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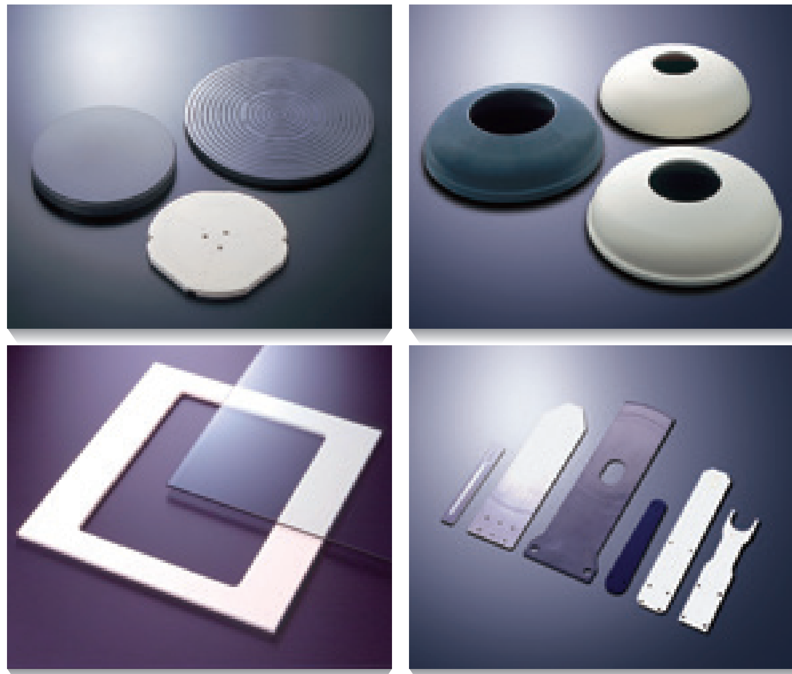

Ceramic Components for Semiconductor Processing

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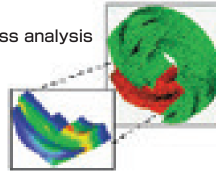
TECHNOLOGY

