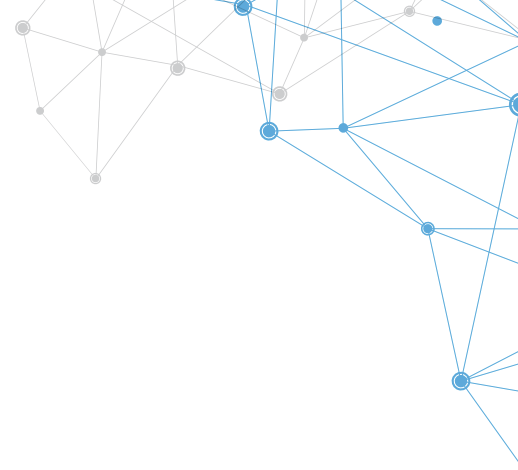
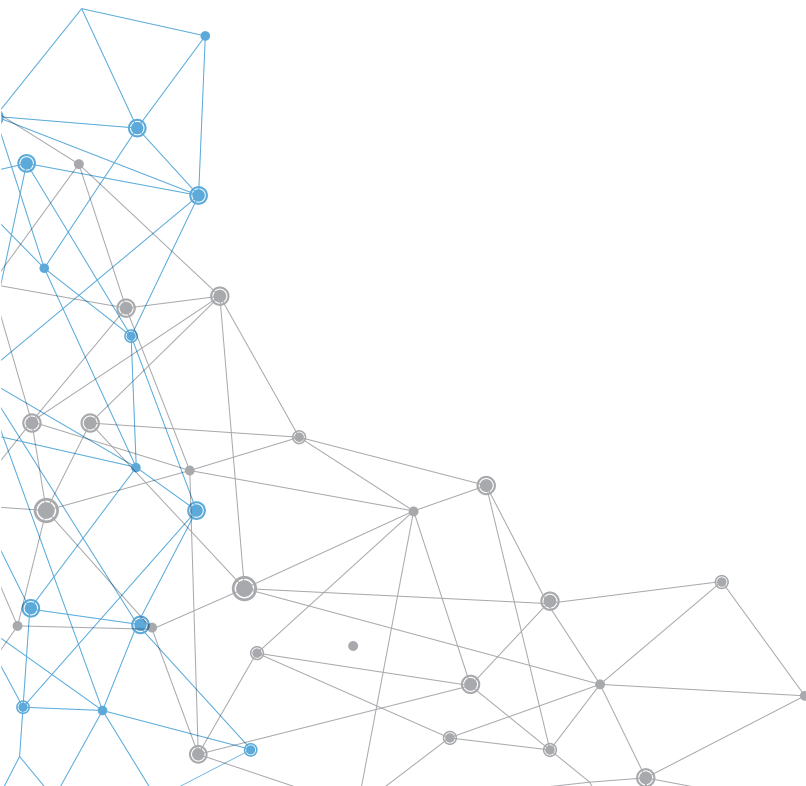


THE NEW VALUE FRONTIER

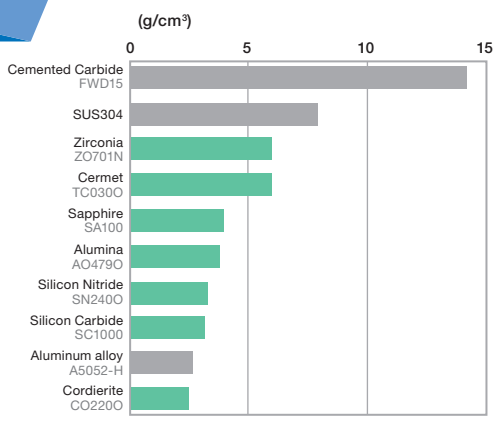
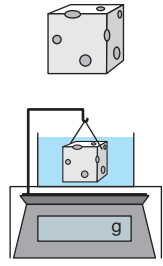


Characteristics of Fine Ceramics

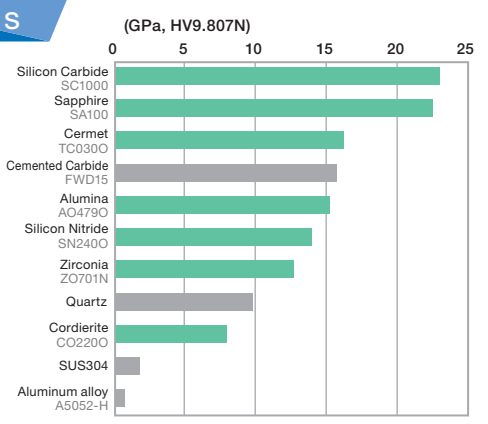
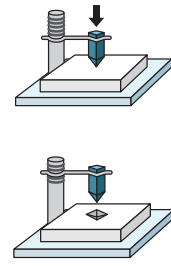


