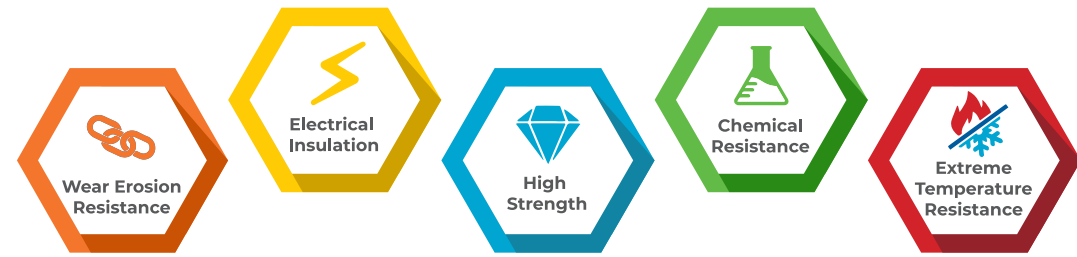


Technical Ceramic Solutions for the Aerospace & Defense Industry

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), Zirconia (YTZP, MSZ, CSZ) and Silicon Nitride (Si₃N₄). The unique attributes of each material allow our engineers to solve individual industry challenges, all while providing cost effective solutions.



	Property	ASTM Method	Units	Alumina			High Purity Alumina		Zirconia Toughened Alumina			Zirconia				Nitride
				AL95 95%	AL96 96%	AL98 98%	AL995 99.5%	AL9980 99.8%	ZTA-02 US Patent 8679995	ZTA-14	ZTA-20	MSZ (Magnesia Stabilized)	YTZP 2000 (Yttria Stabilized)	YTZP 4000 (Yttria Stabilized)	CSZ (Ceria Stabilized)	Silicon Nitride (Si ₃ N ₄)
General	Color	--	--	Ivory	White or Purple	White	Ivory-White	Ivory	Off White	White	White	Ivory or Yellow	Ivory	Ivory	Yellow	Black
	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	gas tight <10 ⁻¹⁰	gas tight <10 ⁻¹⁰	gas tight <10 ⁻¹⁰	gas tight <10 ⁻¹⁰	gas tight <10 ⁻¹⁰
	Density	C 20-97	g/cc	3.65	3.71	3.78	3.88	3.91	3.96	4.17	4.30	5.72	6.02	6.07	6.20	3.25
Mechanical	Hardness	Vickers 500 gm	GPa (kg/mm ²)	11.5 (1175)	12.7 (1300)	12.7 (1300)	14.3 (1459)	15 (1530)	14 (1440)	14.5 (1478)	14.4 (1470)	11.7 (1200)	12.5 (1250)	12.5 (1250)	11.7 (1200)	15 (1529)
	Hardness	--	R45N	79	81	81	82	86	81	82	82	78	80	80	78	83
	Fracture Toughness	Notched Beam	MPam ^{1/2}	3 - 4	4 - 5	4 - 5	4 - 5	3 - 4	5	6	6	12	10	10	12	6
	Flexural Strength (MOR)	F417-87	MPa (psi x 10 ³)	310 (45)	358 (52)	393 (57)	338 (49)	379 (55)	448 (65)	586 (85)	621 (90)	620 (90)	951 (138)	1380 (200)	551 (80)	900 (130)
	Tensile Strength @ RT	--	MPa (psi x 10 ³)	151 (22)	200 (29)	221 (32)	172 (25)	200 (29)	259 (38)	344 (50)	350 (51)	310 (45)	550 (80)	690 (100)	337 (49)	537 (78)
	Compressive Strength @ RT	--	MPa (psi x 10 ³)	1827 (265)	2068 (300)	2241 (325)	2137 (310)	2240 (325)	2413 (350)	2758 (400)	2758 (400)	1862 (270)	2485 (360)	2485 (360)	2000 (290)	2500 (362)
	Elastic Modulus	C848	GPa (psi x 10 ⁶)	303 (44)	310 (45)	345 (50)	379 (55)	379 (55)	358 (52)	338 (49)	338 (49)	206 (29.8)	210 (30)	210 (30)	200 (29)	300 (44)
	Poisson's Ratio	C848	--	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.28	0.30	0.30	0.25	0.28
Thermal	C.T.E. 25 - 100° C	C 372-96	x 10 ⁻⁶ /C	6.1	6.0	6.2	6.3	6.5	6.7	6.0	6.0	8.9	6.9	6.9	6.9	--
	C.T.E. 25 - 600° C	C 372-96	x 10 ⁻⁶ /C	7.7	7.5	7.6	7.6	8.1	8.3	7.1	7.1	10.0	10.5	10.5	10.5	2.9
	Thermal Conductivity @ RT	C 408	W/m K	19	23	29	30	30	27	24	24	3	2.2	2.2	3.5	29
	Max Use Temp	--	Fahrenheit (°F)	3000	3100	3100	3047	3047	2732	2730	2730	2200	932	932	1000	2552
--		Celsius (°C)	1650	1700	1700	1675	1675	1500	1500	1500	1200	500	500	537	1400	
Electrical	Dielectric Strength (.125" Thick)	D 149-97A	V/mil	250	250	260	270	290	230	250	250	300	240	240	250	300
	Dielectric Constant @ 1 MHz	D 150-98	--	9.0	9.1	9.5	9.8	9.8	10.5	12.5	12.5	22.7	30.0	30.0	30.0	9.
	Dielectric Loss @ 1 MHz	D 150-98	--	0.0006	0.0004	0.0006	0.0002	< .0001	0.0003	0.0006	0.0006	0.0016	0.0010	0.0010	0.0010	--
	Volume Resistivity, 25°C	D 257	ohms-cm	> 1 x 10 ¹⁴	> 1 x 10 ¹⁴	> 1 x 10 ¹⁴	> 1 x 10 ¹⁴	> 1 x 10 ¹⁴	> 1 x 10 ¹⁴	> 1 x 10 ¹⁴	> 1 x 10 ¹⁴	> 1 x 10 ¹³	> 1 x 10 ¹³	> 1 x 10 ¹³	> 1 x 10 ¹³	> 1 x 10 ¹⁴
	Volume Resistivity, 500°C	D 1829	ohms-cm	3 x 10 ⁹	7 x 10 ⁹	2 x 10 ⁹	5 x 10 ¹⁰	6 x 10 ¹⁰	6 x 10 ¹⁰	2 x 10 ⁹	2 x 10 ⁹	1 x 10 ⁷	1 x 10 ⁵	1 x 10 ⁶	1 x 10 ⁵	--
Chemical	Acid / Base Resistance*	--	--	●	●	●	●	●	●	●	●	●	--	--	●	●
	*These are general guidelines for reference only. Actual chemical resistance is dependent on the specific application environment. ● Good ● Fair ● Poor															

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 metallized and brazed to produce vacuum tight ceramic to metal assemblies for air and space applications.

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 pressures demand greater material strength and durability. ZTA can also be metallized 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 is a tough material similar to MSZ but with proven low temperature chemical resistance in both extreme acidic 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.



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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.

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