



E L E C T R O N I C S

Material properties of Rubalit<sup>®</sup>,  
Alunit<sup>®</sup>, Zirkolit<sup>®</sup> and Sinalit<sup>®</sup>

## **Advanced Ceramics for Electronic Applications**

# Material Properties of Rubalit®, Alunit®, Zirkolit® and Sinalit®



Property	Definition Property	Unit	Range	Rubalit® 708 D**	Rubalit® 708S C***	Rubalit® 708 HP C***	Ru 71
Al <sub>2</sub> O <sub>3</sub> content		[wt-%]	≥	95.8	96.0	96.0	+
Surface roughness R <sub>a</sub>	@ as fired surface	[µm]	≤	0.8	0.6	0.6	0
Density		g/cm <sup>3</sup>	≥	3.73	3.75	3.75	3
Bending strength DR sigma 0	@ 3 Point Method	[MPa]	≥	300	500 sigma0 @0.38	500 sigma0 @0.38	500
Coefficient of thermal expansion (CTE)	@ 100°C – 200°C	[10 <sup>-6</sup> /K]	+/-				6.0
	@ 100°C – 300°C	[10 <sup>-6</sup> /K]	+/-				6.0
	@ 100°C – 600°C	[10 <sup>-6</sup> /K]	+/-				6.7
	@ 100°C – 800°C	[10 <sup>-6</sup> /K]	+/-		7.0 – 9.0	7.0 – 9.0	7.0
Dielectric constant (@ R <sub>a</sub> ≤ 0.4 µm)	@ 1 GHz @ 2mm thickness	-/-	+/-	8.3 – 11.3	9.8 (@1 MHz)	9.8 (@1 MHz)	8.5
	@ 10 MHz @ 2mm thickness	-/-	+/-	8.3 – 11.3			8.5
	@ 100 MHz @ 2mm thickness	-/-	+/-	8.3 – 11.3			8.5
Dielectric loss factor (@ R <sub>a</sub> ≤ 0.4 µm)	@ 1 GHz @ 2mm thickness	[10 <sup>-3</sup> ]	≤	10	1 (@1 MHz)	1 (@1 MHz)	
	@ 10 MHz @ 2mm thickness	[10 <sup>-3</sup> ]	≤	10			
	@ 100 MHz @ 2mm thickness	[10 <sup>-3</sup> ]	≤	10			
Dielectric strength	@ thickness ≤ 1 mm	[kV/mm]	≥		AC 15 DC 15	AC 15 DC 15	
Standard size		inch			7.5" x 5.5" +/- 1.2 %	7.5" x 5.5" +/- 1.2 %	
Thickness		mm			0.25 to 1.27 +/- 10%	0.25 to 1.27 +/- 10%	
Warpage/camber	depends on substrate thickness	%			0.2 - 0.6 %	0.2 - 0.6 %	
Fracture toughness	IF method	[MPa *√m]	≥		3.0	3.0	
Specific heat capacity	@ 100°C	[J/g*K]	≥	0.9	0.75 (@25°C)	0.75 (@25°C)	
	@ 20°C	[J/g*K]	≥	0.7			
Thermal conductivity*	@ 20°C @ Xe-flash @ sample 16*16 mm <sup>2</sup> @ material specific thickness ≤ 3.5 mm	[W/m*K]		22.0	24.0	24.0	2
Volume resistivity	@ 20°C	Ωcm	≥	10 <sup>13</sup>	10 <sup>14</sup>	10 <sup>14</sup>	
	@ 200°C	Ωcm	≥	10 <sup>11</sup>			
	@ 400°C	Ωcm	≥	10 <sup>9</sup>			
	@ 600°C	Ωcm	≥	10 <sup>7</sup>			
	@ 800°C	Ωcm	≥				
Chemical composition		-/-		The material main component is Al <sub>2</sub> O <sub>3</sub> . Remainer mainly consists of MgO, SiO <sub>2</sub> and CaO and traces of other elements.	The material main component is Al <sub>2</sub> O <sub>3</sub> . Remainer mainly consists of MgO, SiO <sub>2</sub> and CaO and traces of other elements.	The material main component is Al <sub>2</sub> O <sub>3</sub> . Remainer mainly consists of MgO, SiO <sub>2</sub> and CaO and traces of other elements.	The ma comp Al <sub>2</sub> O <sub>3</sub> . mainly MgO ar other

+/- 10% measurement tolerances for all values.