DESIGN & SIMULATION TECHNOLOGY

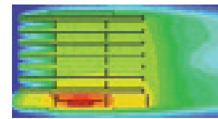
■SUPER COMPUTER

■Thermal conductivity analysis

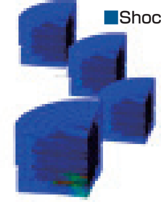
■Stress analysis



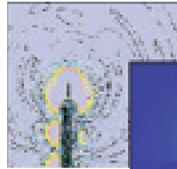
■Fluid thermal analysis

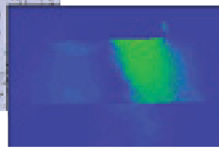


■Shock analysis

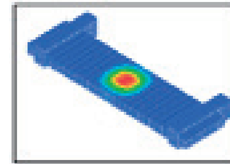


■Electro magnetic field analysis

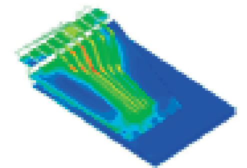




■Piezo electric device vibration analysis



■Electrical analysis

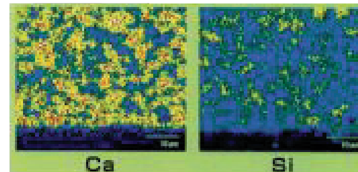


ANALYSIS TECHNOLOGY

■TEM

■XRD

■EPMA



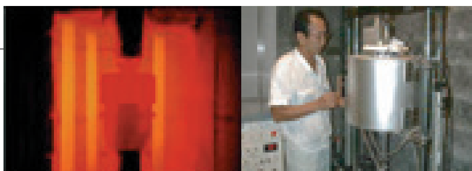
■AFM

EVALUATION TECHNOLOGY

■Electrical evaluation

■Durability evaluation

■Mechanical evaluation



■Thermal friction evaluation

MATERIAL CHARACTERISTICS

Item \ Material	Unit	Measuring Method	Alumina (Al_2O_3)					Sapphire (Al_2O_3)
Material Code			AO479O	AO479S	AO479M AO479G	AO480S	AO601L	SA100
Content (%) Color			99 White	99.5 Ivory	99.5 Ivory	99.7 Ivory	99.9 Ivory	99.99 Transparent
Density	g/cm^3	JIS R1634	3.8	3.9	3.9	3.9	3.9	3.97
Water Absorption	%	JIS C 2141	0	0	0	0	0	0
Vickers Hardness HV9.807N	GPa	JIS R1610	15.2	16.0	15.7	17.2	17.5	a Plane 22.5
Flexural Strength 3 P.B	MPa	JIS R1601	310	400	370	480	500	a Plane c Axis 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	Parallel to Axis c Vertical to Axis c 0.18
Fracture Toughness (SEPB)	MPa･m$^{1/2}$	JIS R1607	3～4	4	4.3	4.3	4.5	2.1
Coefficient of Linear Thermal Expansion 40℃～400℃	X10^{-6}/K	JIS R1618	7.2	7.2	7.2	7.2	7.2	Parallel to Axis c 7.7 Vertical to Axis c 7.0
Coefficient of Linear Thermal Expansion 40℃～800℃	X10^{-6}/K	JIS R1618	8.0	8.0	8.0	8.0	8.0	Parallel to Axis c 8.8 Vertical to Axis c 7.9
Thermal Conductivity 20℃	W/(m･K)	JIS R1611	29	32	32	32	34	42
Specific Heat Capacity	J/(g･K)	JIS R1611	0.79	0.78	0.78	0.79	0.78	0.75
Thermal Shock Temperature Difference (Put in Water,Relative Method)	℃	JIS R1648	150	180	180	180	180	180
Dielectric Strength	kV/mm	JIS C2141	15	15	15	15	15	48
Volume Resistivity 20℃	Ω･cm	JIS C2141	>10^{14}	>10^{14}	>10^{14}	>10^{14}	>10^{14}	>10^{14}
Volume Resistivity 300℃	Ω･cm	JIS C2141	10^{10}	10^{13}	10^{13}	10^{13}	10^{13}	10^{12}
Volume Resistivity 500℃	Ω･cm	JIS C2141	10^{8}	10^{10}	10^{10}	10^{10}	10^{10}	10^{11}
Dielectric Constant (1MHz)	-	JIS C2141	9.9	9.9	9.9	9.9	9.9	Parallel to Axis c 11.5 Vertical to Axis c 9.3
Dielectric Loss Tangent (1MHz)	(X10^{-4})	JIS C2141	2	1	1	1	1	<1
Loss Factor	(X10^{-4})	JIS C2141	20	10	10	10	10	-
Nitric Acid (60%) 90℃, 24H	(Weight Loss) mg/cm^2	-	0.10	0.00	0.01	0.05	0.01	≒0.00
Sulphuric Acid (95%) 95℃, 24H	(Weight Loss) mg/cm^2	-	0.33	0.00	0.00	0.22	0.00	≒0.00
Sodium Hydroxide (30%) 80℃, 24H	(Weight Loss) mg/cm^2	-	0.26	0.00	0.00	0.04	0.01	≒0.00

