

Ceramic Properties Standard

OXIDES

NON-OXIDES

Properties*	Units	Test	OXIDES													NON-OXIDES																
			Alumina													Zirconia				Carbides						Nitrides					Steel	
			Porcelain	Steatite	Cordierite	Mullite	AD-85	AD-90	AD-94	AD-96	FG-995	AD-995	AD-998	PlasmaPure-UC™ Alumina	ESD Alumina	ZTA 10%	DURA-Z™ (TZ)	YTZP (Sintered)	YTZP (HIPed)	SC-RB (SC-2)	UltraSiC™ (SC-30)	PureSiC®	RBB4C	HPB4C	WC	HP AlN	SN 101C	NBD-200	NT 154	Kersit 303		
Nom. 85% Al ₂ O ₃ Nom. 90% Al ₂ O ₃ Nom. 94% Al ₂ O ₃ Nom. 96% Al ₂ O ₃ Nom. 98.5% Al ₂ O ₃ Nom. 99.5% Al ₂ O ₃ Min. 99.8% Al ₂ O ₃ Min. 99.9% Al ₂ O ₃													Zirconia-Toughened Alumina	MgO Partially Stabilized Zirconia	Y ₂ O ₃ Partially Stabilized Zirconia	Y ₂ O ₃ Partially Stabilized Zirconia	Reaction Bonded Silicon Carbide	Direct Sintered Silicon Carbide	CVD Silicon Carbide > 99.9995%	Reaction Bonded Boron Carbide	Hot Pressed Boron Carbide	Tungsten Carbide	Hot Pressed Aluminum Nitride	Silicon Nitride (Glass HIPed)	Silicon Nitride (Glass HIPed)	High Temp Silicon Nitride (Glass HIPed)	Silicon Nitride (GPS)					
Density	gm/cc	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	3	6	2	35	1	1	12	3 - 10	3 - 10	–	15	2	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	
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	
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	
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	1550 (225)	340 ①	1000	900	900 ①	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	627 (91)	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	0.23	0.30	0.23	0.23	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)	–	5000 (725)	–	2500	2500	–	2500	1000-2000 (145-290)
Hardness		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) ②	26 (2800) ②	27 (2750) ②	25.5 (2600) ②	(3200) ②	16 (1630)	11	16	15	16	16	6.4-8.8 (650-900)
		R45N	ROCKWELL 45 N	60	57	–	70	73	75	78	78	82	83	83	86	78	85	77	81	81	–	–	–	–	–	–	–	–	–	–	–	–
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)	Mpa m ^{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	> 6	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	100.0	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	5.1	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	–	–	–	–	–	–	–	–	–	–
Maximum Use Temperature	°C	NO-LOAD COND.		1400	1200	1200	1700	1400	1500	1700	1700	1700	1750	1750	1750	800	1500	500	1500	1500	1000	1600	1600	1000	2000	1000	800	1400	1400	1400	1400	800
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 ⁴
	500° C	ohm-cm	ASTM-D1829	–	10 ⁸	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 ³	–	< 10 ³	–	< 10 ³	> 10 ⁹	–	–	–	–	–
Impingement	–	②	–	–	–	–	1.00	0.45	0.52	0.50	0.48	0.47	0.47	0.47	–	0.41	0.63	0.20	0.20	0.14	0.12	0.03	–	–	0.12	–	–	–	–	–	–	–
Rubbing	–	②	–	–	–	–	1.00	0.36	–	0.60	–	–	–	–	–	0.49	0.57	0.20	0.20	–	–	–	–	–	–	–	–	–	–	–	–	–

CoorsTek, Amazing Solutions, and PureSiC are registered trademarks of CoorsTek, Inc. PlasmaPure-UC, Dura-Z, and UltraSiC are trademarks of CoorsTek, Inc.



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 Wear Resistance – Impingement tests are run using a dry fused alumina abrasive. Rubbing tests are run using a dry 240 grit fused alumina abrasive. The indices in the chart are calculated by dividing the material volume loss by the volume loss of an AD-85 alumina control. The lower in the index, the better the wear resistance.

③ 100 gm load
 ④ Four point bend modulus of rupture

*Ceramic property values vary somewhat with method of manufacture, size, and shape of part. Close control of values of most properties can be maintained if specified.

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.

CoorsTek, Inc.
 16000 Table Mountain Parkway
 Golden, CO 80403 USA
 800.821.6110 toll free
 303.271.7000 tel
 303.271.7009 fax
 info@coorstek.com
 www.coorstek.com