Characteristics of Fine Ceramics

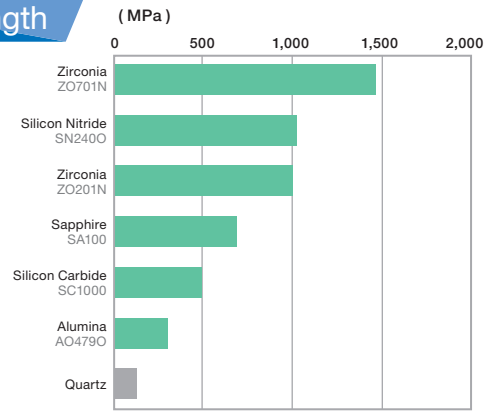
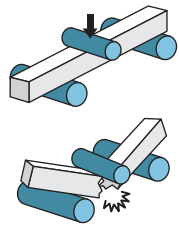
Density



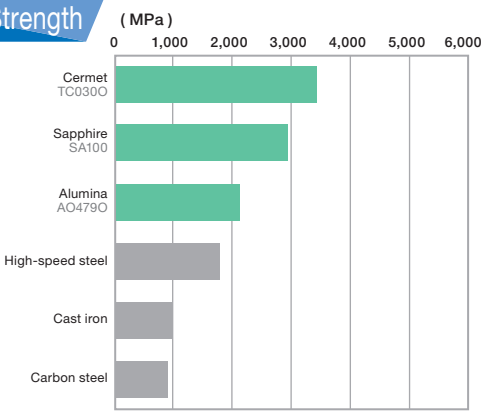
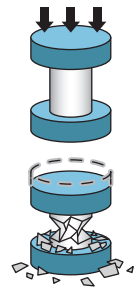
Hardness



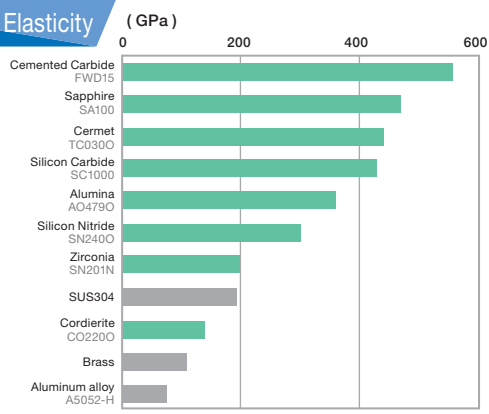
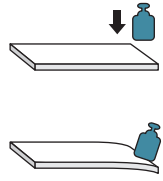
Flexural Strength



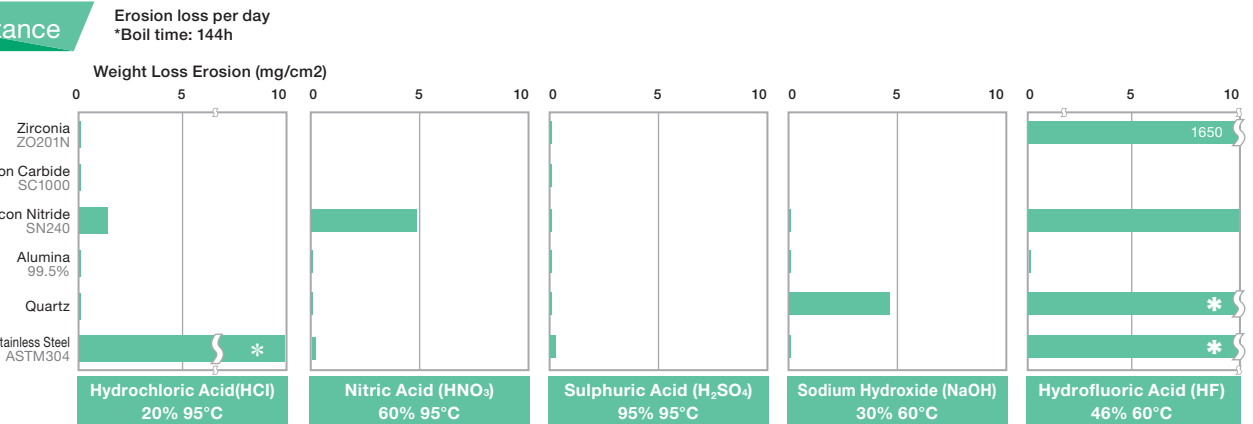
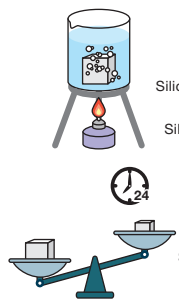
Compressive Strength



