

セラミックスの特性表

Characteristics Of Ceramics

Material Item				ALUMINA (Al ₂ O ₃)					SILICON CARBIDE (SiC)	SILICON CARBIDE (Si ₃ N ₄)	ZIRCONIA PSZ (ZrO ₂)	FORSTTERITE (2MgO·SiO ₂)	SINGLE CRYSTAL SAPPHIRE (Al ₂ O ₃)			
Kyocera No.				A-459	A-473	A-476	A-479	A-479SS	SC-211	SN-220	Z-201N	F-1120	SA-100			
Appearance				Dense	Dense	Dense	Dense	Dense	Dense	Dense	Dense	Dense	Dense	Dense		
Color				Russet	White	White	White	White	Black	Black	Ivory	Light Yellow	Transparent			
Alumina Content (%)				89	92	96	99	99.5	-	-	-	-	99.99			
Main Characteristics				High Mechanical Strength,High Temperature Resistance, High Frequency Insulation,High Chemical Resistance					High Temperature Strength High Chemical Resistance Excellent Thermal Conductivity Fracture Toughness	High Temperature Strength Wear Resistant Excellent Thermal Shock Resistance Light Weight	High Mechanical Strength Excellent Wear Resistance Good Surface Finish High Fracture Toughness	Good Surface Smoothness	High Mechanical Strength High Heat Resistance High Chemical Resistance High Electric Insulation Resistance			
				Good for Metallizing	Good for Metallizing Mechanically Strong	Good Surface Smoothness	Hard and Chemically Stable	Hard and Chemically Stable Fine Grain Strong and Smooth								
				Main Applications				Magnetron	IC Multi Layer Packages Electron tube Housing	Hybrid IC Substrates	Heat Corrosion And Wear Resistant Parts	Pump Shafts	Mechanical Seal Gas Turbine Parts High Temperature Resistance Parts	Internal Combustion Engine Parts Molten Metal Parts Gas Turbine Parts Metal Forming Tool	Pump Parts Dies Knives Cutting Blades Spikes Club Faces Scissors	Film Resistor Core Substrate
Bulk Density		Kg/m ³	JISC 2141	3.6×10 ³	3.6×10 ³	3.7×10 ³	3.8×10 ³	3.9×10 ³	3.2×10 ³	3.2×10 ³	6.0×10 ³	3.0×10 ³	3.97×10 ³			
Water Absorption		%	JISC 2141	0	0	0	0	0	0	0	0	0	0			
Mechanica Characteristics	Vickers Load Hardness 500g		(Gpa)	JISR 1610	12.1	12.3	13.7	15.2	16.0	22.0	13.9	12.3	7.3	22.5		
	Flexural Strenght		MPa	JISR 1601	310	340	350	310	360	540	610	1,000	180	690		
	Compressive Strength		MPa	-	-	2,300	-	2,160	2,350	-	3,820	5,690	-	2,940		
	Young's Modulus Of Elasticity		GPa	JISR 1602	280	280	320	360	370	430	290	200	150	470		
	Poisson's Ratio Fracture		-	-	0.23	0.23	0.23	0.23	0.23	0.16	0.28	0.31	0.24	-		
	Toughness		Mpa√m	JISR 1607	-	-	-	3~4	4	4~5	5	4~5	-	-		
Thermal Characteristics	Coefficient Of Linear Thermal Expansion	40~400℃	×10 ⁻⁶ /℃	JISR 1618	7.0	6.9	7.2	7.2	7.2	3.7	2.6	10.5	9.7	Parallel to C-axis	7.7	
		40~800℃		JISR 1618	7.9	7.8	7.9	8.0	8.0	4.4	3.2	11.0	-	Vertical to C-axis		7.0
	Thermal Conductivity 20℃		W/(m·K)	JISR 1611	14	18	24	29	32	60	20	3	5	41		
	Specific Heat		J/(kg·K)	JISR 1611	0.75×10 ³	0.78×10 ³	0.78×10 ³	0.79×10 ³	0.78×10 ³	0.67×10 ³	0.66×10 ³	0.46×10 ³	0.78×10 ³	0.75×10 ³		
	Heat Shock Resistance		℃	-	-	200	200	200	250	400	550	300	-	-		
Electrical Characteristics	Dielectc Strength		V/m	JISC 2141	15×10 ⁶	16×10 ⁶	15×10 ⁶	15×10 ⁶	15×10 ⁶	-	10×10 ⁶	11×10 ⁶	17×10 ⁶	48×10 ⁶		
	Volume Resistance	20℃	Ω·cm		>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	10 ⁵	>10 ¹⁴	10 ¹³	>10 ¹⁴	>10 ¹⁴		
		300℃			10 ¹⁰	10 ¹²	10 ¹⁰	10 ¹⁰	10 ¹³	10 ⁴	10 ¹²	10 ⁶	10 ¹³	-		
		500℃			10 ⁸	10 ¹⁰	10 ⁸	10 ⁸	10 ¹⁰	10 ³	10 ¹⁰	10 ³	10 ¹⁰	10 ¹¹		
	Dielectric(1MHz) Constant		-		8.8	9.0	9.4	9.9	9.9	-	-	33	6.5	Parallel to C-axis	11.5	9.3
	Dielectric(1MHz) Loss Angle		(×10 ⁻⁴)		6	6	4	2	1	-	-	16	3	Vertical to C-axis		
	Loss Factor		(×10 ⁻⁴)		52	54	38	20	10	-	-	520	20	-		
Chemical Characteristics	Nitri (60%)90℃ Acid		WTLoss Mg/cm ² /day	-	-	0.32	-	0.10	0.07	0.04	1.00	≒0.00	-	≒0.00		
	Sulbhuric Acid (95%)95℃				-	0.65	-	0.33	0.25	0.01	0.40	0.04	-	≒0.00		
	Caustic Soda (30%)80℃				-	0.91	-	0.26	0.05	≒0.00	0.36	0.08	-	≒0.00		

