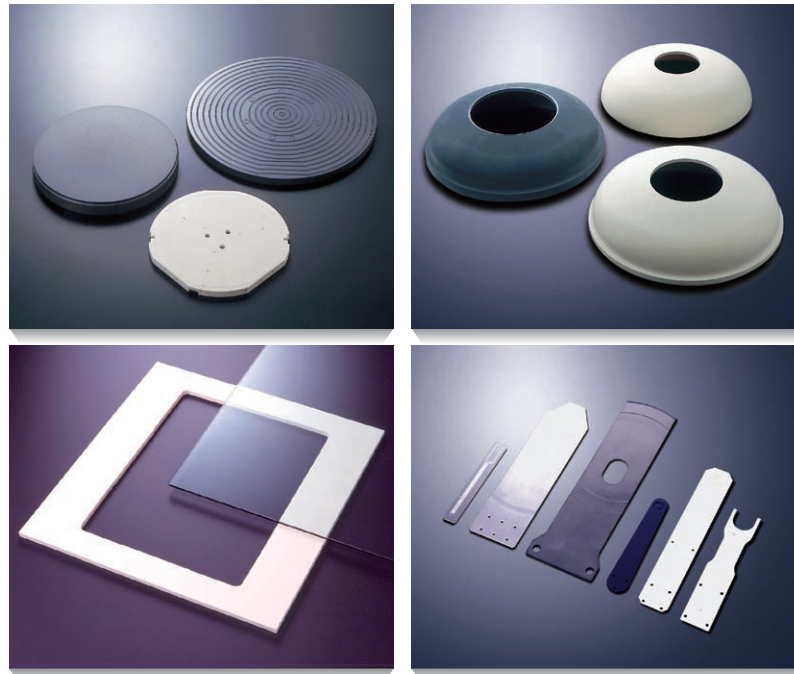


THE NEW VALUE FRONTIER



Ceramic Components for Semiconductor Processing

DESIGN & SIMULATION TECHNOLOGY

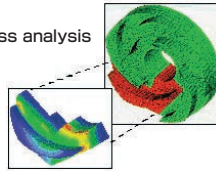
■ SUPER COMPUTER



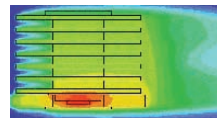
■ Thermal conductivity analysis



■ Stress analysis



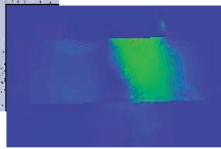
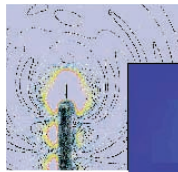
■ Fluid thermal analysis



