Your Experienced Partner

Superior Technical Ceramics (STC) has been a recognized leader in the aerospace and defense industries for over 40 years. We are an ITAR registered, AS9100 and ISO 9001 certified Small Business. We create specialized ceramic components in partnership with the nation's most prominent aerospace and defense participants.

Our Services Include

- Materials Design Consulting
- Proprietary Materials Development
- Prototype Manufacturing
- Toll Processing
- Volume Manufacturing for Full Product Life-Cycle Support
- Proof of Concept through Production
- Specializing in Complex Shapes & Exacting Tolerances

### Engine, Exhaust and Propulsion Components:

- Bladess, Vanes & Valves
- Combustion Liners
- Fuel System Components
- Igniters, Leads, Nozzles & Shrouds
- Tubes & Rods
- Engine Monitoring Components
- Rupture Discs

### Sensor Components:

- High Temperature Sensor Assemblies
- Turbine Sensors
- Sonar Components
- Thermocouple Housing
- Gas Sensor Components

### Analytical Instrumentation Components:

- Altimeters Components
- Fire Detection Components
- Vibration Sensor Components
- Satellite Positioning Components
- Gyroscope Components
- Turbine Sensors
- Explosive & Chemical Detection

### Guidance and Navigation Components:

- Laser Components
- Missile Guidance Components
- Infrared Navigation Components
- Radomes
- Radar Components

### Custom Development and Commercialization:

- Proprietary Ceramic Material Processing
- Advanced Ceramic Optical Windows & Domes
- Ceramic Matrix Composite (CMC) Machining
- Ballistic Transparent Ceramics

### Electrical Components:

- Antennas
- Capacitors
- Connectors
- High Voltage Feed-Throughs
- Lighting Components
- Resistors
Technical Ceramic Solutions for the Aerospace & Defense Industry

We have experience in working with technical ceramics materials, including Alumina (74-99.96%), Zirconia Toughened Alumina (ZTA), YTZP, MSZ, CSZ and Silicon Nitride (Si₃N₄). The unique attributes of each material allow our engineers to solve individual industry challenges, while still providing cost-effective solutions.

**A Broad Spectrum of Ceramic Material Solutions**

We have experience in working with technical ceramics materials, including Alumina (74-99.96%), Zirconia Toughened Alumina (ZTA), YTZP, MSZ, CSZ and Silicon Nitride (Si₃N₄). The unique attributes of each material allow our engineers to solve individual industry challenges, while still providing cost-effective solutions.

**A Broad Spectrum of Ceramic Material Solutions**

**Zirconia Toughened Alumina for Greater Strength & Durability**

Zirconia Toughened Alumina (ZTA) is an excellent choice for applications requiring greater toughness and higher strength than Alumina alone, while maintaining the corrosion resistance of Alumina. This material is used in similar applications as Alumina, but where processes demand greater material strength and durability ZTA can also be metalized and brazed, similar to Alumina, to offer unique possibilities when designing assemblies.

**Zirconia Materials for Robust Mechanical Properties and Thermal Performance**

The Zirconia family of materials provides toughness and durability in extreme environments that often require extended life performance. YTZP offers superior strength, MSZ excellent toughness, and CSZ a tough material similar to MSZ but with proven low thermal chemical resistance in both extreme acids and basic environments. Zirconia’s low thermal conductivity also offers opportunities for thermal management applications.

**Silicon Nitride for High Performance with Reduced Weight**

Silicon Nitride provides superior strength and thermal performance for applications that require thermal shock resistance combined with overall material strength. At a lower density than the Zirconia materials, it is a lighter weight alternative while still providing excellent strength, corrosion and wear resistance.

