

Ceramic Properties Standard

OXIDES

NON-OXIDES

Properties*	Units	Test	OXIDES													NON-OXIDES																
							Alumina									Zirconia				Carbides						Nitrides					Steel	
			Porcelain	Steatite	Cordierite	Mullite	AD-85 Nom. 85% Al ₂ O ₃	AD-90 Nom. 90% Al ₂ O ₃	AD-94 Nom. 94% Al ₂ O ₃	AD-96 Nom. 96% Al ₂ O ₃	FG-995 Nom. 98.5% Al ₂ O ₃	AD-995 Nom. 99.5% Al ₂ O ₃	AD-998 Min. 99.8% Al ₂ O ₃	PlasmaPure-UC™ Alumina Min. 99.9% Al ₂ O ₃	ESD Alumina	ZTA 10% Zirconia-Toughened Alumina	DURA-Z™ (TTZ) MgO Partially Stabilized Zirconia	YTZP (Sintered) Y ₂ O ₃ Partially Stabilized Zirconia	YTZP (HIPed) Y ₂ O ₃ Partially Stabilized Zirconia	SC-RB (SC-2) Reaction Bonded Silicon Carbide	UltraSiC™ (SC-30) Direct Sintered Silicon Carbide	PureSiC® CVD Silicon Carbide > 99.9995%	RBB4C Reaction Bonded Boron Carbide	HPB4C Hot Pressed Boron Carbide	WC (ACI-Ni6) Tungsten Carbide	HP AlN Hot Pressed Aluminum Nitride	SN 101C Silicon Nitride (Glass HIPed)	NBD-200 Silicon Nitride (Glass HIPed)	NT 154 High Temp Silicon Nitride (Glass HIPed)	Kersit 303 Silicon Nitride (GPS)		
Density	g/cm ³	ASTM-C20	2.40	2.78	2.05	2.80	3.42	3.60	3.70	3.72	3.80	3.90	3.92	3.92	3.85	4.01	5.72	6.02	6.07	3.10	3.15	3.21	2.65	2.5	14.90	3.26	3.21	3.16	3.22	3.20	7.5-8.0	
Crystal Size	Average MICRONS	THIN-SECTION	–	–	–	10	6	4	12	6	6	6	6	6	6	2	35	1	1	12	3 - 10	3 - 10	–	15	1	3	–	–	–	–	–	
Water Absorption	%	ASTM-373	0	0	9.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Permeability	–	–	0	0	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Color	–	–	WHITE	BEIGE	YELLOW	TAN	WHITE	WHITE	WHITE	WHITE	WHITE	IVORY	IVORY	IVORY	BLACK	WHITE	IVORY	IVORY	GRAY	BLACK	BLACK	BLACK	–	BLACK	GRAY	GRAY	GRAY	GRAY	GRAY	GRAY	GRAY	GRAY
Flexural Strength (MOR)	20° C MPa (psi x 10 ³)	ASTM-F417	130 (19)	140	55	170 (25)	296 (43)	338 (49)	352 (51)	358 (52)	375 (54)	379 (55)	375 (54)	400 (58)	300	450 (65)	900 (130)	1240 (180)	1720 (250)	462 (67)	480 (70)	470-520	250 (36)	410	2330 (333)	340 ②	1000	900	900 ②	900	–	
Elastic Modulus	20° C GPa (psi x 10 ⁶)	ASTM-C848	104 (15)	110	40	150 (22)	221 (32)	276 (40)	303 (44)	303 (44)	350 (51)	370 (54)	370 (54)	386(56)	370	360 (52)	200 (29)	210 (30)	210 (30)	393 (57)	410 (59)	435-460	379 (55)	460	614 (89)	330	310	320	310	315	210-235 (30-34)	
Poisson's Ratio	20° C –	ASTM-C848	–	–	–	–	0.22	0.22	0.21	0.21	0.22	0.22	0.22	0.22	0.22	0.30	0.30	0.30	0.30	0.20	0.21	0.21	0.18	0.17	–	0.25	0.27	0.26	0.27	–	0.29	
Compressive Strength	20° C MPa (psi x 10 ³)	ASTM-C773	590 (86)	–	–	550 (80)	1930 (280)	2482 (360)	2103 (305)	2068 (300)	2500 (363)	2600 (377)	2500 (363)	2700 (392)	1975 (287)	2900 (421)	1750 (254)	2500 (363)	2500 (363)	2700 (363)	3500 (507)	–	1721 (250)	–	4343 (630)	–	2500	2500	–	2500	1000-2000 (145-290)	
Hardness	R45N	ROCKWELL 45 N	60	57	–	70	73	75	78	78	82	83	83	86	78	85	77	81	81	–	–	–	–	–	–	–	–	–	–	–	–	55-60
	GPa (kg/mm ²)	VICKERS 0.5kg	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	GPa (kg/mm ²)	VICKERS 1.0kg	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	GPa (kg/mm ²)	KNOOP 1000 gm	5.9 (600)	–	–	7.4 (750)	9.4 (960)	10.4 (1058)	11.5 (1175)	11.5 (1175)	13.7 (1400)	14.1 (1440)	14.1 (1440)	14.5 (1480)	–	14.4 (1475)	11.8 (1200)	12.7 (1300)	12.7 (1300)	26 (2500) ③	26 (2800) ③	27 (2750) ③	25.5 (2600) ③	25.5 (2750) ③	15 (1548)	11	16	15	16	16	6.4-8.8 (650-900)	