Young's Modulus of Elasticity



Chemical Resistance

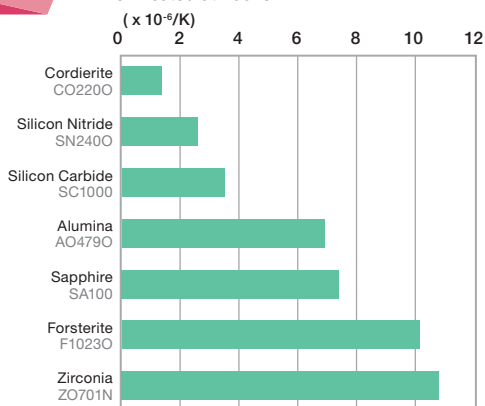
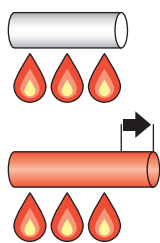


*Cannot be measured due to excessive erosion

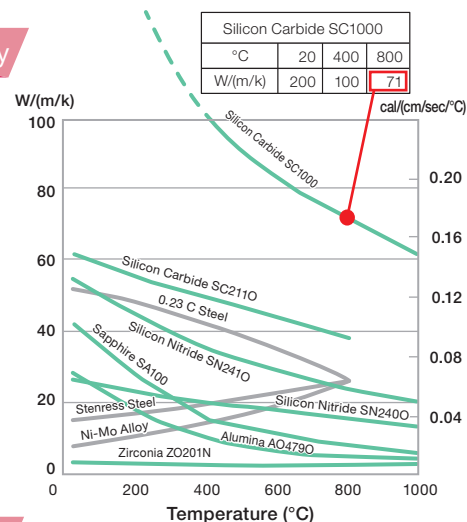
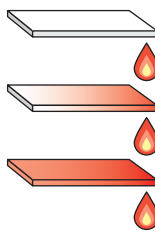
*Cannot be measured due to excessive erosion

Thermal Expansion

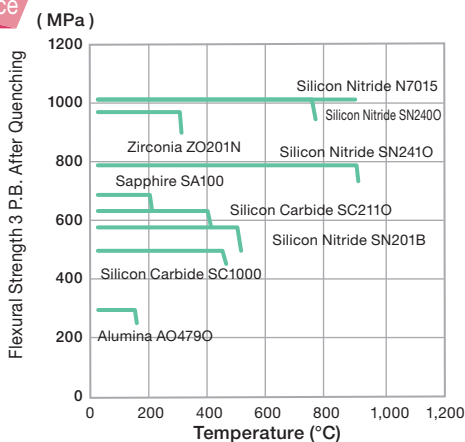
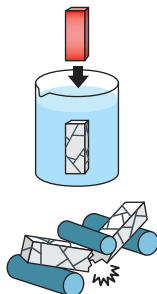
*Coefficient of linear thermal expansion when heated at 400°C



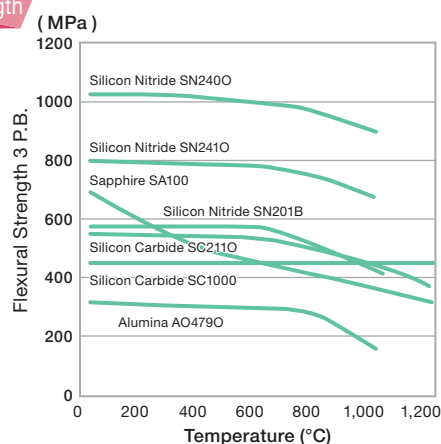
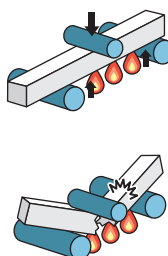
Thermal Conductivity



