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_3N_4 (wt.-%)	92 - 97
			RE_2O_3/Al_2O_3 (wt.-%)	3 - 8
Bulk Density	ρ	[1]	(g/cm³)	3.18 - 3.26
Residual Porosity			(%)	< 0.2
Open Porosity			(%)	0
Grain Size (Longitudinal Direction)			(µm)	1 - 15

3. Mechanical Properties

Hardness		[2]	(GPa)	15.3 - 15.6
Compressive Strength			(MPa)	3000
Bendig Strength	σ	[3]	(MPa)	760 - 880
Weibull-Modulus	**m**			20 - 10
Fracture Toughness	$\mathbf{K_{Ic}}$	[4]	($MPam^{1/2}$)	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 ± 20°C		($10^{-6}K^{-1}$)	1.3
Thermal Shock Parameter	$\mathbf{R_1}$	[5]	(K)	590 - 660
Thermal Shock Parameter	$\mathbf{R_2}$	[6]	(W/m)	12.390 - 13.860

5. Specific Properties

Electrical Resistance (20 °C)	(Ωcm)	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

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

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

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

$$R_2 = \frac{\sigma(1-\nu)}{E\alpha}\lambda$$

The material characterisitics listed above are measured at testing samples. They cannot be transfered 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.