



Semiconductor Oxides Material Properties

			High-Purity Aluminas									Other Oxides					
PROPERTIES*			UNITS	TEST	ADS-11 Min. 99.5% Al ₂ O ₃	ADS-12 Min. 99.5% Al ₂ O ₃	AD-995-I2 Nom. 99.5% Al ₂ O ₃	AD-995-LT Nom. 99.5% Al ₂ O ₃	AD-995-I4 Min. 99.5% Al ₂ O ₃	AD-996-SI Min. 99.5% Al ₂ O ₃	PLASMAPURE™ AD-998-I2 Min. 99.8% Al ₂ O ₃	PLASMAPURE-UC™ SA-999-I Min. 99.9% Al ₂ O ₃	SAPPHAL™ Min. 99.9% Al ₂ O ₃	STATSAFE™ ADC-92 Nom. 92% Al ₂ O ₃	FUSED QUARTZ Min. 99.99% SiO ₂	EXYRA™ BULK YTTRIA Min. 99.9% Y ₂ O ₃	
GENERAL	Bulk Density		g/cm ³	ASTM-C20	3.90	3.90	3.90	3.90	3.90	3.90	3.92	3.92	3.98	3.85	2.20	4.95	
	Minor Chemistry in Sintered Material	Total	ppm weight	Glow Discharge Mass Spectroscopy (GDMS)	3000 ①	3000 ①	3000 ①	3000 ①	2500 ①	2500 ①	500	400	500	2500 ① ②	30	500	
		Si			50	50	800	800	400	500	60	30	15	400	Matrix	100	
		Na			750	750	250	250	200	75	10	7	50	200	<1	1	
		Fe			50	50	80	80	60	100	60	40	10	60	<1	2	
Mg		2000			2000	800	800	500	500	250	200	400	500	<1	1		
Grain Size	Average	μm	ASTM-E112	4	8	6	6	6	36	6	3	20	6	NA	30		
	Range			0.5 - 35	1 - 40	0.7 - 35	0.7 - 35	0.5 - 35	0.5 - 35	3.90	0.4 - 32	2.0 - 50	1.0 - 40	NA	10 - 70		
Flexural Strength (MOR)	3-Point	MPa ^a	ASTM-C1161	400	375	379	379	380	380	390	400	350	300	128	140		
	4-Point			350	300	300	300	320	320	320	360	285	230	104	100		
MECHANICAL	Fracture Toughness		K (I c)	MPa m ^{1/2}	KNOOP 1000 gm	4 - 5	4 - 5	4 - 5	4 - 5	4 - 5	4 - 5	4 - 5	4 - 5	3 - 4	1.1	1.2	
	Hardness (Vickers)	500g	GPa	ASTM-C1327	17	17	16	16	16	16	18	18	18	12	6	7	
		1000g			17	16	16	16	16	16	17	17	17	12	5	6	
Elastic Modulus		GPa		ASTM-C848	380	380	370	370	380	380	380	386	390	370	72	170	
Poisson's Ratio		—		ASTM-C848	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.24	0.23	0.16	0.28	
THERMAL	Coefficient of Thermal Expansion		RT-400°C	PPM/°C	ASTM-C372	7.1	7.1	7.4	7.4	7.0	7.0	7.0	6.9	7.0	7.5	0.7	7.0
			RT-800°C			8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.8	8.0	8.1	0.5	7.7
			RT-1000°C			8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.3	8.3	0.4	7.9
Thermal Conductivity		25°C	W/m-K	ASTM-C408	30	30	30	30	30	30	31	33	35	25	1.3	15	
Specific Heat		25°C	J/kg-K	ASTM-E1269	800	800	800	800	800	800	800	800	800	800	750	450	
Dielectric Strength		1mm	ac-volt/mil	ASTM-D116	425	400	400	400	400	400	420	470	470	NA	800	420	
Dielectric Constant		1 MHz	ASTM-D150		9.9	9.9	9.7	9.8	9.8	9.8	9.8	9.8	10	NA	3.8	11.5	
		5 GHz	TE ₀₁₁ Resonant Mode		9.9	9.9	9.8	9.8	9.8	9.8	9.8	9.8	10	NA	3.8	11.5	
Dielectric Loss (tan δ)		1 MHz	ASTM-D150		3 x 10 ⁻⁴	3 x 10 ⁻⁴	1 x 10 ⁻⁴	<1 x 10 ⁻⁴	2 x 10 ⁻⁴	<1 x 10 ⁻⁴	<1 x 10 ⁻⁴	<1 x 10 ⁻⁴	1 x 10 ⁻³	NA	<1 x 10 ⁻⁴	<1 x 10 ⁻⁴	
		5 GHz	TE ₀₁₁ Resonant Mode		5 x 10 ⁻⁴	5 x 10 ⁻⁴	1 x 10 ⁻⁴	6.5 x 10 ⁻⁵	2 x 10 ⁻⁴	5 x 10 ⁻⁵	2 x 10 ⁻⁵	1 x 10 ⁻⁵	1 x 10 ⁻³	NA	6 x 10 ⁻⁵	1.5 x 10 ⁻⁵	
ELECTRICAL		Volume Resistivity		Ω-cm	ASTM-D1829	25°C	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁵	>10 ¹⁵	1 x 10 ⁸	>10 ¹⁴	>10 ¹⁴
		300°C	5 x 10 ¹²			5 x 10 ¹²	2 x 10 ¹²	2 x 10 ¹²	5 x 10 ¹²	5 x 10 ¹²	1 x 10 ¹³	5 x 10 ¹³	1 x 10 ¹³	NA	6 x 10 ¹²	1 x 10 ¹²	
		500°C	3 x 10 ¹⁰			2 x 10 ¹⁰	2 x 10 ¹⁰	2 x 10 ¹⁰	1 x 10 ¹¹	1 x 10 ¹¹	2 x 10 ¹¹	1 x 10 ¹²	8 x 10 ¹¹	NA	3 x 10 ¹¹	1 x 10 ⁹	
		600°C	2 x 10 ⁹			2 x 10 ⁹	1 x 10 ⁹	1 x 10 ⁹	2 x 10 ⁹	2 x 10 ⁹	1 x 10 ¹⁰	5 x 10 ¹¹	5 x 10 ¹¹	NA	1 x 10 ¹¹	1 x 10 ⁷	
		1000°C	1 x 10 ⁷			1 x 10 ⁷	2 x 10 ⁶	2 x 10 ⁶	1 x 10 ⁷	1 x 10 ⁷	2 x 10 ⁷	1 x 10 ⁸	1 x 10 ¹⁰	NA	9 x 10 ⁹	4 x 10 ⁵	

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Notes:
① THE GDMS method is not optimized for analysis of compositions with individual secondary phase constituents at levels
② Matrix composition contains nominal 7.5% TiO₂

*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.

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