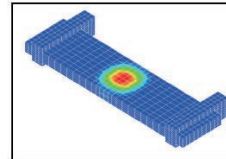
■ Shock analysis



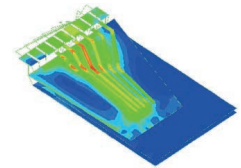
■ Electro magnetic field analysis



■ Piezo electric device vibration analysis



■ Electrical analysis



ANALYSIS TECHNOLOGY

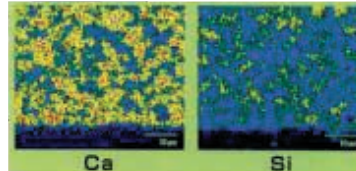
■ TEM



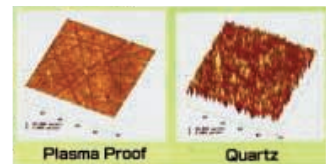
■ XRD



■ EPMA



■ AFM



EVALUATION TECHNOLOGY

■ Electrical evaluation



■ Durability evaluation



■ Mechanical evaluation



■ Thermal friction evaluation



MATERIAL CHARACTERISTICS

Item	Material	Unit	Measuring Method	Alumina (Al ₂ O ₃)					Sapphire	
				A-479	A-479SS	A-479M A-479G	A-480S	A-601D A-601L	SA-100	
Kyocera No.				A-479	A-479SS	A-479M A-479G	A-480S	A-601D A-601L	SA-100	
Color				99% White	99.5% Ivory	99.5% Ivory	99.7% Ivory	99.9% Ivory	99.9% Transparent	
Bulk Density		g/cm ³	JIS R1634	3.8	3.9	3.9	3.9	3.9	3.97	
Water Absorption		%	JIS R1634	0	0	0	0	0	0	
Vickers Hardness HV1 (Load=9.807N)		(GPa)	JIS R1610	15.2	16.0	15.7	17.2	17.5	22.5	
Flexural Strength (3PB) R.T.		MPa	JIS R1601	310	360	370	380	400	690	
Young's Modulus of Elasticity		GPa	JIS R1602	360	370	370	380	380	470	
Poisson's Ratio		-	JIS R1602	0.23	0.23	0.23	0.23	0.23	-	
Fracture Toughness (SEPB)		MPam ^{1/2}	JIS R1607	3 ~ 4	4	-	-	5 ~ 6	-	
Coefficient of Linear Thermal Expansion	40°C ~ 400°C	x10 ⁻⁶ /°C	JIS R1618	7.2	7.2	7.2	7.2	7.2	Parallel to C-axis	7.7
	40°C ~ 800°C			8.0	8.0	8.0	8.0	8.0	Vertical to C-axis	7.0
Thermal Conductivity 20°C		W/(m·k)	JIS R1611	29	32	32	32	34	41	
Specific Heat		J/(g·k)	JIS R1611	0.79	0.78	0.78	0.79	0.78	0.75	
Heat Shock Resistance		°C	JIS R1648	200	250	-	-	-	-	
Dielectric Strength		KV/mm	JIS R1601	15	15	15	15	15	48	
Volume Resistivity	20°C	Ω · cm	JIS R1601	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	
	300°C			10 ¹⁰	10 ¹³	10 ¹³	10 ¹³	10 ¹³	-	
	500°C			10 ⁸	10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ¹¹	
Dielectric Constant (1MHz)		-	C2141	9.9	9.9	9.9	9.9	9.9	Parallel to C-axis	11.5
									Vertical to C-axis	9.3
Dielectric Loss Angle (1MHz)		(X10 ⁴)	JIS R1601	2	1	1	1	1	<1	
Loss Factor		(X10 ⁴)	JIS R1601	20	10	10	10	10	-	
Nitric Acid(60%)90°C		WT Loss	JIS R1614	0.10	0.07	-	0.05	0.03	≒ 0.00	
Sulphuric Acid(95%)95°C		mg/cm ²	JIS R1614	0.33	0.25	-	0.22	0.19	≒ 0.00	
Caustic Soda(30%)80°C		mg/cm ²	JIS R1614	0.26	0.05	-	0.04	0.03	≒ 0.00	

