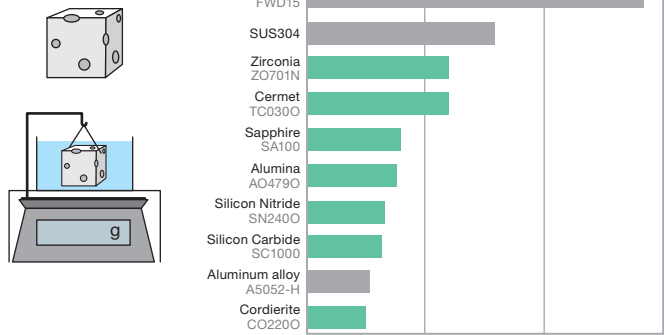


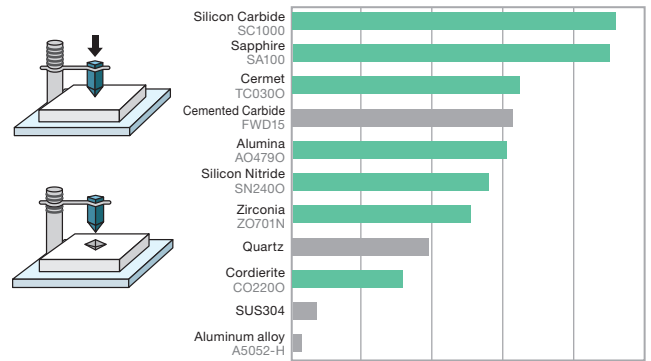
Characteristics of Fine Ceramics

Characteristics of Fine Ceramics

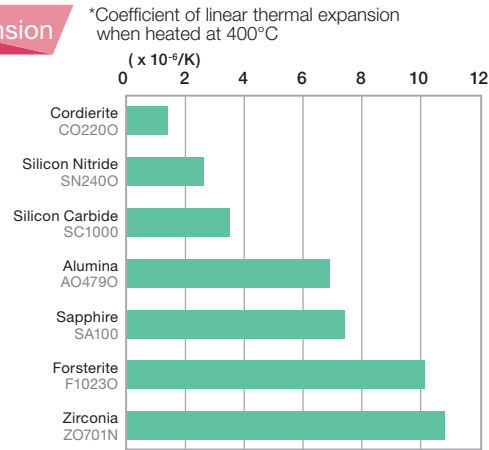
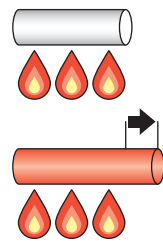
Density



