

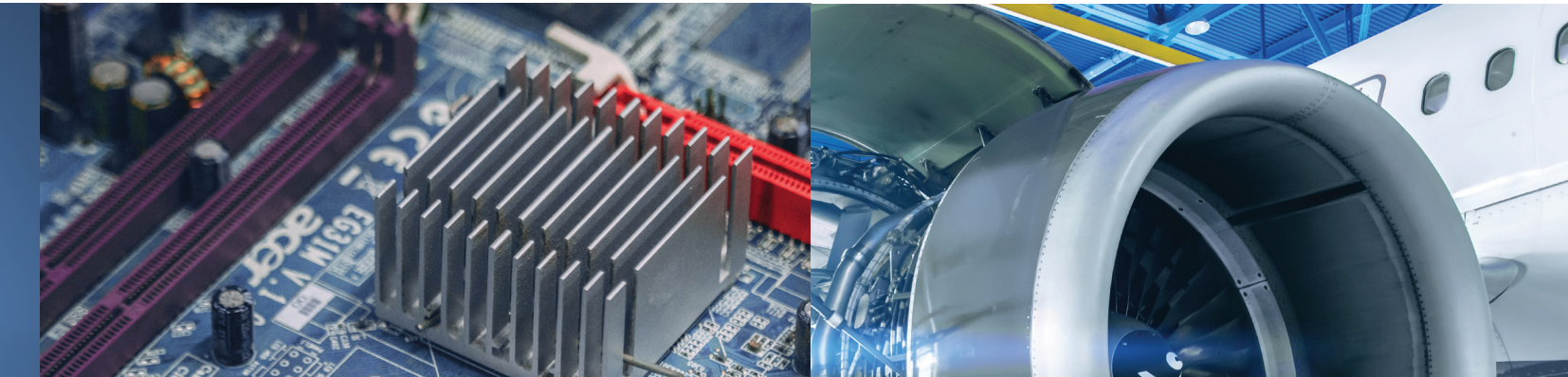
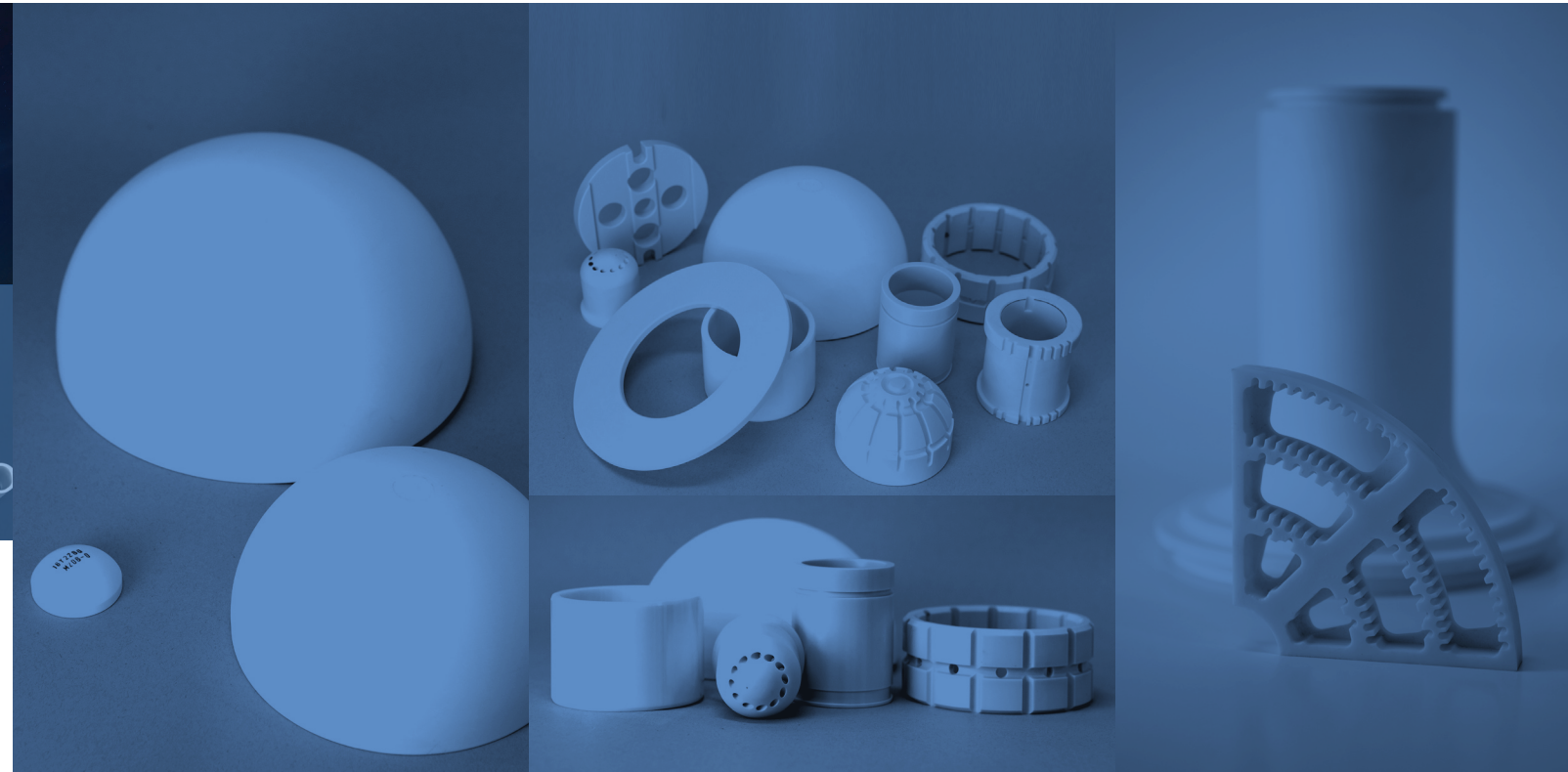
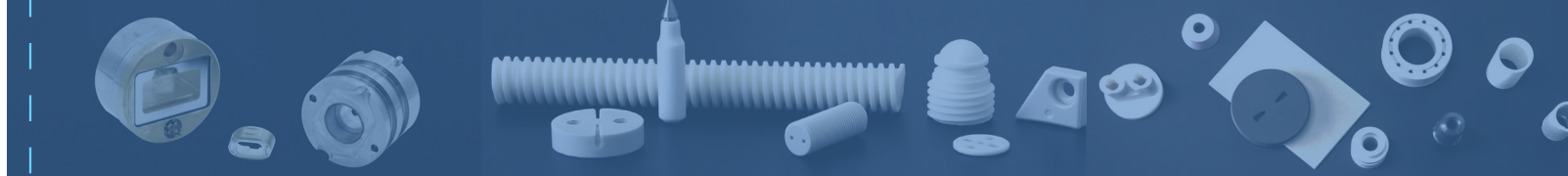
# Capabilities Statement