Item	Material	Unit	Measuring Method	Silicon Nitride (Si ₃ N ₄)				Silicon Carbide (SiC)		Aluminum Nitride (AlN)		Cordierite (2MgO · 2Al ₂ O ₃ · 5SiO ₂)		Yttria (Y ₂ O ₃)	Zirconia (ZrO ₂)	
				SN-201B	SN-260	SN-240	SN-241	SC-211	SC1000	AN216A	AN2000	CO-220	CO-720	Y0100A	Z-201N	
Kyocera No.				SN-201B	SN-260	SN-240	SN-241	SC-211	SC1000	AN216A	AN2000	CO-220	CO-720	Y0100A	Z-201N	
Color				Black	Black	Black	Black	Black	Black	Gray	Ivory	Gray	Gray	White	Ivory	
Bulk Density		g/cm ³	JIS R1634	3.2	3.1	3.3	3.2	3.2 × 10 ³	3.16	3.4	3.2	2.5	2.5	4.9	6.0	
Water Absorption		%	JIS R1634	0	0	0	0	0	0	0	0	0	0	0	0	
Vickers Hardness HV1 (Load=9.807N)		(GPa)	JIS R1610	13.9	12.7	14.0	13.8	22.0	23.0	10.4	11.2	8	8.5	6.0	12.3	
Flexural Strength (3PB) R.T.		MPa	JIS R1601	580	900	1,020	790	540	450	310	220	190	200	130	1,000	
Young's Modulus of Elasticity		GPa	JIS R1602	290	270	300	290	430	440	320	310	140	145	160	200	
Poisson's Ratio		-	JIS R1602	0.28	0.28	0.28	0.28	0.16	0.17	0.24	0.24	0.31	0.31	-	0.31	
Fracture Toughness (SEPB)		MPam ^{1/2}	JIS R1607	4 ~ 5	6 ~ 7	7	6 ~ 7	4 ~ 5	2 ~ 3	-	-	1 ~ 1.5	1 ~ 1.5	1.1	4 ~ 5	
Coefficient of Linear Thermal Expansion	40°C ~ 400°C	x10 ⁻⁶ /°C	JIS R1618	2.4	2.8	2.8	2.9	3.7	3.7	4.6	4.6	1.5(40°C ~ 400°C)	1.5(40°C ~ 400°C)	7.2	10.5	
	40°C ~ 800°C			3.2	3.4	3.3	3.5	4.4	4.4	5.3	5.2	2.1(40°C ~ 800°C)	2.1(40°C ~ 800°C)	7.6	11.0	
Thermal Conductivity 20°C		W/(m·k)	JIS R1611	25	23	27	54	60	200	150	67	4	4	14	3	
Specific Heat		J/(g·k)	JIS R1611	0.64	0.66	0.65	0.66	0.67	0.67	0.71	0.72	0.71	-	0.45	0.46	
Heat Shock Resistance		°C	JIS R1648	550	800	800	900	400	-	-	-	-	400	-	300	
Dielectric Strength		KV/mm	JIS R1601	-	12	13	12	-	-	14	16	19.1	19.3	11	11	
Volume Resistivity	20°C	Ω · cm	JIS R1601	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	10 ⁵	10 ⁶	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹³	10 ¹³	
	300°C			10 ¹²	10 ¹³	10 ¹²	10 ¹²	10 ⁴	10 ⁴	10 ¹⁰	10 ¹⁰	10 ¹²	10 ¹²	10 ¹²	10 ¹⁰	10 ⁶
	500°C			10 ¹⁰	10 ¹¹	10 ¹⁰	10 ¹⁰	10 ³	10 ³	10 ⁸	10 ⁹	10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ⁷	10 ³
Dielectric Constant (1MHz)		-	C2141	-	8.3	9.6	9.6	-	-	8.6	8.5	4.9	4.9	11.0	33.0	
Dielectric Loss Angle (1MHz)		(X10 ⁴)	JIS R1601	-	5	19	18	-	-	3	2	9	8.5	5	16	
Loss Factor		(X10 ⁴)	JIS R1601	-	-	-	-	-	-	26	17	-	-	55	520	
Nitric Acid(60%)90°C, 24H		WT Loss	JIS R1614	-	1.02	1.11	0.18	0.04	≒ 0.00	-	-	-	-	-	≒ 0.00	
Sulphuric Acid(95%)95°C, 24H		mg/cm ²	JIS R1614	-	0.01	0	0	0.01	≒ 0.00	-	-	-	-	-	0.04	
Caustic Soda(30%)80°C, 24H		mg/cm ²	JIS R1614	-	0.49	0.22	0.07	≒ 0.00	≒ 0.00	-	-	-	-	-	0.08	

Unit Conversion Table

Stress

Mpa	Kgf/mm ²	Kgf/cm ²
1	1.0197 × 10 ⁻¹	1.0197 × 10
9.807	1	1 × 10 ²
9.807 × 10 ⁻²	1 × 10 ⁻²	1

Thermal Conductivity

W/(m · k)	Cal/cm · Sec · °C
1	2.39 × 10 ⁻³
1.163	2.78 × 10 ⁻³
418.7	1

Notes

- These values are only for reference, showing the measurement results of test pieces specified.
- The values may change dependent on the using conditions and the shape of products.
- For more details, please feel free to contact us.

WAFER MANUFACTURING PROCESS



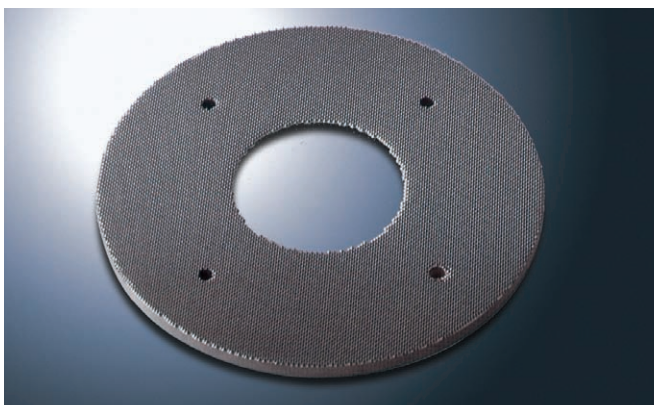
Alumina Wafer Polishing Plate / Turn Table