Heat Shock Resistance

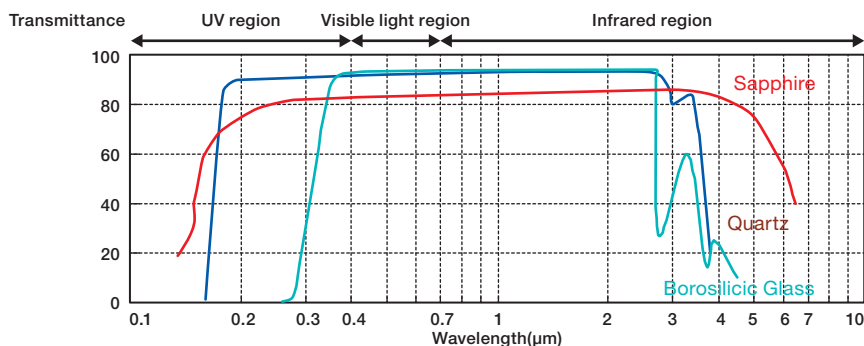


High-Temperature Strength

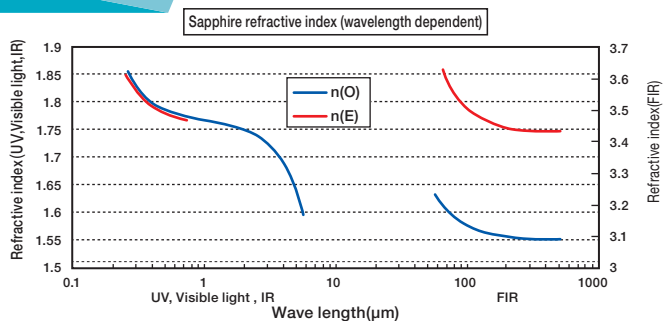


Single-Crystal Sapphire

Transmittance

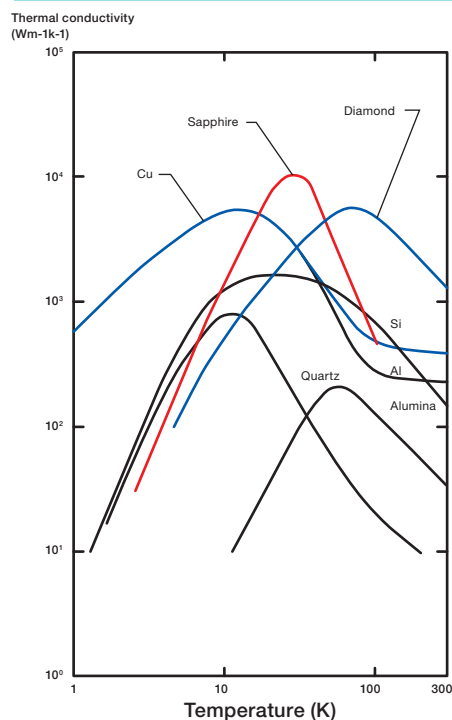


Optical Refractive Index



*According to our research.

Low Temperature Thermal Conductivity



*Reference: NASA (Proceedings of the Cold Electronics Workshop)

Characteristic Table of Fine Ceramics

Item		Material		ALUMINA (Al ₂ O ₃)									
				AO201B	AO445O	AO471O	AO473O	AO484O	AO484B	AO476O	AO479O	AO479S	
Material Code (New)													
Material Code (Old)		A201B	A445	A471	A473	A484	A484B	A476	A479	A479S			
Appearance												Dense	
Color		Black	Dark Brown	White	White	White	White	White	White	White		Ivory	
Content (%)		91	90	92	92	92	92	96	99	99.5			
Main Characteristics		<ul style="list-style-type: none"> •High Frequency Insulation •High Mechanical Strength •Wear Resistant •High Corrosion Resistance •High Temperature Resistance 											
		•Low Light Reflectivity	•Intercepting •High Heat Dissipation	•Wear Resistance	•Metallizing •High Mechanical Strength	•High Wear Resistance	•High Wear Resistance	•Excellent Surface Finish •Excellent Printability	•High Hardness •High Corrosion Resistance	•High Hardness •High Corrosion Resistance	•High Hardness •High Corrosion Resistance		
Main Applications		<ul style="list-style-type: none"> •Semiconductor Processing Equipment •IC Packages •Liner •Pulverizer •IC Multi-Layer Packages •Electron tube Housing •Wear Resistant Parts •Wear Resistant Parts •Pulverizer •Sliding Parts •Capstans •Hybrid IC Substrates •Heat, Corrosion and Wear Resistant Parts •Corrosion and Wear Resistant Parts 											
Density (* 1)	g/cm ³	JIS R 1634	3.8	3.8	3.6	3.6	3.6	3.7	3.7	3.8	3.9		
Water Absorption	%	JIS C 2141	0	0	0	0	0	0	0	0	0		
