

Characteristic

Material			Alumina	Alumina	Alumina	Alumina	Alumina	
Nishimura No.			N-92	N-96	N-6H	N-9H	N-99	
Property			Al ₂ O ₃ 92%	Al ₂ O ₃ 96%	Al ₂ O ₃ 96%	Al ₂ O ₃ over 99.7%	Al ₂ O ₃ over 99.7%	
Color			White	White	White	Cream	Cream	
Bulk density	g/cm ³	JIS R1634	3.6	3.7	3.7	3.9	3.9	
Water absorption	%	JIS R1634	0	0	0	0	0	
Mechanical Properties	Vickers hardness	GPa	JIS R1610	15.7	15.7	15.7	16	16
	Flexural strength	MPa	JIS R1601	340	350	350	390	390
	Compressive strength	MPa	JIS R1608	2350	2450	2450	2940	2940
	Tensile strength	MPa	JIS R 1606	120	150	150	170	170
	Fracture toughness(SEPB)	MPa·m ^{1/2}	JIS R1607	—	—	—	—	—
Electrical Properties	Volume resistivity	Ω·cm	JIS C2141	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴
	Dielectric constant(1MHz)		JIS C2141	8.5	9	9	9.3	9.3
	Dielectric loss tangent(1MHz)		JIS C2141	3.5 × 10 ⁻⁴	3.6 × 10 ⁻⁴	3.6 × 10 ⁻⁴	3.7 × 10 ⁻⁴	3.7 × 10 ⁻⁴
	Dielectric strength	kV/mm	JIS C2141	20	30	30	40	40
	Te value	°C		1000	1100	1100	1100	1100
Thermal Properties	Thermal expansion coefficient	10 ⁻⁶ /°C	JIS R1608	7.5	7.7	7.7	8	8
	Thermal conductivity	W/m·K	JIS R1611	16.7	21.8	21.8	39	31.4
	Max. operation temperature	°C		1200	1200	1200	1200	1200
Strong Point			Heat resistant Abrasion/Wear resistant	Heat resistant Abrasion/Wear resistant	Excellent thermal radiation Wear resistant	Excellent thermal radiation Wear resistant	Heat resistant Wear resistant	
Usefulness			Insulator	Circuit board, Electronic parts Shaft	Heat sink material Electronic parts	Heat sink material Electronic parts	Electronic, Machine parts Semiconductor device	

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Characteristic

Material				Alumina	Alumina	Alumina	Alumina
Nishimura No.				N-999	N-999S	N-9000NS	N-9000T
Property				Al ₂ O ₃ over 99.9%	Al ₂ O ₃ over 99.9%	Al ₂ O ₃ over 99.95%	Al ₂ O ₃ over 99.95%
Color				White	Cream	Translucent	White
Bulk density		g/cm ³	JIS R1634	3.93	3.97	3.98	3.95
Water absorption		%	JIS R1634	0	0	0	0
Mechanical Properties	Vickers hardness		GPa	JIS R1610	17.6	21.37	18.8
	Flexural strength		MPa	JIS R1601	490	500	750
	Compressive strength		MPa	JIS R1608	3200	2500	3655
	Tensile strength		MPa	JIS R 1606	175	—	213
	Fracture toughness(SEPB)		MPa·m ^{1/2}	JIS R1607	—	—	—
Electrical Properties	Volume resistivity		Ω·cm	JIS C2141	>10 ¹⁴	>10 ¹⁴	2.0×10 ¹⁶ (20~100°C)
	Dielectric constant(1MHz)			JIS C2141	9.7	—	10
	Dielectric loss tangent(1MHz)			JIS C2141	4×10 ⁻⁴	—	1×10 ⁻⁴
	Dielectric strength		kV/mm	JIS C2141	40	40	>10
	Te value		°C		1100	—	1000
Thermal Properties	Thermal expansion coefficient		10 ⁻⁶ /°C	JIS R1608	8	7.84	8.18
	Thermal conductivity		W/m·K	JIS R1611	28.9	33.4	37
	Max. operation temperature		°C		1200	1200	1200
Strong Point				Wear resistant Plasma resistant	Wear resistant Plasma resistant	Translucent Plasma resistant Wear resistant Very small crystal	High-reflectivity Ultraviolet resistant
Usefulness				Antifriction parts Plasma resistance parts	Antifriction parts Plasma resistance parts	LED circuit board Precision parts Substitution of Sapphire pipe, window application	Optical reflector