Providing highly engineered advanced material solutions for over 120 years.

# Materials Property Chart



Superior engineering. Trusted solutions. Customized materials.



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## Company Data

STC Materials Solutions is a U.S. owned Small Business that is a market-leading supplier of extreme environment materials to many high tech industries.

Leveraging more than one hundred and twenty years of expertise, STC delivers unique technical ceramic and hermetic solutions to a wide range of industries, including aerospace, defense, analytical instrumentation, energy, oil and gas, semiconductor, and medical. STC provides its customers a combination of versatile technical ceramic materials and joining capabilities with a universal commitment to quality and customer success. For more information on STC Material Solutions, please visit: [www.ceramics.net](http://www.ceramics.net).

## Industrial Codes

DUNS: 002002210  
CAGE: 8ACR2  
NAICS: 327999, 327110, 327113, 327120  
SAM Registered

## Materials & Processing Capabilities

- **Alumina:** Low to high purity (up to 99.9%), Zirconia Toughened (ZTA).
- **Zirconia:** Magnesia Stabilized (MSZ), Yttria Stabilized (YTZP).
- **Metallization, Brazing.**
- **Materials Testing** for bulk material formulation and fired product evaluation.
- **Large batch** powder milling and spray drying (up to 3000kg).
- **Forming:** 3.5" dia **Extrusion**; 12" dia **Mechanical Pressing**; 20" dia **Isostatic Pressing**.
- **Machining:** multi-axis machining centers (3, 4 and 5 axis, wet and dry); lathes (wet and dry); multiple custom machines.
- **Kilns:** gas fired and electric kilns; 6"-dia hydrogen tube furnaces; 8"dia.
- **Surface Grinding, Honing, Lapping, Glazing.**

## Differentiators

- **Full Product life-cycle support**, from material development, to rapid prototype orders, through high volume production.
- **Complete in-house capabilities** to assist with material selection, engineering, tooling, and manufacturing of technical ceramic and hermetic components.
- **Dedicated engineers and scientists** with experience in powder processing, forming, sintering and machining of in-house as well as customer supplied formulations.
- **Full metallization and brazing capabilities** for joining of dissimilar materials.

## Industry Experience:

- Aerospace & Defense
- Oil & Gas
- Semiconductor
- Medical
- Energy
- Instrumentation
- Industrial Equipment





# Materials Property Chart

			Alumina				
Property			AL74 74%	AL95 95%	AL96 96%	AL98 98%	
General	Crystal Size (Average)	Thin Section	Microns	13	11	8	7
	Color	--	--	White	Ivory	White or Purple	White
	Gas Permeability	--	atms-cc/sec	gas tight <10 <sup>-10</sup>	gas tight <10 <sup>-10</sup>	gas tight <10 <sup>-10</sup>	gas tight <10 <sup>-10</sup>
	Water Absorption	C 20-97	%	0	0	0	0
Mechanical	Density	C 20-97	g/cc	3.03	3.65	3.71	3.78
	Hardness	Vickers 500 gm	GPa (kg/mm <sup>2</sup> )	10.5 (1075)	11.5 (1175)	12.7 (1300)	12.7 (1300)
	Hardness	--	R45N	78	79	81	81
	Fracture Toughness	Notched Beam	MPam <sup>1/2</sup>	2 - 5	3 - 4	4 - 5	4 - 5
	Flexural Strength (MOR) (3 point) @ RT	F417-87	MPa (psi x 10 <sup>3</sup> )	241 (35)	310 (45)	358 (52)	393 (57)
	Tensile Strength @ RT	--	MPa (psi x 10 <sup>3</sup> )	117 (17)	151 (22)	200 (29)	221 (32)
	Compressive Strength @ RT	--	MPa (psi x 10 <sup>3</sup> )	1378 (200)	1827 (265)	2068 (300)	2241 (325)
	Elastic Modulus	C848	GPa (psi x 10 <sup>9</sup> )	172 (25)	303 (44)	310 (45)	345 (50)
Poisson's Ratio	C848	--	0.22	0.22	0.22	0.23	
Thermal	C.T.E. 25 - 100° C	C 372-96	x 10 <sup>-6</sup> /C	5.5	6.1	6.0	6.2
	C.T.E. 25 - 300° C	C 372-96	x 10 <sup>-6</sup> /C	5.8	7.0	6.8	6.8
	C.T.E. 25 - 600° C	C 372-96	x 10 <sup>-6</sup> /C	6.3	7.7	7.5	7.6
	Thermal Conductivity @ RT	C 408	W/m K	4	19	23	29
Max Use Temp	--	Fahrenheit (°F)	2800	3000	3100	3100	
	--	Celsius (°C)	1540	1650	1700	1700	
Electrical	Dielectric Strength (.125" Thick)	D 149-97A	V/mil	225	250	250	260
	Dielectric Constant @ 1 MHz	D 150-98	--	7.0	9.0	9.1	9.5
	Dielectric Constant @ Gigahertz	D 2520-95	--	--	9.2	9.1	9.4
				--	11.0	10.9	9.8
	Dielectric Loss @ 1 MHz	D 150-98	--	0.0012	0.0006	0.0004	0.0006
	Dielectric Loss @ Gigahertz	D 2520-95	--	--	0.0009	0.0007	0.0005
				--	12.5	10.9	9.8
	Volume Resistivity, 25° C	D 257	ohms-cm	< 1 x 10 <sup>13</sup>	> 1 x 10 <sup>14</sup>	> 1 x 10 <sup>14</sup>	> 1 x 10 <sup>14</sup>
	Volume Resistivity, 300° C	D 1829	ohms-cm	4 x 10 <sup>10</sup>	5 x 10 <sup>12</sup>	3 x 10 <sup>12</sup>	8 x 10 <sup>11</sup>
	Volume Resistivity, 500° C	D 1829	ohms-cm	3 x 10 <sup>7</sup>	3 x 10 <sup>9</sup>	7 x 10 <sup>9</sup>	2 x 10 <sup>9</sup>
Volume Resistivity, 700° C	D 1829	ohms-cm	2 x 10 <sup>6</sup>	3 x 10 <sup>8</sup>	4 x 10 <sup>8</sup>	2 x 10 <sup>8</sup>	
Volume Resistivity, 1000° C	D 1829	ohms-cm	--	--	--	--	

