

FCT Si₃N₄ Special Materials

<i>FCT-Denotation</i>	SN-Pu	SN-TC	SN-EL	SN-ZrO
Material	High Purity Si ₃ N ₄	High Thermal Conductive Si ₃ N ₄	Electrical Conductive / Semi-conductive Si ₃ N ₄	Low Melt Adhesion / Corrosion-Resistant Si ₃ N ₄
Process	Hot Isostatic Pressed / Hot Pressed	Gas Pressure Sintered / Hot Pressed	Gas Pressure Sintered / Hot Pressed	Gas Pressure Sintered
Color	Grey	Grey / Black	Golden Black	Greyish Silver
Geometry	Three-Dimensional / Planar Components	Three-Dimensional / Planar Components	Three-Dimensional / Planar Components	Three-Dimensional Components
Maximum size	Ø 250 mm, Length 680 mm / Ø 400 mm, Thickness 75 mm	Ø 610 mm, Length 1500 mm / Ø 400 mm, Thickness 75 mm	Ø 610 mm, Length 1500 mm / Ø 400 mm, Thickness 75 mm	Ø 610 mm, Length 1500 mm
Application	Mechanical Engineering, Bearing Applications, Solar and Semiconductor Technology, Chemical Plant Engineering and Construction, Air and Space Applications	Mechanical Engineering, Bearing Applications, Foundry Technology, Solar and Semiconductor Technology, Chemical Plant Engineering and Construction, Air and Space Applications	Mechanical Engineering, Foundry Technology, Chemical Plant Engineering and Construction, Air and Space Applications	Foundry Technology, Chemical Plant Engineering and Construction
General Properties				
Chemical Composition	Si ₃ N ₄	Si ₃ N ₄	Si ₃ N ₄ / TiN	Si ₃ N ₄ / ZrO ₂
Sinter Additives / Fibre Content	RE ₂ O ₃ / Al ₂ O ₃	RE ₂ O ₃ / MgO	RE ₂ O ₃ / Al ₂ O ₃	RE ₂ O ₃ / Al ₂ O ₃
Density ρ [1] (%)	3.18 – 3.22	3.26 – 3.42	3.55 – 3.88	3.35 – 3.56
Residual Porosity (%)	< 0.5	< 0.5	< 0.2	< 0.5
Open Porosity Thereof (%)	0	0	0	0
Grain Size (Length) (µm)	1 – 10	1 – 10	1 – 10	1 – 15
Mechanical Properties				
Compressive Strength (MPa)	3000	3000	3000	3000
Bending Strength σ _{RT} [2] (MPa)	700 – 900	750 – 1100	630 – 720	540 – 580
Weibull-Modulus m	20 – 15	> 12	> 12	25
Youngs Modulus E (GPa)	320	300	310 – 350	190 – 290
Hardness HV [3] (GPa)	16.0	16.0	13.7 – 16.6	13 – 15
Fracture Toughness K _{Ic} [4] (MPam ^{1/2})	6.5 – 6.0	8.5 – 7.5	6.0	5.8 – 6.3
Poissons Ratio ν	0.26	0.26	0.26	0.26
Thermal Properties				
Maximum Working Temperatures				
– Inert Atmosphere (°C)	1500	1500	1000	1200
– Oxidising Atmosphere (°C)	1300	1300	800	1400
Specific Heat Capacity (J/kgK)	720	700	700	–
Thermal Conductivity λ (20°C) (W/mK)	30	85 – 65	21	25
Coefficient of Thermal Expansion	RT-1000 °C (10 ⁻⁶ K ⁻¹)	3.2	3.3	4.7
	RT- 250 °C (10 ⁻⁶ K ⁻¹)	1.6	1.7	2.1 – 2.3
	RT ± 20 °C (10 ⁻⁶ K ⁻¹)	1.3	1.4 – 1.5	1.9 – 2.1
Thermal Shock Parameter R ₁ [5] (K)	614	580 – 860	360 – 380	460 – 660
Thermal Shock Parameter R ₂ [6] (W/m)	18428	49800 – 55860	7600 – 7900	11560 – 16430
Electrical Properties				
Electrical Resistivity (RT) Ωcm	–	–	10 ¹ – 10 ⁻⁵	–
Dielectric Constant (1 MHz)	–	8	–	–

RT = Room Temperature

[1] Determination of density and porosity according to DIN 623-2

[2] Average value of 4-point bending strength at room temperature according to DIN EN 843-1

[3] Hardness according to DIN EN 843-4

[4] Calculated from crack length derived from Vickers hardness indentation, according to Niihara

[5] Critical temperature difference for an infinite high heat transfer (quenching)

[6] Thermal shock coefficient at finite constant heat transfer (slowly heating)

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The material characteristics listed above are measured at testing samples. They cannot be transferred to components with different size, shape or surface properties. We reserve the right to alter properties within the scope of technical progress or new developments.

Further special Si₃N₄ grades are available on demand. We also tailor your specific material solution !