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Characteristic

Material			Alumina (Black)	Alumina (Black)	Porous Alumina	Porous Alumina	Zirconia
Nishimura No.			N-92D	N-9B	R-200	N-99EP	N-650
Property			Al ₂ O ₃	Al ₂ O ₃	Al ₂ O ₃	Al ₂ O ₃	(Tosoh) ZrO ₂
Color			Black	Black	White	White	Milky White
Bulk density	g/cm ³	JIS R1634	3.6	3.8	1.5	2.5	6.05
Water absorption	%	JIS R1634	0	0	35	14	0
Mechanical Properties	Vickers hardness	GPa	—	10.5			12.3
	Flexural strength	MPa	300	330		200	1200
	Compressive strength	MPa	1550	2600			—
	Tensile strength	MPa	120	160			—
	Fracture toughness (SEPB)	MPa·m ^{1/2}	JIS R1607	—	—		
Electrical Properties	Volume resistivity	Ω·cm	>10 ¹⁴	>10 ¹⁴			>10 ¹²
	Dielectric constant (1MHz)		8.5	8.5			33
	Dielectric loss tangent (1MHz)		3.5 × 10 ⁻⁴	3.5 × 10 ⁻⁴			16 × 10 ⁻⁴
	Dielectric strength	kV/mm	10	10			11
	Te value	°C	700	1000			—
Thermal Properties	Thermal expansion coefficient	10 ⁻⁶ /°C	8.5	8.2			9.09
	Thermal conductivity	W/m·K	16.7	22			3
	Max. operation temperature	°C	1300	1000	1100		1100
Strong Point					Pore size 1.4 μm Porosity 55.0%	Pore size 0.1 μm Porosity 35.0%	Wear resistant Fracture toughness
Usefulness			Electrical parts Optical parts	Electrical parts Optical parts	Vacuum Chuck Filter	Filter Bubble generator	Cutters Machine parts

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Characteristic

Material			Zirconia	Zirconia(Black)	Zirconia	Yttria	Aluminum nitride	
Nishimura No.			N-650H	N-650B	N-631	N-100Y	AlN-170	
Property			(Tosoh) ZrO ₂	(Tosoh) ZrO ₂	ZrO ₂ ·Al ₂ O ₃	Y ₂ O ₃	AlN	
Color			Gray	Black	Brown	White	Gray	
Bulk density	g/cm ³	JIS R1634	6.07	6	5.7	4.9	3.3	
Water absorption	%	JIS R1634	0	0	0	0	0	
Mechanical Properties	Vickers hardness	GPa	JIS R1610	12.7	12	12.5	6	10
	Flexural strength	MPa	JIS R1601	1700	1200	874	122	350
	Compressive strength	MPa	JIS R1608	—	—	—	—	270
	Tensile strength	MPa	JIS R 1606	—	—	—	—	—
	Fracture toughness(SEPB)	MPa·m ^{1/2}	JIS R1607	5~6	5~6	9.2	—	—
Electrical Properties	Volume resistivity	Ω·cm	JIS C2141	—	>10 ⁸	—	>10 ¹⁴	>10 ¹⁴
	Dielectric constant(1MHz)		JIS C2141	—	—	—	11.4	8.8
	Dielectric loss tangent(1MHz)		JIS C2141	—	—	—	—	5 × 10 ⁻⁴
	Dielectric strength	kV/mm	JIS C2141	—	—	—	—	—
	Te value	°C		—	—	—	—	—
Thermal Properties	Thermal expansion coefficient	10 ⁻⁶ /°C	JIS R1608	—	9.09	9.26	—	4.5
	Thermal conductivity	W/m·K	JIS R1611	3	3	—	11.4	170
	Max. operation temperature	°C		1100	1100	—	—	—
Strong Point			Wear resistant Fracture toughness	Wear resistant Fracture toughness	Highest Fracture Toughness	Corrosion resistant	Excellent thermal conductivity	
Usefulness			Cutters Machine parts	Cutters Machine parts	Smart phone parts	Semiconductor, Plasma resistance parts	Semiconductor devices High heat conduction parts	