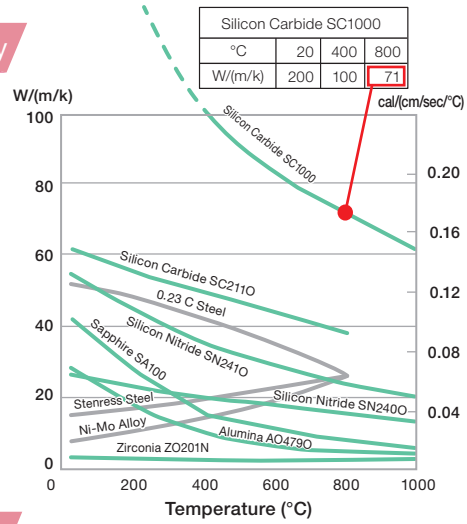
Hardness



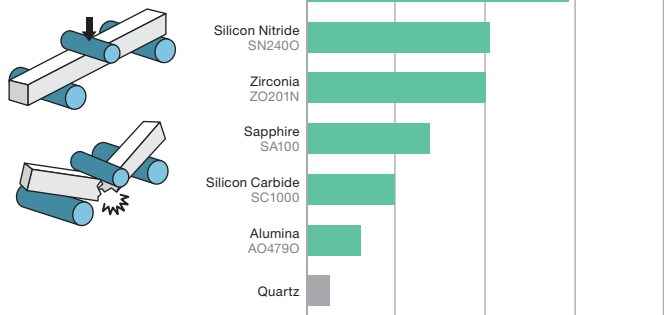
Thermal Expansion



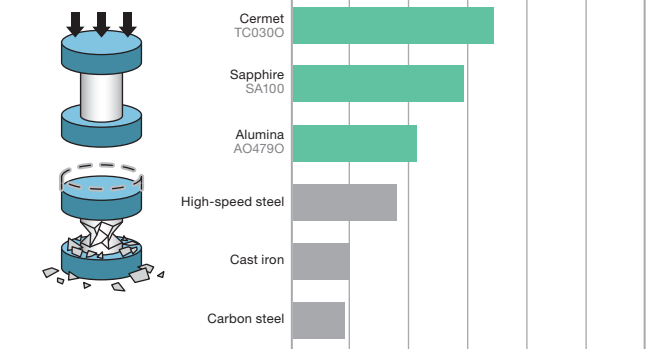
Thermal Conductivity



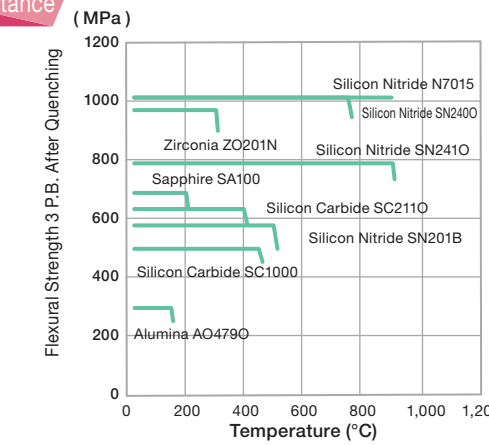
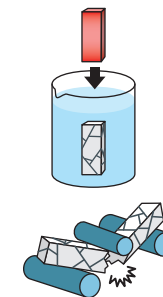
Flexural Strength