Item \ Material	Unit	Measuring Method	Silicon Nitride (Si_3N_4)			Silicon Carbide (SiC)		Aluminum Nitride (AIN)		Cordierite ($2MgO \cdot 2AL_2O_3 \cdot 5SiO_2$)		Yttria (Y_2O_2)	Zirconia (ZrO_2)
Material Code			SN201B	SN240O	SN241O	SC211O	SC1000	AN216A	AN2000	CO220O	CO720O	YO100A	ZO201N
Content (%) Color			- Black	- Black	- Black	- Black	- Black	- Gray	99.9 Ivory	- Gray	- Gray	- White	- Ivory
Density	g/cm^3	JIS R1634	3.2	3.3	3.2	3.2	3.16	3.4	3.2	2.5	2.54	4.9	6.0
Water Absorption	%	JIS C 2141	0	0	0	0	0	0	0	0	0	0	0
Vickers Hardness HV9.807N	GPa	JIS R1610	13.9	14.0	13.8	22.0	23.0	10.4	11.2	8.0	8.5	6.0	12.3
Flexural Strength 3 P.B	MPa	JIS R1601	580	1,020	790	600	500	310	220	190	200	130	1,000
Young's Modulus of Elasticity	GPa	JIS R1602	290	300	290	430	440	320	310	140	145	160	200
Poisson's Ratio	-	JIS R1602	0.28	0.28	0.28	0.16	0.17	0.24	0.24	0.31	0.31	0.3	0.31
Fracture Toughness (SEPB)	MPa･m$^{1/2}$	JIS R1607	4～5	7	6～7	4～5	2～3	3.2	2.5	1～1.5	1～1.5	1.1	6
Coefficient of Linear Thermal Expansion 40℃～400℃	X10^{-6}/K	JIS R1618	2.4	2.8	2.9	3.7	3.7	4.6	4.6	1.5(40℃～400℃) 2.1(40℃～800℃)	1.5(40℃～400℃) 2.1(40℃～800℃)	7.2	10.5
Coefficient of Linear Thermal Expansion 40℃～800℃	X10^{-6}/K	JIS R1618	3.2	3.3	3.5	4.4	4.4	5.3	5.2	<|0.05|(23℃) <|0.02|(22℃)	<|0.05|(23℃) <|0.02|(22℃)	7.6	11.0
Thermal Conductivity 20℃	W/(m･K)	JIS R1611	25	27	54	60	200	150	67	4	4	14	3
Specific Heat Capacity	J/(g･K)	JIS R1611	0.64	0.65	0.66	0.67	0.67	0.71	0.72	0.71	0.74	0.45	0.46
Thermal Shock Temperature Difference (Put in Water,Relative Method)	℃	JIS R1648	550	800	900	400	350	250	200	450	400	-	300
Dielectric Strength	kV/mm	JIS C2141	9.7	13	12	-	-	14	16	19.1	19.3	11	11
Volume Resistivity 20℃	Ω･cm	JIS C2141	>10^{14}	>10^{14}	>10^{14}	10^{5}	10^{8}	>10^{14}	>10^{14}	>10^{14}	>10^{14}	>10^{13}	10^{13}
Volume Resistivity 300℃	Ω･cm	JIS C2141	10^{12}	10^{12}	10^{12}	10^{4}	10^{4}	10^{10}	10^{10}	10^{12}	10^{12}	10^{10}	10^{6}
Volume Resistivity 500℃	Ω･cm	JIS C2141	10^{10}	10^{10}	10^{10}	10^{3}	10^{3}	10^{8}	10^{9}	10^{10}	10^{10}	10^{7}	10^{3}
Dielectric Constant (1MHz)	-	JIS C2141	8.9	9.6	9.6	-	-	8.6	8.5	4.9	4.9	11.0	33.0
Dielectric Loss Tangent (1MHz)	(X10^{-4})	JIS C2141	17.0	19	18	-	-	3	2	9	8.5	5	16
Loss Factor	(X10^{-4})	JIS C2141	-	-	-	-	-	26	17	30	35	55	520
Nitric Acid (60%) 90℃, 24H	(Weight Loss) mg/cm^2	-	-	1.11	0.18	0.04	≒0.00	-	-	-	-	-	≒0.00
Sulphuric Acid (95%) 95℃, 24H	(Weight Loss) mg/cm^2	-	-	0	0	0.01	≒0.00	-	-	-	-	-	0.04
Sodium Hydroxide (30%) 80℃, 24H	(Weight Loss) mg/cm^2	-	-	0.22	0.07	≒0.00	≒0.00	-	-	-	-	-	0.08

Unit Conversion Table

1kgf/mm2 = 9.807MPa   1cal/ (cm･sec･℃) = 418.6W/ (m･K)

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.