Mechanical Characteristics	Vickers Hardness HV9.807N	GPa	JIS R 1610	12.0	12.7	11.8	12.3	12.3	12.3	13.7	15.2	16.0	
	Flexural Strength 3 P.B.	MPa	JIS R 1601	400	320	390	340	370	460	350	310	400	
	Compressive Strength	MPa	JIS R 1608	2,781	2,430	3,024	2,300	2,910	2,900	2,992	2,160	2,350	
	Young's Modulus of Elasticity	GPa	JIS R 1602	320	320	280	280	280	300	320	360	370	
	Poisson's Ratio	-		0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	
	Fracture Toughness (SEPB)	MPa · m ^{1/2}	JIS R 1607	3.6	4.1	3.4	3.5	3.4	3.6	2.9	3~4	4	
Thermal Characteristics	Coefficient of Linear Thermal Expansion	40-400°C	x10 ⁻⁶ /K	JIS R 1618	7.0	7.3	7.1	6.9	6.8	6.6	7.2	7.2	7.2
		40-800°C			8.0	8.1	7.9	7.8	7.7	7.6	7.9	8.0	8.0
	Thermal Conductivity 20°C	W/(m · K)	JIS R 1611	14	12	16	18	17	22	24	29	32	
	Specific Heat Capacity	J/(g · K)	JIS R 1611	0.79	0.75	0.79	0.78	0.78	0.79	0.78	0.79	0.78	
	Thermal Shock Temperature Difference (Put in Water,Relative Method)	°C	JIS R 1648	150	150	150	150	150	150	150	150	180	
Electrical Characteristics	Dielectric Strength		kV/mm	JIS C 2141	14	12	16	16	14	14.5	15	15	15
	Volume Resistivity	20°C	Ω · cm		>10 ¹⁴	10 ¹¹	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴
		300°C			10 ¹⁰	10 ⁷	10 ¹²	10 ¹²	10 ¹⁰	10 ¹¹	10 ¹⁰	10 ¹⁰	10 ¹³
		500°C			10 ⁸	10 ⁵	10 ⁹	10 ¹⁰	10 ⁸	10 ⁹	10 ⁸	10 ⁸	10 ¹⁰
	Dielectric Constant (1MHz)		-		9.7	9.8	8.9	9.0	8.9	9.2	9.4	9.9	9.9
	Dielectric Loss Angle (1MHz)		(x10 ⁻⁴)		11	20	6	6	9	4	4	2	1
	Loss Factor		(x10 ⁻⁴)		106	190	53	54	80	37	38	20	10
Chemical Characteristics	Nitric Acid (60%) 90°C ,24H		(Weight Loss) mg/cm ²	-	0.00	1.17	-	0.32	0.14	-	0.02	0.10	0.00
	Sulphuric Acid (95%) 95°C ,24H				0.01	0.33	-	0.65	0.34	-	0.01	0.33	0.00
	Sodium Hydroxide (30%) 80°C ,24H				0.15	0.58	-	0.91	0.95	-	0.86	0.26	0.00