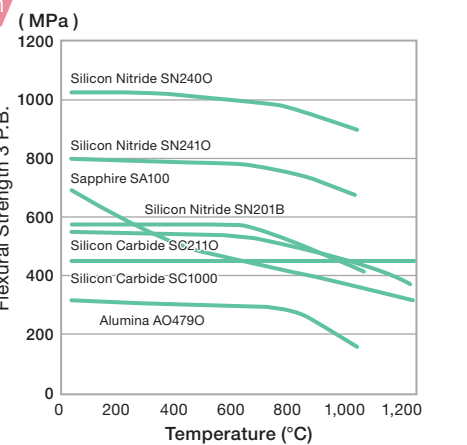
Compressive Strength



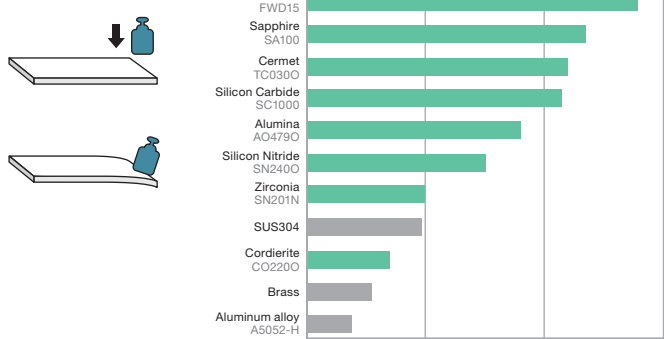
Heat Shock Resistance



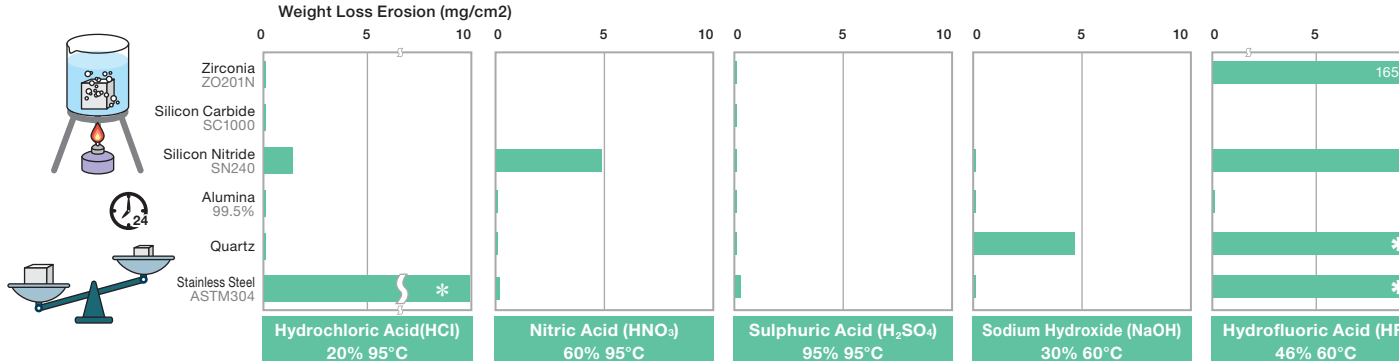
High-Temperature Strength



Young's Modulus of Elasticity

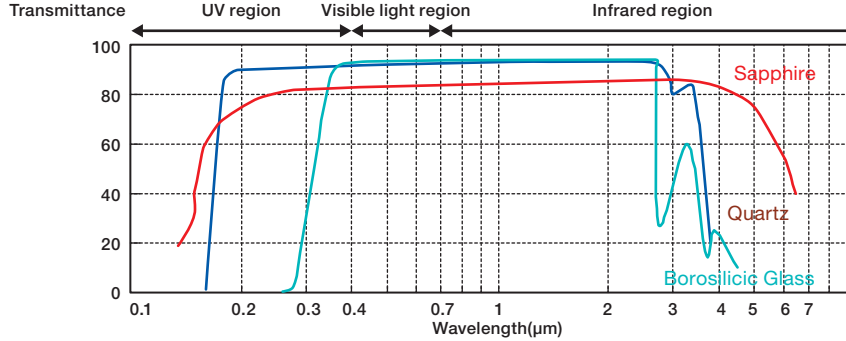


Chemical Resistance

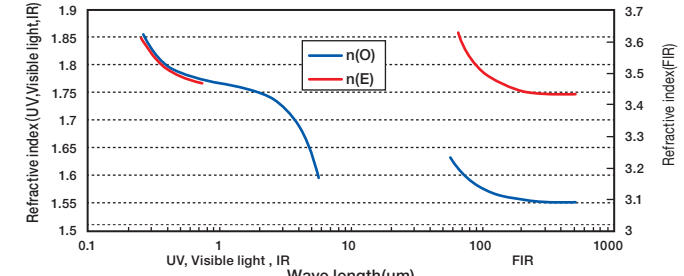


Single-Crystal Sapphire

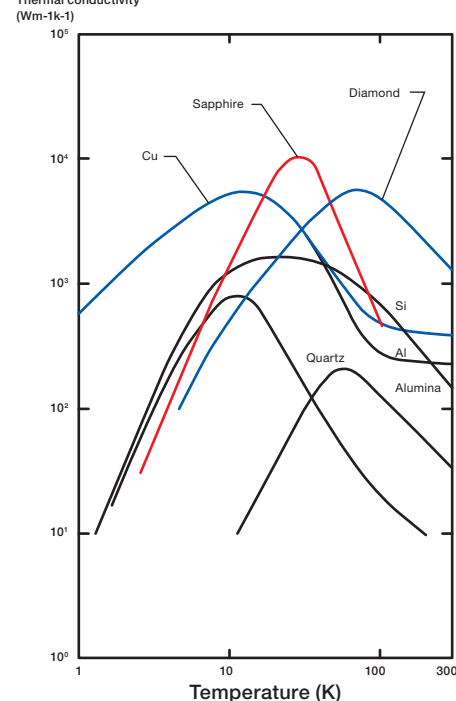
Transmittance



Optical Refractive Index



Low Temperature Thermal Conductivity



Characteristic Table of Fine Ceramics

Item \ Material				ALUMINA (Al ₂ O ₃)												SAPPHIRE (Al ₂ O ₃)		ZIRCONIA TOUGHED ALUMINA ZTA		ZIRCONIA (ZrO ₂)						YTTRIA (Y ₂ O ₃)	YAG DISPERSED ALUMINA				
Material Code (New)				AO201B	AO445O	AO471O	AO473O	AO484O	AO484B	AO476O	AO479O	AO479S		AO479M AO479G	AO479U	AO480S	AO601L	SA100	AZ201O	AZ205O	ZO220O	ZO201N	ZO206N	ZO701N	Z21H04	Z21H12	YO100A	AG1000			
Material Code (Old)				A201B	A445	A471	A473	A484	A484B	A476	A479	A479S		A479M A479G	A479U	A480S	A601L	SA100	AZ201	AZ205	Z220	Z201N	Z206N	Z701N	Z21H04	Z21H12	YO100A	AG1000			
Appearance					Dense												Dense		Dense		Dense						Dense	Dense			
Color				Black	Dark Brown	White	White	White	White	White	White	Ivory		Ivory	White	Ivory	Ivory	Transparent	White		Yellow	Ivory	White	Ash Black	Black	Black	White	Ivory			
Content (%)				91	90	92	92	92	92	96	99	99.5		99.5	99.6	99.7	99.9	99.99	—		—	—	—	—	—	—	—	—			
Main Characteristics				●High Frequency Insulation ●High Mechanical Strength ●Wear Resistant ●High Corrosion Resistance ●High Temperature Resistance												Single Crystal		●High Mechanical Strength ●High Hardness ●High Wear Resistance		●High Mechanical Strength ●High Fracture Toughness ●Excellent Sliding Properties ●Excellent Surface Finish						●Semi-conductivity ●High Mechanical Strength ●Excellent Sliding Properties ●Excellent Surface Finish		●Good Plasma Resistance	●Good Plasma Resistance ●High Mechanical Strength		