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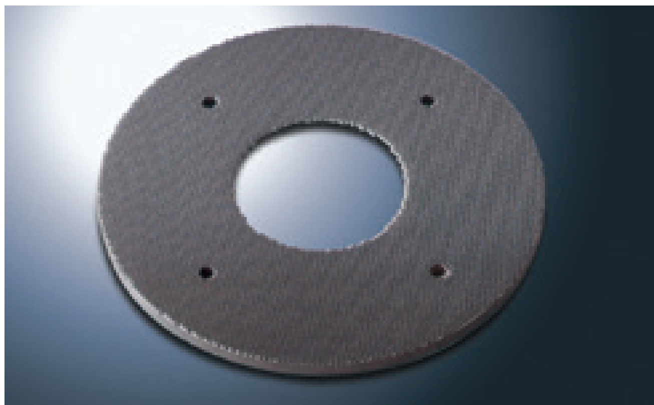
WAFER MANUFACTURING PROCESS

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

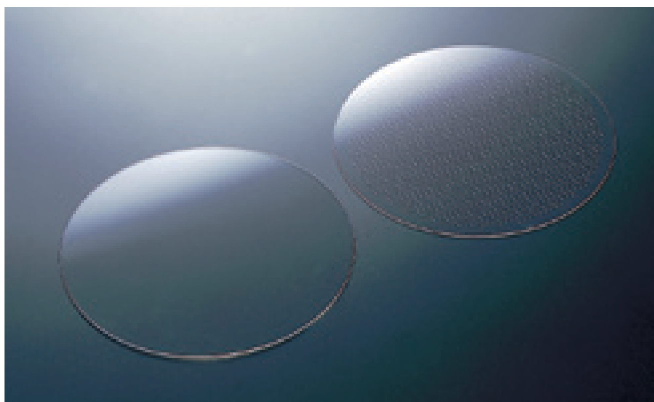
Silicon Carbide Wafer Polishing Plate

- 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

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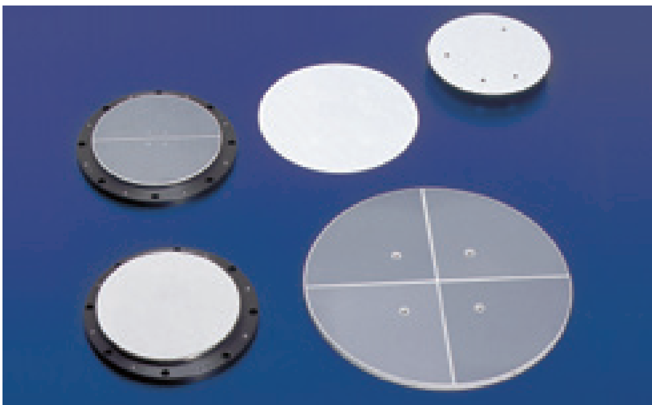
DEVICE MANUFACTURING PROCESS

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



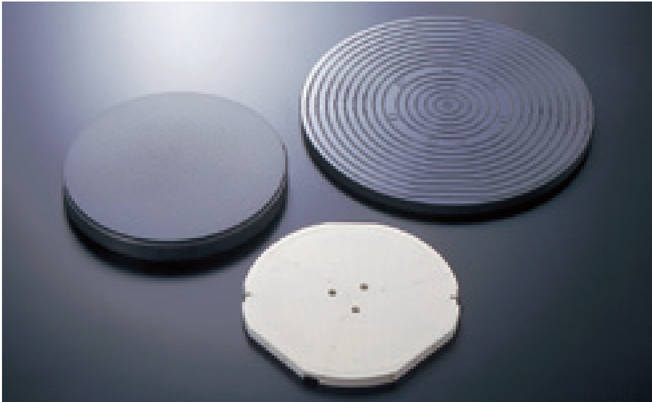
Electro-Static Chuck

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

Heater

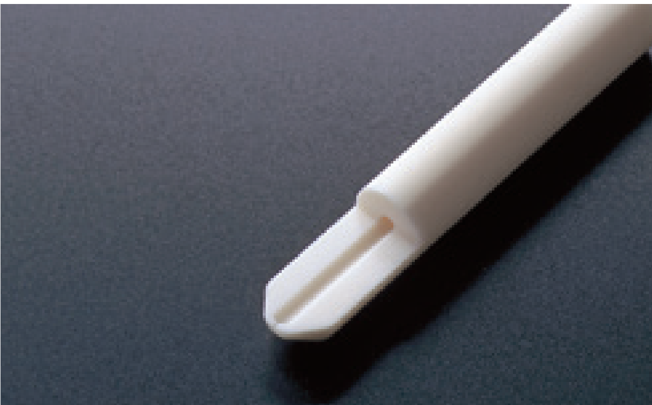
- Material : AIN
- Size : For 200mm / 300mm equipment
- Features : ●High purity
  ●High plasma durability
  ●Uniform thermal distribution