The values are typical material properties and may vary according to products configuration and manufacturing process. For more details, Please feel free to contact us.

* 1: All values for apparent density and bulk density are the same, except for the porous materials which lists apparent density only.

				SAPPHIRE (Al ₂ O ₃)	ZIRCONIA TOUGHED ALUMINA ZTA		ZIRCONIA (ZrO ₂)						YTTRIA (Y ₂ O ₃)	YAG DISPERSED ALUMINA	
AO479M AO479G	AO479U	AO480S	AO601L	SA100	AZ201O	AZ205O	ZO220O	ZO201N	ZO206N	ZO701N	Z21H04	Z21H12	YO100A	AG1000	
A479M A479G	A479U	A480S	A601L	SA100	AZ201	AZ205	Z220	Z201N	Z206N	Z701N	Z21H04	Z21H12	YO100A	AG1000	
				Dense	Dense		Dense						Dense	Dense	
Ivory	White	Ivory	Ivory	Transparent	White		Yellow	Ivory	White	Ash Black	Black	Black	White	Ivory	
99.5	99.6	99.7	99.9	99.99	-		-	-	-	-	-	-	-	-	
				Single Crystal	<ul style="list-style-type: none"> •High Mechanical Strength •High Hardness •High Wear Resistance 		<ul style="list-style-type: none"> •High Mechanical Strength •High Fracture Toughness •Excellent Sliding Properties •Excellent Surface Finish 				<ul style="list-style-type: none"> •Semi-conductivity •High Mechanical Strength •Excellent Sliding Properties •Excellent Surface Finish 		<ul style="list-style-type: none"> •Good Plasma Resistance 	<ul style="list-style-type: none"> •Good Plasma Resistance •High Mechanical Strength 	
<ul style="list-style-type: none"> •High Hardness •High Corrosion Resistance •High Wear Resistance 	<ul style="list-style-type: none"> •High Hardness •High Corrosion Resistance •Low Dielectric Tangent 	<ul style="list-style-type: none"> •High Purity •High Corrosion Resistance •Good Plasma Resistance •High Wear Resistance 	<ul style="list-style-type: none"> •Optical Transparency •High Heat Resistance •High Frequency Insulation •High Corrosion Resistance 	<ul style="list-style-type: none"> •Good Thermal Conductivity 			<ul style="list-style-type: none"> •Industrial Cutlery •Pump Parts •Dies •Knives •Scissors •Wear Resistant Parts 				<ul style="list-style-type: none"> •OA Equipment Jig 	<ul style="list-style-type: none"> •Jig •Chip Mounter Nozzle 	<ul style="list-style-type: none"> •Semiconductor Processing Equipment 	<ul style="list-style-type: none"> •Semiconductor Processing Equipment 	
3.9	3.9	3.9	3.9	3.97	4.0	4.3	5.6	6.0	6.0	6.0	5.6	5.7	4.9	4.0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15.7	15.2	17.2	17.5	a Plane	22.5	16.0	16.0	10.7	12.3	12.0	12.7	10.8	12.4	6.0	15.7
370	380	480	500	a Plane c Axis	690	600	705	750	1,000	1,100	1,470	740	1,000	130	420
2,984	2,530	2,900	3,229	2,940		3,455	3,390	2,312	3,000	3,100	-	3,100	3,100	1,832	3,600
370	387	380	380	470		380	330	200	200	210	220	210	220	160	370
0.23	0.23	0.23	0.23	Parallel to Axis c Vertical to Axis c	0.18	0.24	0.25	0.31	0.31	0.32	0.31	0.32	0.31	0.3	0.24
4.3	4.3	4.3	4.5	2.1		3.5	3.9	7~8	6	6	6	3~4	4.5	1.1	2.9
7.2	7.2	7.2	7.2	Parallel to Axis c Vertical to Axis c	7.7 7.0	7.2	7.8	10	10.5	10.4	10.8	10.3	10.8	7.2	7.1
8.0	8.0	8.0	8.0	Parallel to Axis c Vertical to Axis c	8.8 7.9	8.2	8.7	10.5	11.0	10.8	11.3	11.4	11.0	7.6	8.0
32	32	32	34	42		26	16	3	3	3	3	3	4	14	30
0.78	0.77	0.79	0.78	0.75		0.71	0.71	0.46	0.46	0.44	0.46	0.48	0.49	0.45	0.76
180	180	180	180	180		150	200	450	300	300	350	250	200	-	200
15	14.6	15	15	48		14	12	13	11	14	-	1	≐ 0	11.0	16.6
>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴		>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	10 ¹³	>10 ¹⁴	-	10 ⁸	10 ⁶	>10 ¹³	>10 ¹⁴
10 ¹³	10 ¹²	10 ¹³	10 ¹³	10 ¹²		10 ¹²	10 ⁸	10 ⁶	10 ⁶	10 ⁸	-	10 ⁶	-	10 ¹⁰	10 ¹³
10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ¹¹		10 ¹⁰	10 ⁶	10 ⁴	10 ³	10 ⁶	-	10 ⁷	-	10 ⁷	10 ¹⁰
9.9	10	9.9	9.9	Parallel to Axis c Vertical to Axis c	11.5 9.3	11	13	28	33	34	-	33	250	11	10
1	<1	1	1	<1		60	6	17	16	13	-	880	5700	5	<1
10	-	10	10	-		660	78	476	520	442	-	-	-	55	-
0.01	-	0.05	0.01	≐ 0.00		-	-	-	≐ 0.00	-	≐ 0.00	0.03	-	-	-
0.00	-	0.22	0.00	≐ 0.00		-	-	-	0.04	-	0.04	0.01	-	-	-
0.00	-	0.04	0.01	≐ 0.00		-	-	-	0.08	-	0.08	0.01	-	-	-

