in Vermont. We pride ourselves on providing direct access to our key team members and quick response times for our customers.

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Applications

YTZP

- Structural ceramics
- Wear parts
- Cutting tools (knives, blades, shears)
- Deep well, down hole components
- Thread and wire guides
- Thermal barrier coatings
- Fiber optic ferrules and sleeves
- Oxygen sensors
- Precision ball valve, balls and seats
- Rollers and guide for metal tube forming
- Hot metal extrusion dies
- Solid oxide fuel cell components

CSZ

- Instrumentation
- Sensors
- Seals
- Bearings
- Desalination plant components
- Steam system instrumentation
- Boiler probes
- Underwater sensors
- Medical instrumentation
- Pump pistons
- Pump liners
- Valve seats
- Emission sensors
- Marine system components
- Chemical pumps
- Fluid metering pumps
- Fluid control valves
- Chemical analysis fluid control systems

MSZ

- Deep well, down hole components
- Wear parts
- Structural ceramics
- Precision valve seats and seals
- Roller guides for tube forming
- MWD tools
- Bushings
- Wear sleeves
- Pump pistons
- Pump sleeves
- Spray nozzles
- Ceramic bearings

ZTA

- Standoffs
- Pump Piston Sleeves
- Insulators
- Instrument
- Probe bodies
- Sensor bulbs
- Pump components
- Valve seals
- Bushings
- Impellers
- Fluid delivery system components
- Analytical instrument columns