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Characteristic

Material			Aluminum titanate	Forsterite	Forsterite(Black)	Steatite	Steatite(Black)
Nishimura No.			N-420	N-75	FB-10	N-68	N-6805B
Property			$\text{Al}_2\text{O}_3 \cdot \text{TiO}_2$	Mg_2SiO_4	Mg_2SiO_4	$\text{MgO} \cdot \text{SiO}_2$	$\text{MgO} \cdot \text{SiO}_2$
Color			Gray	Light yellow	Dark brown	White	Black
Bulk density	g/cm ³	JIS R1634	3.3	3	3.2	2.7	2.8
Water absorption	%	JIS R1634	<2.0	0	0	0	0
Mechanical Properties	Vickers hardness	GPa	—	—	8.19	7.5	—
	Flexural strength	MPa	39	150	187	118	120
	Compressive strength	MPa	176	—	—	550	560
	Tensile strength	MPa	JIS R 1606	—	—	59	60
	Fracture toughness(SEPB)	MPa·m ^{1/2}	JIS R1607	—	—	1.3	—
Electrical Properties	Volume resistivity	$\Omega \cdot \text{cm}$	JIS C2141	—	—	$>10^{13}$	$>10^{13}$
	Dielectric constant(1MHz)		JIS C2141	—	6.5	—	6
	Dielectric loss tangent(1MHz)		JIS C2141	—	3×10^{-4}	—	5×10^{-4}
	Dielectric strength	kV/mm	JIS C2141	>10	—	>10	10
	Te value	°C		—	—	—	640
Thermal Properties	Thermal expansion coefficient	$10^{-6}/^\circ\text{C}$	JIS R1608	0.7	9.7	11.1	7.8
	Thermal conductivity	W/m·K	JIS R1611	1.5	3.4	5.9	2.5
	Max. operation temperature	°C		1500	1000	1000	1200
Strong Point			Low-thermal expansion Thermal shock residence	High-thermal expansion Glass bond ability	High-thermal expansion Glass bond ability		
Usefulness			Thermal shock resistant parts Aluminum	High frequency insulation parts	Parts for optical instrument	Low frequency insulation parts	Low frequency insulation parts

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Characteristic

Material			β -spodumene	Zircon	Zircon	Zircon	Zircon
Nishimura No.			N-10J	N-300	N-330	N-370	N-37C
Property			$\text{LiO}_2 \cdot \text{Al}_2\text{O}_3 \cdot \text{SiO}_2$	ZrSiO_4	ZrSiO_4	ZrSiO_4	ZrSiO_4
Color			White	White	White	Brown	White
Bulk density	g/cm ³	JIS R1634	2.2	3.2	2.8	2.8	3.6
Water absorption	%	JIS R1634	<1.0	<0.1	<7	12~15	<1
Mechanical Properties	Vickers hardness	GPa	JIS R1610	1.4	—	—	—
	Flexural strength	MPa	JIS R1601	80	100	25	25
	Compressive strength	MPa	JIS R1608	200	353	39.2	67.7
	Tensile strength	MPa	JIS R 1606	20	68.6	12.7	12.2
	Fracture toughness(SEPB)	MPa·m ^{1/2}	JIS R1607	—	—	—	—
Electrical Properties	Volume resistivity	$\Omega \cdot \text{cm}$	JIS C2141	$>10^{13}$	$>10^{13}$	$>10^{13}$	$>10^{13}$
	Dielectric constant(1MHz)		JIS C2141	5.3	8	7.5	6.3
	Dielectric loss tangent(1MHz)		JIS C2141	4.8×10^{-4}	2.2×10^{-4}	3.8×10^{-4}	5.4×10^{-4}
	Dielectric strength	kV/mm	JIS C2141	5~10	15	2	—
	Te value	°C		500	850	600	570
Thermal Properties	Thermal expansion coefficient	$10^{-6}/\text{°C}$	JIS R1608	0.4~0.5 (20~25°C)	3.2	3.0	4.8
	Thermal conductivity	W/m·K	JIS R1611	2	7	5.5	5
	Max. operation temperature	°C		1100	1200	1200	1100
Strong Point			Heat resistant Thermal shock resistant	Thermal shock resistance Great Arc-proof	Thermal shock resistance Great Arc-proof	Far infrared heater	Thermal shock resistant
Usefulness			Heat resistance parts Thermal shock resistance parts	Lateral plate Arc barrier	Lateral plate Arc barrier	Far infrared heater	Thermal shock resistant parts