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.

High Purity Alumina		Zirconia Toughened Alumina		Zirconia	
AL995 99.5%	AL9980 99.8%	ZTA-14	ZTA-20	MSZ (Magnesia Stabilized)	YTZP 2000 (Yttria Stabilized)
6	6	6	3	30	1
Ivory - White	Ivory	White	White	Ivory or Yellow	Ivory
gas tight <10 <sup>-10</sup>	gas tight <10 <sup>-10</sup>	gas tight <10 <sup>-10</sup>	gas tight <10 <sup>-10</sup>	gas tight <10 <sup>-10</sup>	gas tight <10 <sup>-10</sup>
0	0	0	0	0	0
3.88	3.91	4.17	4.30	5.72	6.02
14.3 (1459)	15 (1530)	14.5 (1478)	14.4 (1470)	11.7 (1200)	12.5 (1250)
82	86	82	82	78	80
4 - 5	3 - 4	6	6	12	10
338 (49)	379 (55)	586 (85)	621 (90)	620 (90)	951 (138)
172 (25)	200 (29)	344 (50)	350 (51)	310 (45)	550 (80)
2137 (310)	2240 (325)	2758 (400)	2758 (400)	1862 (270)	2485 (360)
379 (55)	379 (55)	338 (49)	338 (49)	206 (29.8)	210 (30)
0.23	0.23	0.23	0.23	0.28	0.30
6.3	6.5	6.0	6.0	8.9	6.9
6.9	7.9	7.0	7.0	9.7	8.1
7.6	8.1	7.1	7.1	10	10.5
30	30	24	24	3	2.2
3047	3047	2730	2730	2200	932
1675	1675	1500	1500	1200	500
270	290	250	250	300	240
9.8	9.8	12.5	12.5	22.7	30.0
9.7	10	--	12.4	29.2	--
9.8	9.6	--	9.4	6.2	--
0.0002	< .0001	0.0006	0.0006	0.0016	0.0010
< .0001	< .0001	0.0005	0.0005	0.0018	--
9.8	9.6	9.4	9.4	6.2	--
> 1 x 10 <sup>14</sup>	> 1 x 10 <sup>14</sup>	> 1 x 10 <sup>14</sup>	> 1 x 10 <sup>14</sup>	> 1 x 10 <sup>13</sup>	> 1 x 10 <sup>13</sup>
1 x 10 <sup>12</sup>	3 x 10 <sup>12</sup>	1 x 10 <sup>10</sup>	1 x 10 <sup>10</sup>	5 x 10 <sup>7</sup>	1 x 10 <sup>10</sup>
5 x 10 <sup>10</sup>	6 x 10 <sup>10</sup>	2 x 10 <sup>9</sup>	2 x 10 <sup>9</sup>	1 x 10 <sup>7</sup>	1 x 10 <sup>6</sup>
2 x 10 <sup>9</sup>	6 x 10 <sup>9</sup>	2 x 10 <sup>8</sup>	4 x 10 <sup>8</sup>	2 x 10 <sup>6</sup>	5 x 10 <sup>3</sup>
--	--	--	--	--	--