---

**Technical Specifications for Ceramic Materials**

<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Method</th>
<th>Units</th>
<th>Al2O3 95%</th>
<th>Al2O3 96%</th>
<th>Al2O3 98%</th>
<th>AL95 99.5%</th>
<th>AL98 99.8%</th>
<th>ZTA-02</th>
<th>ZTA-14</th>
<th>ZTA-20</th>
<th>MSZ (Magnesia Standard)</th>
<th>YTZP 2000 (Magnesia Standard)</th>
<th>YTZP 4000 (Magnesia Standard)</th>
<th>CSZ (Stabilized)</th>
<th>Silicon Nitride (Si₃N₄)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>--</td>
<td>--</td>
<td>White</td>
<td>White</td>
<td>White</td>
<td>Off White</td>
<td>White</td>
<td>Off White</td>
<td>White</td>
<td>White</td>
<td>Off White</td>
<td>White</td>
<td>White</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Gas Permeability</td>
<td>--</td>
<td>atm/s-cc/sec</td>
<td>gas tight</td>
<td>gas tight</td>
<td>gas tight</td>
<td>gas tight</td>
<td>gas tight</td>
<td>gas tight</td>
<td>gas tight</td>
<td>gas tight</td>
<td>gas tight</td>
<td>gas tight</td>
<td>gas tight</td>
<td>gas tight</td>
<td>gas tight</td>
</tr>
<tr>
<td>Density</td>
<td>C 20-97</td>
<td>g/cc</td>
<td>3.65</td>
<td>3.71</td>
<td>3.78</td>
<td>3.88</td>
<td>3.91</td>
<td>3.96</td>
<td>4.17</td>
<td>4.30</td>
<td>5.72</td>
<td>6.02</td>
<td>6.07</td>
<td>6.20</td>
<td>3.25</td>
</tr>
<tr>
<td>Hardness</td>
<td>Vickers</td>
<td>GPA (kg/mm²)</td>
<td>11.5</td>
<td>12.7</td>
<td>12.7</td>
<td>14.3</td>
<td>15</td>
<td>14</td>
<td>14.5</td>
<td>14.4</td>
<td>11.7</td>
<td>12.5</td>
<td>12.5</td>
<td>11.7</td>
<td>15</td>
</tr>
<tr>
<td>Density</td>
<td>--</td>
<td>RON</td>
<td>79</td>
<td>81</td>
<td>81</td>
<td>81</td>
<td>82</td>
<td>79</td>
<td>80</td>
<td>80</td>
<td>79</td>
<td>80</td>
<td>80</td>
<td>78</td>
<td>80</td>
</tr>
<tr>
<td>Fracture Toughness</td>
<td>Notched Beam</td>
<td>MPa/M²</td>
<td>3 - 4</td>
<td>4 - 5</td>
<td>4 - 5</td>
<td>4 - 5</td>
<td>3 - 4</td>
<td>5</td>
<td>6</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>12</td>
<td>6</td>
<td>--</td>
</tr>
<tr>
<td>Mechanical Properties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elastic Modulus</td>
<td>C948</td>
<td>GPA (g/cm²)</td>
<td>303 (44)</td>
<td>310 (45)</td>
<td>345 (60)</td>
<td>379 (50)</td>
<td>379 (50)</td>
<td>358 (52)</td>
<td>338 (49)</td>
<td>338 (49)</td>
<td>206 (29.8)</td>
<td>210 (30)</td>
<td>210 (30)</td>
<td>202 (29.9)</td>
<td>300 (44)</td>
</tr>
<tr>
<td>Poison's Ratio</td>
<td>C948</td>
<td>--</td>
<td>0.22</td>
<td>0.22</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
<td>0.23</td>
<td>0.25</td>
<td>0.28</td>
</tr>
<tr>
<td>CTE, 25 - 100° C</td>
<td>C 372-96</td>
<td>x 10¹⁵</td>
<td>6.1</td>
<td>6.1</td>
<td>6.2</td>
<td>6.3</td>
<td>6.5</td>
<td>6.7</td>
<td>6.0</td>
<td>6.0</td>
<td>8.9</td>
<td>6.9</td>
<td>6.9</td>
<td>6.9</td>
<td>6.9</td>
</tr>
<tr>
<td>CTE, 25 - 600° C</td>
<td>C 372-96</td>
<td>x 10¹⁵</td>
<td>7.7</td>
<td>7.5</td>
<td>7.6</td>
<td>7.6</td>
<td>8.1</td>
<td>8.3</td>
<td>7.1</td>
<td>7.1</td>
<td>10.0</td>
<td>10.5</td>
<td>10.5</td>
<td>10.5</td>
<td>10.5</td>
</tr>
<tr>
<td>Thermal Conductivity @ RT</td>
<td>C 408</td>
<td>W/H °K</td>
<td>19</td>
<td>23</td>
<td>29</td>
<td>30</td>
<td>30</td>
<td>27</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>3</td>
<td>2.2</td>
<td>3.5</td>
<td>2.9</td>
</tr>
<tr>
<td>Max Use Temp</td>
<td>--</td>
<td>Fahrenheit (°F)</td>
<td>3000</td>
<td>3100</td>
<td>3100</td>
<td>3047</td>
<td>3047</td>
<td>2732</td>
<td>2730</td>
<td>2730</td>
<td>2200</td>
<td>932</td>
<td>932</td>
<td>1000</td>
<td>2552</td>
</tr>
<tr>
<td>Electrical Properties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dielectric Strength (125° Thick)</td>
<td>D 149-97A</td>
<td>V/m²</td>
<td>250</td>
<td>250</td>
<td>265</td>
<td>270</td>
<td>290</td>
<td>290</td>
<td>250</td>
<td>250</td>
<td>300</td>
<td>240</td>
<td>240</td>
<td>250</td>
<td>300</td>
</tr>
<tr>
<td>Dielectric CONSTANT @ 1 MHz</td>
<td>D 150-98</td>
<td>--</td>
<td>9.0</td>
<td>9.1</td>
<td>9.5</td>
<td>9.8</td>
<td>9.8</td>
<td>10.5</td>
<td>12.5</td>
<td>12.5</td>
<td>22.7</td>
<td>30.0</td>
<td>30.0</td>
<td>30.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Dielectric Loss @ 1 MHz</td>
<td>D 150-98</td>
<td>--</td>
<td>0.0006</td>
<td>0.0004</td>
<td>0.0006</td>
<td>0.0002</td>
<td>&lt;0.0001</td>
<td>0.0003</td>
<td>0.0006</td>
<td>0.0006</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0010</td>
<td>0.0010</td>
</tr>
<tr>
<td>Volume Resistivity, 25°C</td>
<td>D 257</td>
<td>ohms-cm</td>
<td>&gt; 1 x 10¹²</td>
<td>&gt; 1 x 10¹²</td>
<td>&gt; 1 x 10¹²</td>
<td>&gt; 1 x 10¹²</td>
<td>&gt; 1 x 10¹²</td>
<td>&gt; 1 x 10¹²</td>
<td>&gt; 1 x 10¹²</td>
<td>&gt; 1 x 10¹²</td>
<td>&gt; 1 x 10¹²</td>
<td>&gt; 1 x 10¹²</td>
<td>&gt; 1 x 10¹²</td>
<td>&gt; 1 x 10¹²</td>
<td>&gt; 1 x 10¹²</td>
</tr>
<tr>
<td>Volume Resistivity, 500°C</td>
<td>D 1829</td>
<td>ohms-cm</td>
<td>3 x 10¹⁰</td>
<td>7 x 10¹⁰</td>
<td>2 x 10¹⁰</td>
<td>5 x 10¹⁰</td>
<td>6 x 10¹⁰</td>
<td>6 x 10¹⁰</td>
<td>2 x 10⁹</td>
<td>2 x 10⁹</td>
<td>1 x 10¹⁰</td>
<td>1 x 10¹⁰</td>
<td>1 x 10¹⁰</td>
<td>1 x 10¹⁰</td>
<td>--</td>
</tr>
<tr>
<td>Acid / Base Resistance*</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

