

Properties of ceramic materials

Non-Oxide Ceramics (Nitride + Carbide)

Oxide Ceramics

Material		CeSinit Si ₃ N ₄	CeSinit Si ₃ N ₄	CeSinit Si ₃ N ₄	CeSinit Si ₃ N ₄	CeSinit electr. cond.	AlN Alunitr.	BN Bornitr.	SSiC α-SiC	SSiC with Graphite	SiSiC Si-infiltr.	Al ₂ O ₃ 99.5%	AZ90 Al ₂ -ZrO ₂	ZrO ₂ Y ₂ O ₃
Type		CS14	CS40	CS40H	CS45	CS30	CS95	CS90	CS10	CS10G	CS11	CS20	CS19	CS15
Colour		grey	black	black	black	brown	light grey	whitish	black	black	black	yellowy	white	ivory
Microstructure														
Density	[g/cm ³]	3.2	3.23	3.24	3.24	3.95	3.3	1.9	3.15	3.02	3.1	3.9	4.05	6.05
Porosity	[Vol.%]	<1	<1	<0.1	<0.5	<1	<1	15	<2	<3	0	<1	<1	<1
Gas Permeability	[Vol.%]	0	0	0	0	0	0	>5	0	0	0	0	0	0
Water Absorption	[Vol.%]	0	0	0	0	0	0	-	0	0	0	0	0	0
Mechanical Properties														
Compressive Strength	[MPa]	3'000	3'000	3'000	3'000	3'000	2'000	40	3'000	2'500	2'000	3'000	2'500	2'300
Flexural Strength σ at 20°C	[MPa]	750	850	900	900	700	300	20	400	250	300	350	400	900
Flexural Strength σ at 800°C	[MPa]	750	850	900	900	700	280	-	400	250	300	315	360	360
Weibull-Modulus m		>17	>20	25	25	>25	10	>19	13	14	11	12	15	>15
Fracture Toughness K _{IC}	[MPa√m]	8	8.5	9	9	9	3.2	-	4	3.5	3.5	4	4.5	10
Young's Modulus E	[GPa]	310	320	320	320	340	310	15	400	390	330	380	360	200
Poisson Ratio ν		0.28	0.28	0.28	0.28	0.28	0.20	0.12	0.16	0.16	0.20	0.20	0.20	0.30
Hardness Vickers (HV 1)	[GPa]	15	16	17	17	14	11	-	25	24	23	17	16	12
Thermal Properties														
Maximum Temperature														
· Inert Gas	[°C]	1'200	1'200	1'200	1'200	1'200	1'200	2'300	1'900	1'900	1'350	1'700	1'600	1'000
· Air	[°C]	1'100	1'100	1'100	1'100	550	1'200	1'100	1'650	1'000	1'350	1'700	1'600	1'000
Thermal Conductivity λ at 20°C	[W/mK]	25	28	25	25	45	180	25	125	110	130	30	20	2
Thermal Expansion α at 20–100°C	[10 ⁻⁶ /K]	2	2	2	2	3.5	3.6	0	3	3	3.3	6.5	6.8	9
Thermal Expansion α at 20–1000°C	[10 ⁻⁶ /K]	3.5	3.5	3.5	3.5	5.5	5.6	-0.15	5	5	5.5	8.5	8.8	11
Thermal Shock parameter R ₁ ¹⁾	[K]	600	700	730	730	360	160	>1200	210	130	170	100	120	310
Thermal Shock parameter R ₂ ²⁾	[W/mm]	15	19	18	18	16	29	>30	26	14	22	3	2.5	0.5
Electrical Properties														
Resistivity at 20°C	[Ωcm]	10 ¹²	10 ¹²	10 ¹²	10 ¹²	10 ⁻³	10 ¹⁴	10 ¹²	10 ⁵	10 ⁴	10 ⁻¹	10 ¹⁴	10 ¹²	10 ¹⁰
Resistivity at 800°C	[Ωcm]	10 ⁷	10 ⁷	10 ⁷	10 ⁷	-	-	-	10 ⁻¹	-	10 ⁻²	10 ^{>8}	10 ^{>8}	10 ⁴
Dielectric constant	1 MHz	6	7	7	7	-	9	4	-	-	-	10	11	29

¹⁾ Critical temperature difference for an infinite high heat transfer (quenching experiments) $R_1 = \frac{\sigma(1-\nu)}{E\alpha}$

²⁾ Thermal shock coefficient at finite constant heat transfer (slowly heating) $R_2 = \frac{\sigma(1-\nu)}{E\alpha} \lambda$

All indications are to be considered as mean values for a simple comparison between the various materials.



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