				●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 Wear Resistance	●High Hardness ●High Corrosion Resistance ●High Wear Resistance	●High Hardness ●High Corrosion Resistance ●Low Dielectric Tangent	●High Purity ●High Corrosion Resistance ●Good Plasma Resistance ●High Wear Resistance	●Optical Transparency ●High Heat Resistance ●High Frequency Insulation ●High Corrosion Resistance	●Good Thermal Conductivity														
Main Applications				●Semiconductor Processing Equipment	●IC Packages	●Liner ●Pulverizer	●IC Multi-Layer Packages ●Electrontube 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 ●Semiconductor Processing Equipment	●Semiconductor Processing Equipment	●Corrosion and Wear Resistant Parts ●Semiconductor Processing Equipment	●Thin Film Substrates ●Windows ●Corrosion Resistant Parts		●Pulverizer		●Industrial Cutlery ●Pump Parts ●Dies ●Knives ●Scissors ●Wear Resistant Parts						●OA Equipment Jig	●Jig ●Chip Mounter Nozzle	●Semiconductor Processing Equipment	●Semiconductor Processing Equipment			
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		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		
Water Absorption			%	JIS C 2141	0	0	0	0	0	0	0	0	0		0	0	0	0	0	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		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	
	Flexural Strength 3 P.B.		MPa	JIS R 1601	400	320	390	340	370	460	350	310	400		370	380	480	500	a Plane c Axis	690	600	705	750	1,000	1,100	1,470	740	1,000	130	420	
	Compressive Strength		MPa	JIS R 1608	2,781	2,430	3,024	2,300	2,910	2,900	2,992	2,160	2,350		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	
	Young's Modulus of Elasticity		GPa	JIS R 1602	320	320	280	280	280	300	320	360	370		370	387	380	380	470		380	330	200	200	210	220	210	220	160	370	
	Poisson's Ratio		—		0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23		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
	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		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	