1kgf/mm²=9.807MPa

1cal/(cm·sec·°C)=418.6W/(m·K)

Characteristic Table of Fine Ceramics

Item	Material		CORDIERITE (2MgO · 2Al ₂ O ₃ · 5SiO ₂)		STEATITE (MgO · SiO ₂)	FORSTERITE (2MgO · SiO ₂)	TITANIA	CERMET			
			CO2200	CO7200	SO2100	F11200	TO7160	TC0300	GO1020		
Material Code (New)			CO2200	CO7200	SO2100	F11200	TO7160	TC0300	GO1020		
Material Code (Old)			CO220	CO720	S210	F1120	T716	TC30	G102		
Appearance			Dense		Dense	Dense	Dense	Dense			
Color			Gray	Gray	White	Light Yellow	Light Brown	Silver			
Content (%)			-	-	-	-	-	-			
Main Characteristics			<ul style="list-style-type: none"> •Very Low Thermal Expansion •Light Weight 		<ul style="list-style-type: none"> •Good Insulation Property 	<ul style="list-style-type: none"> •Excellent Surface Finish 	<ul style="list-style-type: none"> •Excellent Surface Finish •CaTiO₃ 	<ul style="list-style-type: none"> •High Mechanical Strength •Excellent Wear Resistance •High Heat Shock Resistance •Electrical Conductivity 			
Main Applications			<ul style="list-style-type: none"> •Lithography Stage Component •Wafer Inspection Stage Component •SEM/TEM 		<ul style="list-style-type: none"> •Various Circuit Parts 	<ul style="list-style-type: none"> •Substrate For Resistor •Core For Resistor 	<ul style="list-style-type: none"> •Substrate •Slider Pads for Disk Drive Heads 	<ul style="list-style-type: none"> •Cutting Tool Tips •Wear Resistant Parts •Metal Forming Tools 	<ul style="list-style-type: none"> •Watch Parts •Wear Resistant Parts 		
Density (*1)	g/cm ³	JIS R 1634	2.50	2.54	2.8	3.0	3.9	6.0	5.4		
Water Absorption	%	JIS C 2141	0	0	0	0	0	0	0		
Mechanical Characteristics	Vickers Hardness HV9.807N	GPa	JIS R 1610	8.0	8.5	5.8	7.3	8.5	15.7	18.4	
	Flexural Strength 3 P.B.	MPa	JIS R 1601	190	200	190	180	320	1,810	1,290	
	Compressive Strength	MPa	JIS R 1608	1,800	1,923	1,305	-	1,160	3,430	-	
	Young's Modulus of Elasticity	GPa	JIS R 1602	140	145	120	150	260	430	440	
	Poisson's Ratio	-		0.31	0.31	0.22	0.24	0.26	0.22	0.22	
	Fracture Toughness (SEPB)	MPa · m ^{1/2}	JIS R 1607	1~1.5	1~1.5	1.9	1.8	1.8	7.6	5.7	
Thermal Characteristics	Coefficient of Linear Thermal Expansion	40-400°C	×10 ⁻⁶ /K	JIS R 1618	1.5 (40°C-400°C)	1.5 (40°C-400°C)	7.7	9.7	11.5	7.6	7.1
					2.1 (40°C-800°C)	2.1 (40°C-800°C)					
		40-800°C			< 0.05 (23°C)	< 0.05 (23°C)	8.0	10.8	12.1	8.5	8.2
					< 0.02 (22°C)	< 0.02 (22°C)					
	Thermal Conductivity 20°C	W/(m · K)	JIS R 1611	4	4	2	5	4	17	14	
Specific Heat Capacity	J/(g · K)	JIS R 1611	0.71	0.74	0.75	0.78	0.71	-	-		
Thermal Shock Temperature Difference (Put in Water,Relative Method)	°C	JIS R 1648	450	400	150	-	150	310	-		
Electrical Characteristics	Dielectric Strength	kV/mm	JIS C 2141	19.1	19.3	18	17	6.8	-	-	
	Volume Resistivity	20°C		>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	10 ¹²	10 ⁴	10 ⁴	
		300°C		10 ¹²	10 ¹²	10 ¹⁰	10 ¹³	10 ¹⁰	-	-	
		500°C		10 ¹⁰	10 ¹⁰	10 ⁷	10 ¹⁰	10 ⁷	-	-	
	Dielectric Constant (1MHz)	-		4.9	4.9	6.0	6.5	177.7	-	-	
	Dielectric Loss Angle (1MHz)	(×10 ⁻⁴)		9	8.5	18	3	<1	-	-	
	Loss Factor	(×10 ⁻⁴)		30	35	108	20	-	-	-	
Chemical Characteristics	Nitric Acid (60%) 90°C ,24H	(Weight Loss) mg/cm ²	-	-	0.01	-	0.07	6.0	-		
	Sulphuric Acid (95%) 95°C ,24H		-	-	0.00	0.00	0.79	0.26	-		
	Sodium Hydroxide (30%) 80°C ,24H		-	-	15.35	8.01	0.01	0.02	-		

The values are typical material properties and may vary according to products configuration and manufacturing process. For more details, Please feel free to contact us.

* 1: All values for apparent density and bulk density are the same, except for the porous materials which lists apparent density only.