- Material : Al_2O_3
- Size : Up to 39" in diameter
- Features :
 - High rigidity
 - High chemical durability
 - Surface shape & roughness control



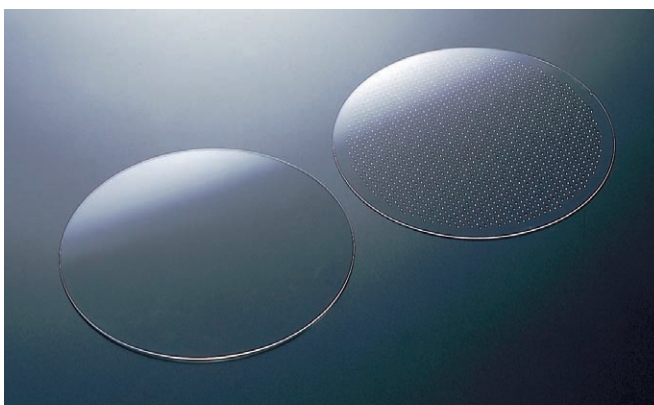
Silicon Carbide Wafer Polishing Plate

- Material : SiC
- Size : Up to 30" in diameter
- Features :
 - High thermal conductivity
 - Low thermal expansion
 - High rigidity



Pad Dresser

- Material : Al_2O_3 , SiC, Si_3N_4
- Features :
 - High wear resistance
 - Square bumps / pyramid bumps



Sapphire Carrier Plate

- Material : Sapphire
- Size : Up to 8" in diameter
- Features :
 - High purity
 - High chemical durability
 - No grain boundary
 - Transparent

DEVICE MANUFACTURING PROCESS



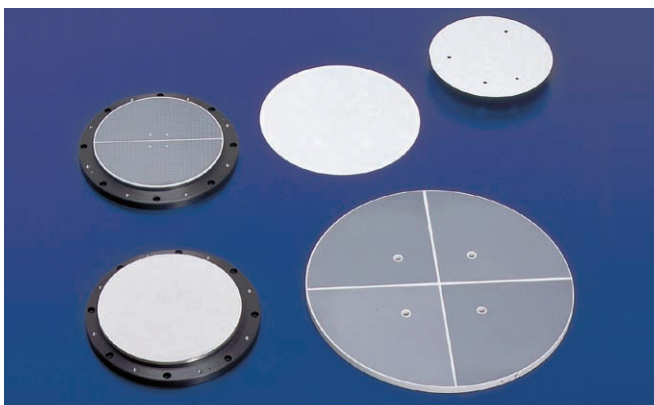
Plasma Proof Dome

- Material : Al_2O_3
- Size : For 200mm / 300mm equipment
- Features : ●High purity
●High plasma durability



Plasma Proof Ring

- Material : Al_2O_3 , Y_2O_3
- Size : For 200mm / 300mm equipment
- Features : ●High purity
●High plasma durability



Electro-Static Chuck

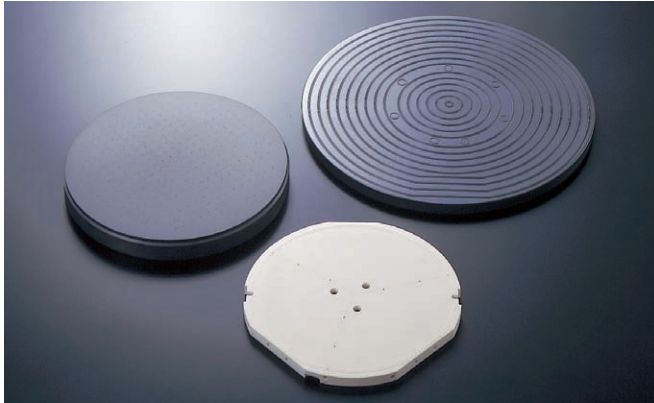
- Material : Al_2O_3 , AlN , Sapphire
- Size : For 200mm / 300mm equipment
- Features : ●High purity
●High plasma durability
●Good chucking / de-chucking response
●High temp. and low temp. application



Heater

- Material : AlN
- Size : For 200mm / 300mm equipment
- Features : ●High purity
●High plasma durability
●Uniform thermal distribution