Thermal Characteristics	Coefficient of Linear Thermal Expansion	40-400°C	×10 ⁻⁶ /K	JIS R 1618	7.0	7.3	7.1	6.9	6.8	6.6	7.2	7.2	7.2		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	
		40-800°C			8.0	8.1	7.9	7.8	7.7	7.6	7.9	8.0	8.0	8.0	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
		Thermal Conductivity 20°C			W/(m · K)	JIS R 1611	14	12	16	18	17	22	24	29	32		32	32	32	34	42		26	16	3	3	3	3	3	4	14
	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		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	
	Thermal Shock Temperature Difference (Put in Water,Relative Method)			°C	JIS R 1648	150	150	150	150	150	150	150	180		180	180	180	180	180		150	200	450	300	300	350	250	200	—	200	
Electrical Characteristics	Dielectric Strength		kV/mm	JIS C 2141	14	12	16	16	14	14.5	15	15	15		15	14.6	15	15	48		14	12	13	11	14	—	1	≒ 0	11.0	16.6	
	Volume Resistivity	20°C	Ω · cm		>10 ¹⁴	10 ¹¹	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴		>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	
		300°C			10 ¹⁰	10 ⁷	10 ¹²	10 ¹²	10 ¹⁰	10 ¹¹	10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ¹³		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
		500°C			10 ⁸	10 ⁵	10 ⁹	10 ¹⁰	10 ⁸	10 ⁹	10 ⁸	10 ⁸	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			
	Dielectric Constant (1MHz)		—		9.7	9.8	8.9	9.0	8.9	9.2	9.4	9.9	9.9		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	
	Dielectric Loss Angle (1MHz)		(×10 ⁻⁴)		11	20	6	6	9	4	4	2	1		1	<1	1	1	<1		60	6	17	16	13	—	880	5700	5	<1	
	Loss Factor		(×10 ⁻⁴)		106	190	53	54	80	37	38	20	10		10	—	10	10	—		660	78	476	520	442	—	—	—	55	—	
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		0.01	—	0.05	0.01	≒ 0.00		—	—	—	≒ 0.00	—	≒ 0.00	0.03	—	—	—	
	Sulphuric Acid (95%) 95°C ,24H				0.01	0.33	—	0.65	0.34	—	0.01	0.33	0.00		0.00	—	0.22	0.00	≒ 0.00		—	—	—	0.04	—	0.04	0.01	—	—	—	
	Sodium Hydroxide (30%) 80°C ,24H				0.15	0.58	—	0.91	0.95	—	0.86	0.26	0.00		0.00	—	0.04	0.01	≒ 0.00		—	—	—	0.08	—	0.08	0.01	—	—	—	

