

Material Data Sheet for Hot Isostatic Pressed Silicon Nitride

1. Material

FCT Denotation	SN-HIP
Material Description	Hot Isostatic Pressed Silicon Nitride

2. General Properties

Chemical Composition	Si ₃ N ₄ (wt.-%)	92 - 97
	RE ₂ O ₃ /Al ₂ O ₃ (wt.-%)	3 - 8

Bulk Density	ρ	[1]	(g/cm ³)	3.18 - 3.26
Residual Porosity			(%)	< 0.2
Open Porosity			(%)	0
Grain Size (Longitudinal Direction)			(μ m)	1 - 15

3. Mechanical Properties

Hardness		[2]	(GPa)	15.3 - 15.6
Compressive Strength			(MPa)	3000
Bending Strength	σ	[3]	(MPa)	760 - 880
Weibull-Modulus	m			20 - 10
Fracture Toughness	K_{Ic}	[4]	(MPa ^{1/2})	6.5 - 6.2
Youngs Modulus	E		(GPa)	300 - 310
Poisson Ratio	ν			0.26

4. Thermal Properties

Max. Working Temperature				
- Inert Atmosphere			(°C)	1400
- Air			(°C)	1200
Specific Heat Capacity			(J/kgK)	600
Thermal Conductivity	λ (20°C)		(W/mK)	21
Coeff. of Thermal Expansion α RT-1000°C			(10 ⁻⁶ K ⁻¹)	3.2
Coeff. of Thermal Expansion α RT \pm 20°C			(10 ⁻⁶ K ⁻¹)	1.3
Thermal Shock Parameter	R_1	[5]	(K)	590 - 660
Thermal Shock Parameter	R_2	[6]	(W/m)	12.390 - 13.860

5. Specific Properties

Electrical Resistance (20 °C)			(Ω cm)	10 ¹⁴
-------------------------------	--	--	----------------	------------------

[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 $R_1 = \frac{\sigma(1-\nu)}{E\alpha}$

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

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

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.