Tensile Strength	25° C MPa (psi x 10 ³)	ACMA TEST #4	–	–	–	–	155 (22)	221 (32)	193 (28)	221 (32)	248 (36)	262 (38)	248 (36)	283 (41)	–	290 (42)	483 (70)	–	–	307 (44.5)	–	–	–	–	–	–	–	–	–	630	–	1110 (103)
Fracture Toughness	K(I c) MPam ^{1/2}	NOTCHED BEAM	2	–	–	2	3 - 4	3 - 4	4 - 5	4 - 5	4 - 5	4 - 5	4 - 5	4 - 5	3 - 4	5 - 6	11	13	13	4	4	3.5	3-4	2.5	24	3	6.5	5.5	6.0	7.5	50-80	
Thermal Conductivity	20° C W/m K	ASTM-C408	5.0	2.5	1.6	3.5	16.0	16.7	22.4	24.7	27.5	30.0	30.0	35.0	25	27.0	2.2	2.2	2.2	125.0	150.0	115.0	50.0	90	69.0	80.0	34	29	38	19	35-55	
Coefficient of Thermal Expansion	25-1000° C 1X 10 ⁻⁶ /°C	ASTM-C372	4.9	9	3.4	5.3	7.2	8.1	8.2	8.2	8.2	8.2	8.2	8.1	8	8.3	10.2	10.3	10.3	4.3	4.4	4.6	4.5	5.6	5.9	5.0	3.7	2.9	3.1	3.1	12	
Specific Heat	100° C J/kg*K	ASTM-E1269	–	–	–	950	920	920	880	880	880	880	880	870	–	885	400	400	400	800	800	665	–	–	–	740	–	–	–	724	800	475
Thermal Shock Resistance	ΔTc °C	①	–	100	350	300	300	250	250	250	200	200	200	200	–	300	350	350	350	400	300	–	–	–	–	–	–	–	–	–	–	–
Dielectric Strength	6.35mm ac-kV/mm (ac V/mil)	ASTM-D116	–	–	–	9.8 (248)	9.4 (240)	8.3 (210)	8.3 (210)	8.3 (210)	8.7 (220)	8.7 (220)	8.7 (220)	8.7 (220)	–	9.0 (228)	9.4 (240)	9.0 (228)	9.0 (228)	–	–	–	–	–	–	17	–	–	–	15	–	
Dielectric Constant	1 MHz 25° C	ASTM-D150	5.9	–	–	6.0	8.2	8.8	9.1	9	9.6	9.7	9.8	9.8	–	10.6	28.0	29.0	29.0	–	–	–	–	–	–	9	8	8	–	–	–	
Dielectric Loss (tan delta)	1 MHz 25° C	ASTM-D150	0.0024	–	–	0.002	0.0009	0.0004	0.0004	0.0002	0.0002	0.0001	< 0.0001	< 0.0001	–	0.0005	0.001	0.001	0.001	–	–	–	–	–	–	< 0.001	–	–	–	–	–	
Volume Resistivity	25° C ohm-cm	ASTM-D1829	–	10 ¹³	10 ¹²	> 10 ¹⁴	> 10 ¹⁴	> 10 ¹⁴	> 10 ¹⁴	> 10 ¹⁴	> 10 ¹⁴	> 10 ¹⁴	> 10 ¹⁴	> 10 ¹⁵	10 ⁹ - 10 ¹⁰	> 10 ¹⁴	> 10 ¹³	> 10 ¹³	> 10 ¹³	< 10 ³	> 10 ⁵	< 0.10 - > 10 ⁶	< 10 ³	10 ²	< 10 ³	> 10 ¹³	10 ¹⁴	10 ¹⁴	–	10 ¹⁰	10 ⁹	
	500° C ohm-cm	ASTM-D1829	–	10 ⁹	10 ⁶	4 x 10 ⁹	4 x 10 ⁸	4 x 10 ⁸	4 x 10 ⁹	4 x 10 ⁹	2 x 10 ¹⁰	2 x 10 ¹⁰	2 x 10 ¹⁰	1 x 10 ¹²	–	2 x 10 ⁹	2 x 10 ⁵	2 x 10 ⁴	2 x 10 ⁴	< 10 ³	> 10 ³	–	< 10 ³	–	< 10 ³	> 10 ⁹	–	–	–	–	–	
	1000° C ohm-cm	ASTM-D1829	–	–	–	–	–	5 x 10 ⁵	5 x 10 ⁵	1 x 10 ⁶	2 x 10 ⁶	2 x 10 ⁶	2 x 10 ⁷	1 x 10 ⁷	–	3 x 10 ⁶	< 10 ³	< 10 ³	< 10 ³	< 10 ³	> 10 ²	–	< 10 ³	–	< 10 ³	> 10 ³	–	–	–	–	–	

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CoorsTek, Inc.
16000 Table Mountain Parkway
Golden, CO 80403 USA

+1.800.821.6110 toll free
+1.303.271.7000 tel
+1.303.271.7009 fax



Notes:
① Thermal Shock Resistance – Tests are run by quenching samples into water from various elevated temperatures. The change in temperature where a sharp decrease in flexural strength is observed is listed as ΔTc.
② Four point bend modulus of rupture ③ 100 gm load

*The chart is intended to illustrate typical properties. Property values vary with method of manufacture, size, and shape of part. Data contained herein is not to be construed as absolute and does not constitute a representation or warranty for which CoorsTek assumes legal responsibility. Close control of values of most properties can be maintained if specified.