DEVICE MANUFACTURING PROCESS



Vacuum Chuck

- Material : Al_2O_3, Porous Al_2O_3, SiC
- Size : For 200mm / 300mm equipment
- Features : ●High purity
  ●High chemical durability
  ●Vacuum channel inside
  ●Variety surface shape

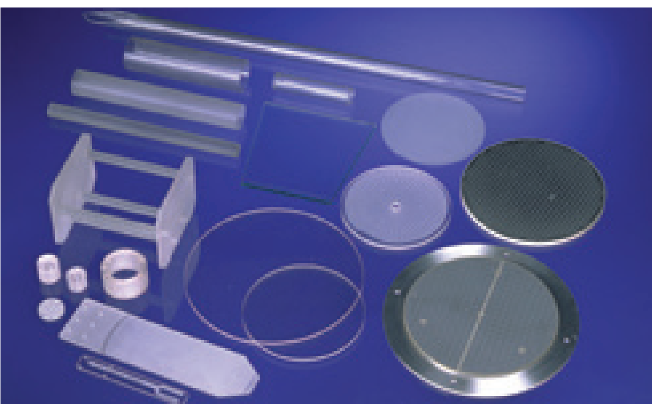


Nozzle

- Material : Al_2O_3
- Size : Nozzle diameter +/-5μm
- Features : ●High plasma durability
  ●Gas flow rate control

End Effector

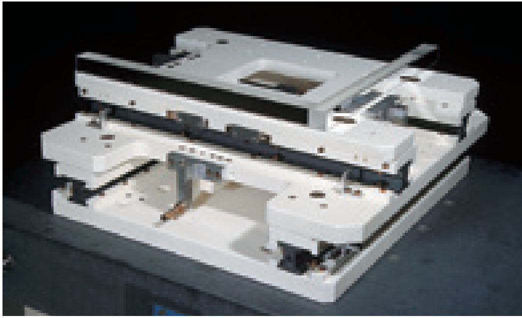
- Material : Al_2O_3, SiC, Sapphire
- Size : For 200mm / 300mm equipment
- Features : ●High purity
  ●Vacuum channel inside
  ●SiC coating
  ●Mirror polished surface



Chamber Window & Tube

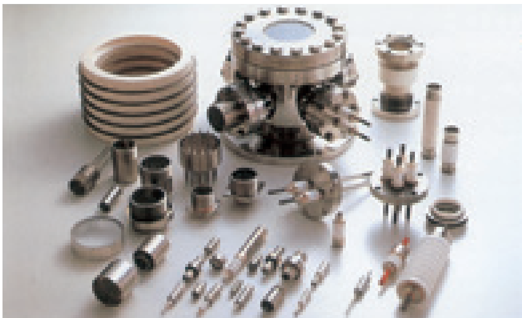
- Material : Sapphire
- Features : ●High purity
  ●High plasma durability
  ●Transparent
  ●High transmission factor

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

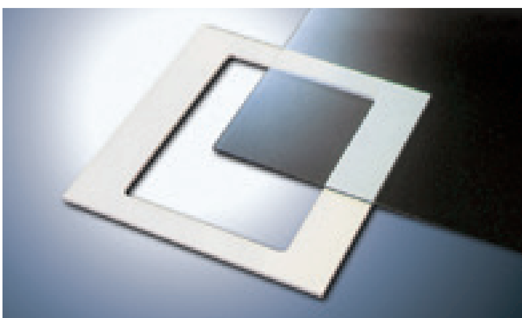


Metalized Products - Metal Assembly Technology

- 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

KYOCERA Corporation

Corporate Fine Ceramics Group

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

Product Inquiries→

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