SILICON CARBIDE (SiC)				SILICON NITRIDE (Si ₃ N ₄)			ALUMINIUM NITRIDE (AlN)		KFPG			KFSG	
									ALUMINIUM TITANATE (Al ₂ TiO ₅)	SILICON CARBIDE (SiC)	SILICON NITRIDE (Si ₃ N ₄)	ALUMINIUM (Al ₂ O ₃)	ZIRCONIA (ZrO ₂ -Mg-PSZ-1)
SC1200	SC121P	SC2110	SC1000	SN201B	SN2400	SN2410	AN216A	AN2000	AT	SiSiC	N7015	F99.7	FZM
SC120	SC121	SC211	SC1000	SN201B	SN240	SN241	AN216A	AN2000					
Dense	Porous	Dense		Dense			Dense		POROUS	Dense	Dense	Dense	Dense
Black	Black	Black	Black	Black	Black	Black	Gray	Ivory	White/Gray	Black	Black	Ivory	Dark yellow
-	-	-	-	-	-	-	-	AlN 99.9	-	-	-	-	-
<ul style="list-style-type: none"> •High Temperature Strength •High Corrosion Resistance •Excellent Thermal Conductivity •Light Weight and High Stiffness •Good Surface Smoothness 	<ul style="list-style-type: none"> •High Temperature Strength •High Corrosion Resistance •Wear Resistance •Excellent Thermal Conductivity •Light Weight and High Stiffness 	<ul style="list-style-type: none"> •High Temperature Strength •Wear Resistance •Excellent Thermal Shock Resistance •Light Weight 	<ul style="list-style-type: none"> •High Purity •Good Plasma Resistance 	<ul style="list-style-type: none"> •High Strength, High Temperature Durability •Thermal Conductivity 	<ul style="list-style-type: none"> •Insulation Property •High Thermal Conductivity •Lower Thermal Expansion 	<ul style="list-style-type: none"> •Heat Shock Resistance •Thermal Insulation 	<ul style="list-style-type: none"> •Including Si •Very High Thermal Conductivity •Light Weight •High Stiffness •Less Voids 	<ul style="list-style-type: none"> •High-Temperature Strength •Wear Resistance •Heat Shock Resistance •Light Weight 	<ul style="list-style-type: none"> •High Purity •High Corrosion Resistance •High Heat Resistance 	<ul style="list-style-type: none"> •High Mechanical Strength •High Toughness •Excellent Surface Finish 			
<ul style="list-style-type: none"> •Mechanical Seal •Sliding Parts •High Temperature Resistance Parts •Pulverizer •Semiconductor Processing Equipment 				<ul style="list-style-type: none"> •Anti Wear Liner •Pulverizer •Molten Metal Parts •Metal Forming Tool 	<ul style="list-style-type: none"> •Heat Uniformity Parts •High-Temperature Treatment Fixtures •Semiconductor Processing Equipment 	<ul style="list-style-type: none"> •Molten Aluminum 	<ul style="list-style-type: none"> •Semiconductor Processing Equipment •Mechanical Seals 	<ul style="list-style-type: none"> •Anti Wear Liner •Pulverizer •Molten Metal Parts •Metal Forming Tool 	<ul style="list-style-type: none"> •Corrosion Resistant Parts •Heat Resistant Parts •Semiconductor Processing Equipment 	<ul style="list-style-type: none"> •Pump Parts •Wire Drawing Machine Parts •Pressure Sensors 			
3.15	3.1	3.2	3.16	3.2	3.3	3.2	3.4	3.2	3.4(* 1)	3.05	3.2	3.93	5.76
0	0.01	0	0	0	0	0	0	0	1.2	0	0	0	0
23.0	22.0	22.0	23.0	13.9	14.0	13.8	10.4	11.2	3.2	22	14.2	17	10.0
500	296	600	500	580	1,020	790	310	220	30	350	1,020	400	605
4,300	3,064	4,200	4,200	3,160	3,551	3,292	3,200	2,900	230	2,300	3,880	2,500	2,012
430	410	430	440	290	300	290	320	310	30	380	300	388	207
0.16	0.16	0.16	0.17	0.28	0.28	0.28	0.24	0.24	-	0.18	0.3	0.24	0.31
2.5	2.3	4~5	2~3	4~5	7	6~7	3.2	2.5	-	3	5.7	5	8.5
3.7	3.6	3.7	3.7	2.4	2.8	2.9	4.6	4.6	0.0	3.5	2.4	7.0	10.2
4.4	4.3	4.4	4.4	3.2	3.3	3.5	5.3	5.2	0.7	4.2	3.0	8.0	10.6
190	190	60	200	25	27	54	150	67	2	185	20	33	3.5
0.67	0.70	0.67	0.67	0.64	0.65	0.66	0.71	0.72	0.80	0.70	0.63	0.74	0.50
300	250	400	350	550	800	900	250	200	-	350	>900	180	250
-	-	-	-	9.7	13	12	14	16	10	-	13.2	-	-
10 ⁶	>10 ⁶	10 ⁵	10 ⁸	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ⁸	>10 ³	>10 ¹⁴	-	-
10 ⁴	10 ⁵	10 ⁴	10 ⁴	10 ¹²	10 ¹²	10 ¹²	10 ¹⁰	10 ¹¹	-	-	10 ¹³	-	-
10 ⁴	10 ³	10 ³	10 ³	10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ⁸	10 ⁹	-	-	10 ¹¹	-	-
-	-	-	-	8.9	9.6	9.6	8.6	8.5	13.2	-	8.1	-	-
-	-	-	-	17.0	19	18	3	2	-	-	4.0	-	-
-	-	-	-	-	-	-	26	17	-	-	-	-	-
-	-	0.04	≒ 0.00	-	1.11	0.18	-	-	-	0.01	-	0.00	0.30
-	-	0.01	≒ 0.00	-	0	0	-	-	-	0.01	-	0.00	0.20
-	-	≒ 0.00	≒ 0.00	-	0.22	0.07	-	-	-	3.53	-	0.10	0.00

1kgf/mm²=9.807MPa


1cal/(cm·sec·°C)=418.6W/(m·K)



KYOCERA Corporation

Corporate Fine Ceramics Group

<https://global.kyocera.com/prdct/fc/>

Kyocera Fine Ceramics 

Product Inquiries→



The contents of this catalog are subject to change without prior notice for future improvement.
Application and the using conditions are required to be consulted when considering to purchase.

Duplication or reproduction of any part of this brochure without approval is prohibited.

© 2023 KYOCERA Corporation 008/024/2306 Printed in Japan