接合金属の特性表

Characteristics Of Material

			Fe-Ni-Co Alloy	Alloy42	Ni	Mo	Al	OFHC (COPPER)	STEEL	SUS304	SUS316	Cu/W-10	Cu/W-15	Ti
Composition by Weight(%)			Fe54 Co17 Ni29	Fe58 Ni42	Ni99.0 min	Mo99.9	Al99.4	Cu99.96	Fe99.2	Fe67 Cr20 Ni10	Fe62 Cr18 Ni14	Cu10 W90	Cu15 W85	Ti99.1
Application			1/0pin Lead Frame Seal Ring	1/0pin Lead Frame Seal Ring	Lead Frame	Heat Sink	Connector	Heat Sink	Flange Sleeve	Flange Sleeve	Flange Sleeve	Heat Sink	Heat Sink	Flange Sleeve
Bulk Density			8.3	8.2	8.8	10.3	2.7	8.9	8.7	7.8	7.98	17.3	16.4	4.51
Hardness Rockwell-B			70-85	60-80	50-80	54-58	-	12-43	55	90	90	105	103	-
Mechanical Characteristics	Tensile Strength	Mpa Kpsi	490-510 71-74	471 64	343-549 50-80	686-980 100-142	167-382 24-55	206 30	392 57	588 84	588 84	490 71	529 77	- -
	Elongation	%	Brazed 35	Brazed 35	Brazed 35	5	40	40	35	60	60	-	-	-
	Young's Modulus of Elasticity	Gpa Mpsi	137 20.0	147 21.4	200 29.0	324 47.1	69 10.0	117 17.0	196 28.4	193 28.1	193 28.1	333 48.5	314 45.7	106 -
Thermal Characteristics	Coefficient Of Linear Thermal Expansion	$\times 10^{-6}/^{\circ}\text{C}$ 20-500°C	5.7-6.2	7.5-8.5	15	5.7	23 (20-100°C)	18.3	13.9	18.7	16.0	6.0	6.5	8.4
	Thermal Conductivity $\frac{\text{W}}{\text{M}\cdot\text{K}}$	20°C 100°C	16.7 18.4	14.7 16.7	84.1 82.9	155 147	151 -	391 393	58.6 -	- 16.3	- 16.3	170 -	190 -	- 17.2
	Specific Heat	Cal/g°C	0.105	0.120	0.130	0.060	0.210	0.090	-	0.120	0.120	0.05	0.07	0.124
Electrical Characteristics	Volume Resistivity	$\mu\Omega\cdot\text{cm}$ 20°C	48	58	6.8	5.8	2.7	1.7	12	72	74	-	-	55
	Electrical Conductivity	%IACS	-	-	-	-	64	100	18	2.4	-	26	34	3.1