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.

1kgf/mm2=9.807MPa1cal/ (cm · sec · °C)=418.6W/ (m · K)

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

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		SILICON CARBIDE (SiC)				SILICON NITRIDE (Si ₃ N ₄)			ALUMINIUM NITRIDE (AlN)		KFEG Selb Plant			KFEG Mannheim Plant			
				ALUMINUM TITANATE (Al ₂ TiO ₃)	SILICON CARBIDE (SiC)	SILICON NITRIDE (Si ₃ N ₄)	ALUMINIUM (Al ₂ O ₃)	ZIRCONIA (ZrO ₂ -Mg- PSZ-1)																		
Material Code (New)				CO2200	CO7200	SO2100	F11200	TO7160	TC0300	GO1020	SC1200	SC121P	SC2110	SC1000	SN201B	SN2400	SN2410	AN216A	AN2000	AT	SiSiC	N7015	F99.7	FZM		
Material Code (Old)				CO220	CO720	S210	F1120	T716	TC30	G102	SC120	SC121	SC211	SC1000	SN201B	SN240	SN241	AN216A	AN2000							
Appearance				Dense		Dense	Dense	Dense	Dense		Dense	Porous	Dense		Dense			Dense		POROUS	Dense	Dense	Dense	Dense		
Color				Gray	Gray	White	Light Yellow	Light Brown	Silver		Black	Black	Black	Black	Black	Black	Black	Gray	Ivory	White/Gray	Black	Black	Ivory	Dark yellow		
Content (%)				—	—	—	—	—	—		—	—	—	—	—	—	—	AlN 99.9	—	—	—	—	—			
Main Characteristics				•Very Low Thermal Expansion •Light Weight •Void Less		•Good Insulation Property	•Excellent Surface Finish	•Excellent Surface Finish •CaTiO3	•High Mechanical Strength •Excellent Wear Resistance •High Heat Shock Resistance •Electrical Conductivity •Nonmagnetic		•High Temperature Strength •High Corrosion Resistance •High Corrosion Resistance •Excellent Thermal Conductivity •Light Weight and High Stiffness •Good Surface Smoothness		•High Temperature Strength •High Corrosion Resistance •Wear Resistance •Excellent Thermal Conductivity •Light Weight and High Stiffness •High Toughness •High Corrosion Resistance		•High Temperature Strength •Wear Resistance •Excellent Thermal Shock Resistance •Light Weight •High Strength, High Temperature Durability •Thermal Conductivity		•Insulation Property •High Thermal Conductivity •Lower Thermal Expansion •High Purity •Good Plasma Resistance		•Heat Shock Resistance •Thermal Insulation	•Including Si •Very High Thermal Conductivity •Light Weight •High Stiffness •Less Voids	•High-Temperature Strength •Wear Resistance •Heat Shock Resistance •Light Weight	•High Purity •High Corrosion Resistance •High Heat Resistance	•High Mechanical Strength •High Toughness •Excellent Surface Finish			
Main Applications				•Lithography Stage Component •Wafer Inspection Stage Component •SEM/TEM		•Various Circuit Parts	•Substrate For Resistor •Core For Resistor	•Substrate •Slider Pads for Disk Drive Heads	•Cutting Tool Tips •Wear Resistant Parts •Metal Forming Tools		•Watch Parts •Wear Resistant Parts		•Mechanical Seal •Sliding Parts •High Temperature Resistance Parts •Pulverizer •Semiconductor Processing Equipment				•Anti Wear Liner •Pulverizer •Molten Metal Parts •Metal Forming Tool			•Heat Uniformity Parts •High-Temperature Treatment Fixtures •Semiconductor Processing Equipment		•Molten Aluminum	•Semiconductor Processing Equipment •Mechanical Seals	•Anti Wear Liner •Pulverizer •Molten Metal Parts •Metal Forming Tool	•Corrosion Resistant Parts •Heat Resistant Parts •Semiconductor Processing Equipment	•Pump Parts •Wire Drawing Machine Parts •Pressure Sensors