*These are general guidelines for reference only. Actual chemical resistance is dependent on the specific application environment.

**Alumina - All Around Material Solution**

Alumina has versatile material properties making it a go-to solution for diverse types of aerospace and defense applications. Its high strength along with excellent electrical, temperature and corrosion resistance makes it an excellent choice for use in analytical instrumentation, guidance and navigation, engine and sensor applications. Alumina is also easily metalized and brazed to produce vacuum tight ceramic to metal assemblies for air and space applications.

**Zirconia Toughened Alumina**

Zirconia Toughened Alumina (ZTA) is an excellent choice for applications requiring greater toughness and higher strength than Alumina alone, while maintaining the corrosion resistance of Alumina. This material is used in similar applications as Alumina, but where processes demand greater material strength and durability ZTA can also be metalized and brazed, similar to Alumina, to offer unique possibilities when designing assemblies.

**Silicon Nitride**

Silicon Nitride provides superior strength and thermal performance for applications that require thermal shock resistance combined with overall material strength. At a lower density than the Zirconia materials, it is a lighter weight alternative while still providing excellent strength, corrosion and wear resistance.
We specialize in providing highly technical, custom solutions for aerospace & defense equipment applications. We are able to offer our customers deep expertise in the specific material properties of given ceramic materials, and matching them to specific use cases. Please contact us to discuss your unique challenges.

Maria Puma
Applications Engineer,
Aerospace & Defense
mpuma@ceramics.net
(802) 524-5820

Ceramic Engineering Insight
We bring 120 years of ceramics engineering experience to our customers. Our engineers’ expertise provides guidance in material selection, design-to-manufacture geometry and cost effective production.

Proven Experience in Quality Documentation Assurance
The performance of a ceramic component is dependent on the consistency and quality of its material properties. That’s why we control every aspect of manufacturing; from raw material through to finished component. Powder preparation, forming, green machining, sintering and diamond grinding are all governed by the same principles of total quality management.

Responsive Service Culture
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.