\*\* Dry pressed

\*\*\* Tape casted



Rubalit® OF C***	Rubalit® ZTA***	Thomit® 600 D**	Alunit® AlN 170 C***	Alunit® AlN 170 D**	Alunit® AlN HP***	Sinalit® Si <sub>3</sub> N <sub>4</sub> ***	Zirkolit® ZrO <sub>2</sub> 5Y C***
99.6	90 +/- 1.2	45.0					
0.12	0.4	0.9	0.6	1.0	0.4	0.4	0.2
3.80	4.00		3.26	3.28	3.34	3.22	5.7
420	700	130	320	200	450	700	800
0 - 8.0		5.0 - 7.0	3.7 - 5.7	3.5 - 5.5			9 - 12
0 - 8.0		5.0 - 7.0	3.7 - 5.7	4.0 - 6.0			9 - 12
7 - 8.7		5.5 - 7.5	4.5 - 5.9	4.5 - 6.5			9 - 12
0 - 9.0	6.9 - 10.3	5.5 - 7.5	4.8 - 6.2	4.6 - 6.7	4.8 - 6.2	3.3	9 - 12
- 11.5	10.2 (@1 Mhz)		7.2 - 9.8		8.5 (@1 Mhz)	7.8 (@1 Mhz)	
- 11.5			7.2 - 9.8				
- 11.5			7.2 - 9.8				
	2 (@1 Mhz)		10		1 (@1 Mhz)	3 (@1 Mhz)	
			10				
			10				
15	AC 25 DC 25	15	AC 15 DC 15		AC 15 DC 15	AC 25 DC 25	10
	7.5" x 5.5" +/- 1.2 %				7.5" x 5.5" +/- 1.2%	5.5" x 7.5" + 0.2 mm / -0.05 mm	
	0.25/0.32/0.5/0.63 +/- 10%				0.38 to 1.5 +/- 10%	+0.2 mm / - 0.05 mm +/-10%	
	0.2 - 0.6 %				0.2 - 0.6 %	0.2 - 0.6 %	
	3.5				3.0	6.5	
0.8	0.72 (@25°C)		0.7	0.7	0.72 (@25°C)	0.68 (@25°C)	0.4
0.7			0.6	0.6			0.3
25.0	27.0	2.0	170	170	170	90	1.5
10 <sup>13</sup>	10 <sup>14</sup>		10 <sup>14</sup>	10 <sup>14</sup>	10 <sup>14</sup>	10 <sup>14</sup>	
10 <sup>11</sup>			10 <sup>13</sup>	10 <sup>13</sup>			
10 <sup>9</sup>			10 <sup>12</sup>	10 <sup>12</sup>			
10 <sup>7</sup>			10 <sup>9</sup>	10 <sup>9</sup>			
10 <sup>7</sup>			10 <sup>9</sup>	10 <sup>9</sup>			
Material main component is Remainder consists of and traces of elements.	The material main components are Al <sub>2</sub> O <sub>3</sub> and ZrO <sub>2</sub> . Additional component is Y <sub>2</sub> O <sub>3</sub> . Remainder mainly consists of MgO, SiO <sub>2</sub> and CaO and traces of other elements.	The material main components are Al <sub>2</sub> O <sub>3</sub> and SiO <sub>2</sub> . Additional components are BaO and traces of other elements.	The material main component is AlN. Additional components are Y <sub>2</sub> O <sub>3</sub> and traces of other elements.	The material main component is AlN. Additional components are Y <sub>2</sub> O <sub>3</sub> and traces of other elements.	The material main component is AlN. Additional components are Y <sub>2</sub> O <sub>3</sub> and traces of other elements.	The material main component is Si <sub>3</sub> N <sub>4</sub> . Additional compo- nents are Y <sub>2</sub> O <sub>3</sub> , MgO, ZrO <sub>2</sub> , and traces of other elements.	The material main component is ZrO <sub>2</sub> . Additional components are Y <sub>2</sub> O <sub>3</sub> and traces of other elements.

#### Indexes and parameters for ceramic substances

In order to profile ceramic substances certain parameters are indicated. The crystalline nature of these substances, statistical fluctuations in the composition of the substances and in the factors that impact on the production processes indicate that the figures quoted are typically mean values are within the usual measurement tolerances and hence the substance parameters quoted in this brochure are only standard, recommended or guide values that might differ given dissimilar dimensions and production processes.

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