

Accumet Engineering Corp. Materials Properties Chart

Properties	Units	Test	99.5% Alumina	99.6% Alumina	Aluminum Nitride K170	Aluminum Nitride	Beryllia Oxide	Cordierite	Graphite	Lava, Grade A	Corning Macor	Mullite	Corning Pyrex (7740)	Fused Silica Dynasil 4000	Quartz GE 124	Sapphire	Silicon	Silicon Carbide	Silicon Nitride Hot Pressed	Steatite L-5	Boron Nitride	Zirconia (TZP)
Chemical Formula			Al ₂ O ₃	Al ₂ O ₃	AlN	AlN	BeO	2MgO-2Al ₂ O ₃ -5SiO ₂	C	Al ₂ (Si ₄ O ₁₀)-(OH) ₂	Glass Ceramic	3Al ₂ O ₃ -SiO ₂	Borosilicate Glass	SiO ₂	SiO ₂	α-Al ₂ O ₃	Si	α-SiC	Si ₃ N ₄	H ₂ Mg ₃ -(SiO ₃) ₄	BN	ZrO ₂
Density	g/cm ³	ASTM C20	3.7 – 3.97	3.87	3.28	3.25	2.85	2.60	2.25	2.30	2.52	2.80	2.23	2.20	2.21	3.97	2.33	3.21	3.31	2.71	2.28	6.04
Color			White	White	Tan / Gray	Tan / Gray	White	Tan	Black	Pink	White	Tan	White/Transparent	White/Transparent	White/Transparent	White/Transparent	Gray	Dark Gray	Dark Gray	Buff	White	White
Crystal Structure			Hexagonal	Hexagonal	Hexagonal	Hexagonal		Orthorhombic	Hexagonal	Random	Random	Orthorhombic	Random		Hexagonal	Trigonal	Cubic	Hexagonal	Hexagonal (α & β)	Hexagonal	Hexagonal	Tetragonal
Water Absorption	% @ R.T.	ASTM C373	0.0	0.0	0.0	0.0		0.02 – 3.2	0.5 – 3.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 – 0.02	0.0	0.0
Hardness	Moh's		9			5		7	1.0 – 1.5	6	4.5	8	-----	7	7	9	7	9 - 10	9	7.5	6.5	6.5
Hardness	Rockwell			87			45							600 kg/mm ²							2	
Hardness	knoop kg/mm ²	Knoop 100G	2000		1200	1170		-----	-----	500	250	1450	418		>600	2200	1150	2800	2200	-----	25-205	1600
Compressive Strength	MPa @ R.T.	ASTM C773	2070 – 2620			2068	225k psi Astm c 773-74	350	96	172.5	345	551	N/A		650 - 1100	2000	120	1725 - 2500	689 - 2760	621	23.5	2500
Compressive Strength	M(10 ⁶) lbs/in ²			54										(10 ³) lbs/in 161								
Tensile Strength	MPa @ R.T.	ACMA Test #4	260-300			-----	225K psi Astm c-565-71	25.5	4.8	20.7	90	103.5	N/A		48	250 - 400	113	310	360 - 434	62	2.41 (1000°C)	248
Elastic Modulus	10 ⁶ psi	ASTM C848		54																		
Modulus Of Elasticity (Young's Mod.)	Gpa	ASTM C848	394		320	308	M 10 ⁶ lbs/in ² 50	70	4.8	-----	66.9	150	64	745 x 10 ³ kg/cm ²	70	250 - 400	112	476	317	138	675	207
Flexural Strength	K(10 ³) lbs/in ²			90	59 (4pt.bend)		35 (3pt.bend)							25								
Flexural Strength (MOR)	MPa @ R.T.	ASTM F417	310 – 379			428		117	50	69	94	170	69		80	760 - 1035	~300	324	679 - 896	140	51.8	900
Poisson's Ratio		ASTM C818	0.27			0.25	0.26 Astm C-565-71	0.21	-----	-----	0.29	0.25	0.20	0.17	0.17	0.29	0.28	0.19	0.23	-----	0.05	0.32
Poisson's Ratio	-	ASTM C848		0.20	0.24																	
Fracture Toughness	MPa @ m ^{1/2}	Notched beam Test	4.5		3.5	3.5		-----	-----	-----	1.53	2.0	0.77		-----	1.89	3.0 – 6.0	4.0	5.0 – 8.0	-----	2.6	13.0
Max use Temperature (* denotes inert atm)	°C	No Load Cond.	1750		1600	1600		1371	3650*	1150	1000	1700	490	1200	1200	~2000	1350	1400	1500	1425	985	500
Thermal Shock Resistance	ΔT (°C)	Quenching	200			400	>1500	500	200 – 250	-----	25 - 100	300	100		>1400	200	-----	350 - 500	750	190	>1500	280 – 360
Thermal Conductivity	W/m-K @ R.T.	ASTM C408	35	27	170	82.3	270	3.0	24	1.98	1.46	3.5	1.1		1.4	40	125	41	27	2.9	20	2.7
Coefficient of Linear Thermal Expansion	10 ⁻⁶ /°C	ASTM C372		7.0 – 8.3 (25-1000°C)	4.6 25-300 °C		9.0 25-1000°C							0.55 20-320°C								
Coefficient of Linear Thermal Expansion	μm/m-°C (-25°C through ≤ 1000°C)	ASTM C372	8.4			4.6 – 5.7		1.7	8.39	3.6	6.3 – 9.7	5.3	3.25 Through 300°C		0.45	7.9 – 8.8	2.49 – 4.44	5.12	3.4	7.0	1.0 – 2.0	11.0
Specific Heat	Cal/g-°C @ R.T.	ASTM C351	0.21			0.25		0.35	0.16	0.20	0.19	0.23	0.18	0.177	0.16	0.18	0.18	0.15	0.17	0.22	0.19	0.10
Dielectric Constant	1MHz @ R.T.	ASTM D150	9.6	9.9±.1	8.6	8.0 – 9.1	6.5	4.7	-----	5.3	6.03	6.0	4.6	3.826	3.8	9.3 – 11.4	11.8	10.2	7.0	6.3	4.08	26 @ 100kHz
Dielectric Strength (60 cycles AC avg. RMS) .025 Thick .050 Thick	Volts/mil	ASTM D149		600 450																		
Dielectric Strength	kV/mm	ASTM D116	15		14	15		5.11	-----	0.1	40	9.8	0.5	500°C (150-200) kv/cm	25 - 40	15 - 50	-----	-----	17.7	9.3	374	9.0
Electrical Resistivity	Wcm @ R.T.	ASTM D1829	>10 ¹⁴	>10 ¹⁴	10 ¹³	>10 ¹⁴	10 ¹⁵ ohm-cm	10 ¹⁴	7 x 10 ⁻³	10 ¹⁴	>10 ¹⁷	10 ¹³	8 x 10 ¹⁰		6 x 10 ¹⁰	10 ¹⁷	10 ⁻³	10 ⁸	10 ¹³	10 ⁴	10 ¹³	>10 ¹³

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