Nitride	Silicates					Units
Silicon Nitride (Si <sub>3</sub> N <sub>4</sub> )	Steatite L-4	Steatite L-5	Corderite	Mullite	Lava Grade A Fired	
4	7	7	--	7	--	Microns
Black	Tan	Gray-Green	Orange-Tan	Gray-Tan	Gray-Tan	--
gas tight <10 <sup>-10</sup>	--	--	Porous	--	Porous	atms-cc/sec
0	0	0	10	0	3	%
3.25	2.65	2.75	2.00	3.00	2.30	g/cc
15 (1529)	4.9 (500)	4.9 (500)	5.8 (590)	10 (1000)	4.4 (450)	GPa (kg/mm <sup>2</sup> )
83	57	57	50	78	42	R45N
6	--	--	--	3	--	MPam <sup>1/2</sup>
900 (130)	117 (17)	138 (20)	66 (9.5)	206 (30)	69 (10)	MPa (psi x 10 <sup>3</sup> )
537 (78)	103 (15)	103 (15)	19 (2.7)	138 (20)	21 (3)	MPa (psi x 10 <sup>3</sup> )
2500 (362)	551 (80)	586 (85)	165 (24)	1034 (150)	172 (25)	MPa (psi x 10 <sup>3</sup> )
300 (44)	103 (15)	103 (15)	103 (15)	179 (26)	--	GPa (psi x 10 <sup>9</sup> )
0.28	0.24	0.24	0.31	0.24	--	--
--	7.3	8.5	2.1	3.6	2.9	x 10 <sup>-6</sup> /C
--	7.4	8.6	2.5	4.1	3.3	x 10 <sup>-6</sup> /C
2.9	7.5	8.6	3.0	4.8	3.6	x 10 <sup>-6</sup> /C
29	3	3	3	4	2	W/m K
2552	2350	2350	2350	3100	2000	Fahrenheit (°F)
1400	1290	1290	1290	1700	1100	Celsius (°C)
300	260	270	120	250	100	V/mil
9.2	5.6	5.7	5.5	6.7	5.3	--
--	5.6	5.8	--	6.7	--	--
--	9.2	12.5	--	11.4	--	--
--	0.003	0.0014	--	0.003	--	--
--	0.005	0.0017	--	0.003	--	--
--	9.2	12.5	--	11.4	--	--
> 1 x 10 <sup>14</sup>	> 1 x 10 <sup>14</sup>	> 1 x 10 <sup>14</sup>	> 1 x 10 <sup>14</sup>	> 1 x 10 <sup>14</sup>	--	ohms-cm
--	2 x 10 <sup>10</sup>	1 x 10 <sup>11</sup>	--	4 x 10 <sup>10</sup>	--	ohms-cm
--	1 x 10 <sup>9</sup>	4 x 10 <sup>10</sup>	--	1 x 10 <sup>9</sup>	--	ohms-cm
--	2 x 10 <sup>8</sup>	1 x 10 <sup>9</sup>	--	--	--	ohms-cm
--	--	--	--	--	--	ohms-cm

Note: In addition to the above compositions, STC offers a wide range of alternative materials. Please contact one of our applications engineers for material requirements that may not be shown above. Revised: 10/5/2023