DEVICE MANUFACTURING PROCESS



Vacuum Chuck

- Material : Al₂O₃, Porous Al₂O₃, SiC
- Size : For 200mm / 300mm equipment
- Features :
 - High purity
 - High chemical durability
 - Vacuum channel inside
 - Variety surface shape



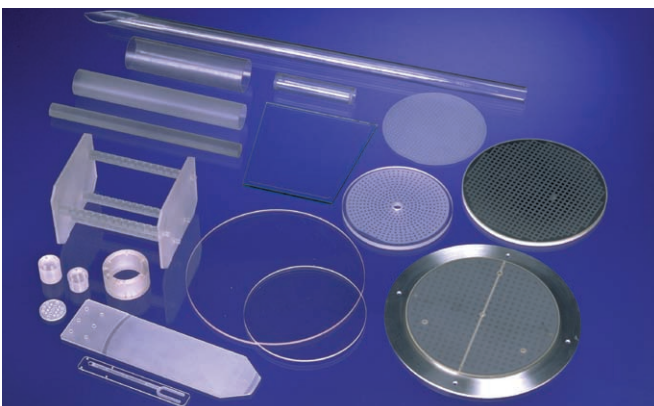
Nozzle

- Material : Al₂O₃
- Size : Nozzle diameter +/-5 μm
- Features :
 - High plasma durability
 - Gas flow rate control



End Effector

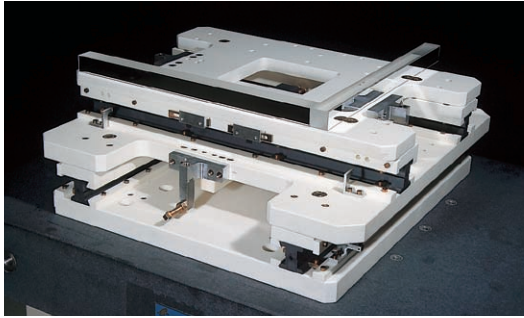
- Material : Al₂O₃, SiC, Sapphire
- Size : For 200mm / 300mm equipment
- Features :
 - High purity
 - Vacuum channel inside
 - SiC coating
 - Mirror polished surface



Chamber Window & Tube

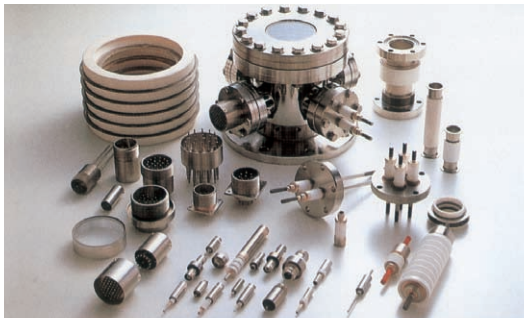
- Material : Sapphire
- Features :
 - High purity
 - High plasma durability
 - Transparent
 - High transmission factor

EPOCH-MAKING TECHNOLOGIES



USM Stage - Assembly Technology

- Material : Al_2O_3 , Al
Non Magnetic Metal, etc.
- Features : ●Ultrasonic Motor drive
●High positioning accuracy
●Compact design



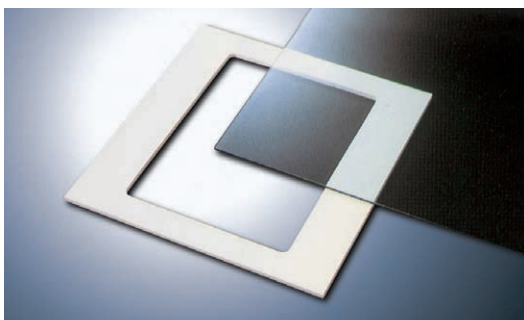
Metalized Products - Metal Assembly Technology

- Material : Al_2O_3 , Al, Stainless steel, etc.
- Application : ●IC Packages
●High vacuum component
●High voltage terminal, etc.



Coating Technology

- Material : SiC, DLC, etc.
- Features : ●Discharge of static electricity
●Soft contact



Large Size Product Manufacturing Technology

- Material : Al_2O_3 , Y_2O_3 , SiC, Si_3N_4
- Application : ●LCD manufacturing equipment
●Lithography equipment



Material Development Technology

example

- Material : Low thermal expansion materials
- Application : ●Lithography equipment
●Wafer Inspection equipment

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