



# Silicon Nitride PCSN4000

## General Properties

Silicon Nitride is a lightweight and tough material with good thermal shock properties and high hardness values. It is particularly suitable for any application needing a fracture tough, hard and light material that can be used at elevated temperatures.

Like most technical ceramics, silicon nitride shrinks when sintered and in most applications needs to be ground to remove the outer skin, but as most uses are for tight tolerance components, diamond grinding is usually required in any case.

Silicon Nitride is seen as part of a group of materials with good fracture toughness. Other materials such as Zirconia don't have the high temperature characteristics of silicon nitride.

See our interactive material comparison table for more information – [www.precision-ceramics.co.uk](http://www.precision-ceramics.co.uk).

## Typical Applications

- Aerospace Applications
- Bearing Applications
- Chemical Plant Engineering & Construction
- Engine Wear Parts
- Foundry Applications
- Mechanical Engineering
- Medical Components

*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)*

*The material characteristics listed above are measured with 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.*

## Typical Properties

PCSN4000			
Process	Extruded Gas Over-Pressure Sintered		
Colour	Black		
Geometry	High Aspect Ratio Components		
General Properties			
Chemical Composition	Si <sub>3</sub> N <sub>4</sub>		
Sinter Additives	RE <sub>2</sub> O <sub>3</sub> / Al <sub>2</sub> O <sub>3</sub>		
Density ρ	[1]	g/cm <sup>3</sup>	3.23
Residual Porosity		(%)	<1
Open Porosity		(%)	0
Grain Size (Diameter)		(µm)	1 - 15
Mechanical Properties			
Compressive Strength		(MPa)	3000
Bending Strength σ RT	[2]	(MPa)	850
Weibull-Modulus m			18
Youngs Modulus E		(GPa)	>20
Hardness HV	[3]	(GPa)	16
Fracture Toughness K <sub>IC</sub>	[4]	(MPam <sup>1/2</sup> )	8.5
Poissons Ratio ν			0.28
Thermal Properties			
Maximum Working Temperatures			
- Inert Atmosphere		(°C)	1400
- Oxidizing Atmosphere		(°C)	1200
Specific Heat Capacity		(J/kgK)	700
Thermal Conductivity λ (20°C)		(W/mK)	28
Coefficient of Thermal Expansion	RT-1000°C	(10 <sup>-6</sup> K <sup>-1</sup> )	3.2
	RT- 250°C	(10 <sup>-6</sup> K <sup>-1</sup> )	1.9
	RT ± 20°C	(10 <sup>-6</sup> K <sup>-1</sup> )	1.3
Thermal Shock Parameter R <sub>1</sub>	[5]	(K)	700
Thermal Shock Parameter R <sub>2</sub>	[6]	(W/mm)	19
Electrical Properties			
Electrical Resistivity (RT)		Ωcm	10 <sup>12</sup>
Dielectric Constant (1 MHz)		-	7

[www.precision-ceramics.co.uk](http://www.precision-ceramics.co.uk)  
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