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Characteristic

Material			Zircon Cordierite	Cordierite	Cordierite	Mullite	
Nishimura No.			N-32	N-23S	N-53	N-800	
Property			$ZrO_2 \cdot SiO_2 - 2MgO \cdot 2Al_2O_3 \cdot 5SiO_2$	$2MgO \cdot 2Al_2O_3 \cdot 5SiO_2$	$2MgO \cdot 2Al_2O_3 \cdot 5SiO_2$	$3Al_2O_3 \cdot 2SiO_2$	
Color			White	White	Gray	White	
Bulk density	g/cm ³	JIS R1634	3.6	2.2	2.7	2.7	
Water absorption	%	JIS R1634	<1	<0.5	0	<0.01	
Mechanical Properties	Vickers hardness	GPa	JIS R1610	—	1.4	7.5	9.8
	Flexural strength	MPa	JIS R1601	120	120	120	180
	Compressive strength	MPa	JIS R1608	400	566	1022	1200
	Tensile strength	MPa	JIS R 1606	80	35	59	130
	Fracture toughness(SEPB)	MPa·m ^{1/2}	JIS R1607	—	—	—	—
Electrical Properties	Volume resistivity	Ω·cm	JIS C2141	>10 ¹³	>10 ¹³	>10 ¹³	>10 ¹³
	Dielectric constant(1MHz)		JIS C2141	6.5	4	4	6.5
	Dielectric loss tangent(1MHz)		JIS C2141	5 × 10 ⁻⁴	4 × 10 ⁻⁴	5 × 10 ⁻⁴	3.7 × 10 ⁻⁴
	Dielectric strength	kV/mm	JIS C2141	6	7	10	10~20
	Te value	°C		450	500	640	650
Thermal Properties	Thermal expansion coefficient	10 ⁻⁶ /°C	JIS R1608	3.5	2.8	2.6	5.3
	Thermal conductivity	W/m·K	JIS R1611	1.3	1.25	2.5	4.2
	Max. operation temperature	°C		1200	1200	1200	1200
Strong Point			Thermal shock resistant	Low-thermal expansion Thermal shock resistant	Thermal shock resistance Low-thermal expansion	Thermal shock resistance Electric insulation	
Usefulness			Thermal shock resistant parts Circuit breaker	Parts for semiconductor devices Low-thermal expansion parts	Thermal shock resistant parts Low-thermal expansion parts	Thermal shock resistant parts	

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Characteristic

Material			Ordinary porcelain	
Nishimura No.			N-04	
Property			SiO ₂ ·Al ₂ O ₃	
Color			White	
Bulk density	g/cm ³	JIS R1634	2.3	
Water absorption	%	JIS R1634	<0.01	
Mechanical Properties	Vickers hardness	GPa	JIS R1610	—
	Flexural strength	MPa	JIS R1601	80
	Compressive strength	MPa	JIS R1608	300
	Tensile strength	MPa	JIS R 1606	20
	Fracture toughness(SEPB)	MPa·m ^{1/2}	JIS R1607	—
Electrical Properties	Volume resistivity	Ω·cm	JIS C2141	>10 ¹³
	Dielectric constant(1MHz)		JIS C2141	5.9
	Dielectric loss tangent(1MHz)		JIS C2141	5.3×10 ⁻⁴
	Dielectric strength	kV/mm	JIS C2141	10
	Te value	°C		300
Thermal Properties	Thermal expansion coefficient	10 ⁻⁶ /°C	JIS R1608	6.7
	Thermal conductivity	W/m·K	JIS R1611	1.7
	Max. operation temperature	°C		1200
Strong Point				
Usefulness			Electric insulation parts Insulator	

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