Density (* 1)			g/cm ³	JIS R 1634	2.50	2.54	2.8	3.0	3.9	6.0	5.4	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	
Water Absorption			%	JIS C 2141	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	1.2	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	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	
	Flexural Strength 3 P.B.		MPa	JIS R 1601	190	200	190	180	320	1,810	1,290	500	296	600	500	580	1,020	790	310	220	30	350	1,020	400	605	
	Compressive Strength		MPa	JIS R 1608	1,800	1,923	1,305	—	1,160	3,430	—	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	
	Young's Modulus of Elasticity		GPa	JIS R 1602	140	145	120	150	260	430	440	430	410	430	440	290	300	290	320	310	30	380	300	388	207	
	Poisson's Ratio		—		0.31	0.31	0.22	0.24	0.26	0.22	0.22	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	
	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	2.5	2.3	4~5	2~3	4~5	7	6~7	3.2	2.5	—	3	5.7	5	8.5	
Thermal Characteristics	Coefficient of Linear Thermal Expansion		40-400°C	×10 ⁻⁶ /K	JIS R 1618	1.5 (40°C~400°C) 2.1 (40°C~800°C) < 0.05 (23°C) < 0.02 (22°C)	1.5 (40°C~400°C) 2.1 (40°C~800°C) < 0.05 (23°C) < 0.02 (22°C)	7.7	9.7	11.5	7.6	7.1	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
			40-800°C					8.0	10.8	12.1	8.5	8.2	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
			Thermal Conductivity 20°C			W/(m · K)	JIS R 1611	4	4	2	5	4	17	14	190	190	60	200	25	27	54	150	67	2	185	20
	Specific Heat Capacity		J/(g · K)	JIS R 1611	0.71	0.74	0.75	0.78	0.71	—	—	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	
	Thermal Shock Temperature Difference (Put in Water,Relative Method)		°C	JIS R 1648	450	400	150	—	150	310	—	300	250	400	350	550	800	900	250	200	—	350	>900	180	250	
Electrical Characteristics	Dielectric Strength		kV/mm	JIS C 2141	19.1	19.3	18	17	6.8	—	—	—	—	—	9.7	13	12	14	16	10	—	13.2	—	—		
	Volume Resistivity	20°C	Ω · cm		>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	10 ¹²	10 ⁻⁴	10 ⁻⁴	10 ⁶	>10 ⁶	10 ⁵	10 ⁸	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ⁸	>10 ³	>10 ¹⁴	—	—	
		300°C			10 ¹²	10 ¹²	10 ¹⁰	10 ¹³	10 ¹⁰	—	—	10 ⁴	10 ⁵	10 ⁴	10 ⁴	10 ¹²	10 ¹²	10 ¹²	10 ¹⁰	10 ¹¹	—	—	10 ¹³	—	—	
		500°C			10 ¹⁰	10 ¹⁰	10 ⁷	10 ¹⁰	10 ⁷	—	—	10 ⁴	10 ³	10 ³	10 ³	10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ⁸	10 ⁹	—	—	10 ¹¹	—	—	
	Dielectric Constant (1MHz)		—		4.9	4.9	6.0	6.5	177.7	—	—	—	—	—	8.9	9.6	9.6	8.6	8.5	13.2	—	8.1	—	—		
	Dielectric Loss Angle (1MHz)		(×10 ⁻⁴)		9	8.5	18	3	<1	—	—	—	—	—	—	17.0	19	18	3	2	—	—	4.0	—	—	
	Loss Factor		(×10 ⁻⁴)		30	35	108	20	—	—	—	—	—	—	—	—	—	—	26	17	—	—	—	—	—	
Chemical Characteristics	Nitric Acid (60%) 90°C ,24H		(Weight Loss) mg/cm ²	—	—	—	0.01	—	0.07	6.0	—	—	—	0.04	≒ 0.00	—	1.11	0.18	—	—	—	0.01	—	0.00	0.30	
	Sulphuric Acid (95%) 95°C ,24H				—	—	0.00	0.00	0.79	0.26	—	—	—	—	0.01	≒ 0.00	—	0	0	—	—	—	0.01	—	0.00	0.20
	Sodium Hydroxide (30%) 80°C ,24H				—	—	15.35	8.01	0.01	0.02	—	—	—	—	≒ 0.00	≒ 0.00	—	0.22	0.07	—	—	—	3.53	—	0.10	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.

1kgf/mm2=9.807MPa 1cal/ (cm · sec · °C) =418.6W/ (m · K)



KYOCERA Corporation

Corporate Fine Ceramics Group

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Kyocera Fine Ceramics 

Product Inquiries→



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