
IPS
TECHNICAL CERAMICS

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Technical ceramics are fast becoming the essential enabler for our modern, high performance lifestyle. Their impressive combination of properties has seen them replace metals in key areas for high-tech consumer products, demanding engineering applications and in process equipment for aggressive conditions.

Technical ceramics offer many advantages over alternative materials, not least their excellent performance at elevated temperatures and high mechanical strengths. They are resistant to abrasion, corrosion and chemical attack, giving increased durability in extreme conditions. Compared to metals, technical ceramics are lightweight and electrically and thermally insulating.

IPS Ceramics is a relatively new company but one with a long history in this industry. Established in its present form in 2009, it evolved from the merger of several leading manufacturers of high temperature ceramics, all bringing a bank of expertise stretching back over 60 years.

Today's IPS team collectively boasts over 200 years of experience in ceramic technology, including design, material selection/specification and manufacturing. We can rapidly and expertly evaluate possible technical ceramic solutions for your specific application or a whole host of manufacturing, engineering and laboratory demands.

IPS collaborates with other quality manufacturers in both Europe and Asia to offer flexibility in production. Our technical ceramics are formed in a variety of ways, typically by extrusion, injection moulding, casting or pressing, so that components can be designed from the start to meet your specific needs.

The main technical ceramics in our range are high alumina, silicon carbide and steatite; however, recent additions include aluminium nitride and TZP-zirconia, and we can source most technical ceramic materials if you have a particular requirement. IPS Ceramics is also very well known around the world as a major supplier of kiln furniture systems based on mullite-cordierite materials.

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Alumina is the most widely used technical ceramic and is the material of choice in about 80% of engineering applications due to its combination of properties. Fired at over 1600°C (2900°F) to give a fully dense technical ceramic, alumina exhibits high mechanical strength, rigidity and can be machined to tight tolerances and fine surface finishes. Alumina is often used as a replacement for metallic components in demanding engineering applications.

Abrasion resistance – Alumina technical ceramics are very hard and resistant to abrasion.

Alumina is ideal for the manufacture of wear-resistant inserts or products (e.g. mill or chute linings, cam discs, location or centering pins for welding, thread guides and friction discs for textiles, etc).

Thermally stable – Alumina can be used in both oxidizing and reducing atmospheres up to 1600°C (2900°F) and in vacuum furnaces up to 2000°C (3600°F).

HIGH PURITY ALUMINA

IPS CERAMICS

Chemical resistance – Alumina is chemically inert and is not corroded by water or steam. It offers good resistance to strong acids and alkalis at elevated temperatures and is ideal for applications where resistance to corrosive substances is required. Alumina is often used for catalyst supports operating at elevated temperatures. It is also an obvious choice for pump and valve components when its excellent abrasion resistance is considered.

Electrical insulation – Alumina is also widely used as an electrically insulating material, particularly the high purity grades which exhibits enhanced resistivity. It can be used for insulators operating at elevated temperatures (e.g. furnace lead-in tubes, fuel cells).

Thermal conductivity – Alumina is an excellent electrical insulator it offers reasonably high thermal conductivity for a ceramic.

It is often used as a substrate for semiconductors and for high performance heat sinks and thermal control products.

The all-round strong performance of alumina has long been proven in a number of demanding applications including the automotive, aerospace, defence, medical, electrical and heat treatment industries.

High Alumina is a highly flexible material when it comes to product development and we are constantly working with design engineers and system manufacturers to come up with new applications. Alumina components can be threaded, perforated, rebated, slotted, hollowed or tapered to suit thousands of design and performance demands.

Complex shapes are often achievable and they also lend themselves to surface treatments where required, such as precision grinding and lapping.

IPS Ceramics offers a range of premium quality alumina materials, from 90% right up to 99.7% alumina.

	Units	Technical Alumina (92%)	Technical Alumina (95%)	Technical Alumina (99%)
Max use temperature	^{O}C	1400	1450	1600
	^{O}F	2550	2650	2900
Density	g/cm^3	3.6	3.7	3.8
Open Porosity	%	<0.5	<0.5	<0.5
Bending Strength	MPa	200	250	300
Modulus of Elasticity	GPa	300	300	300
Thermal conductivity	W/mK	20	25	25
Coefficent of thermal expansion	10^{-6} /K	7	8	8
Volume Resistance	(Ω.cm)	$>10^{14}$	$>10^{14}$	$>10^{14}$
Dielectric constant	-	8	9	10
Dielectric strength	(kV/mm)	10	15	20

HIGH PURITY ALUMINA

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IPS Ceramics offers all the principal types of silicon carbide, a long lasting, rugged, dependable performer in many challenging environments. Our products are made to tight dimensional tolerances and have excellent load-bearing ability at higher temperatures. Silicon carbide retains most of its mechanical strength at elevated temperatures and exhibits very low levels of creep, making it the first choice for load-bearing applications in the range 1300°C to 1650°C (2400°F to 3000°F).

Silicon carbide components provide outstanding thermal shock resistance but unlike traditional ceramics they also combine low density with high mechanical strength. Additionally, these products offer extreme hardness/abrasion resistance and outstanding chemical stability in aggressive environments.

SILICON CARBIDE

IPS CERAMICS

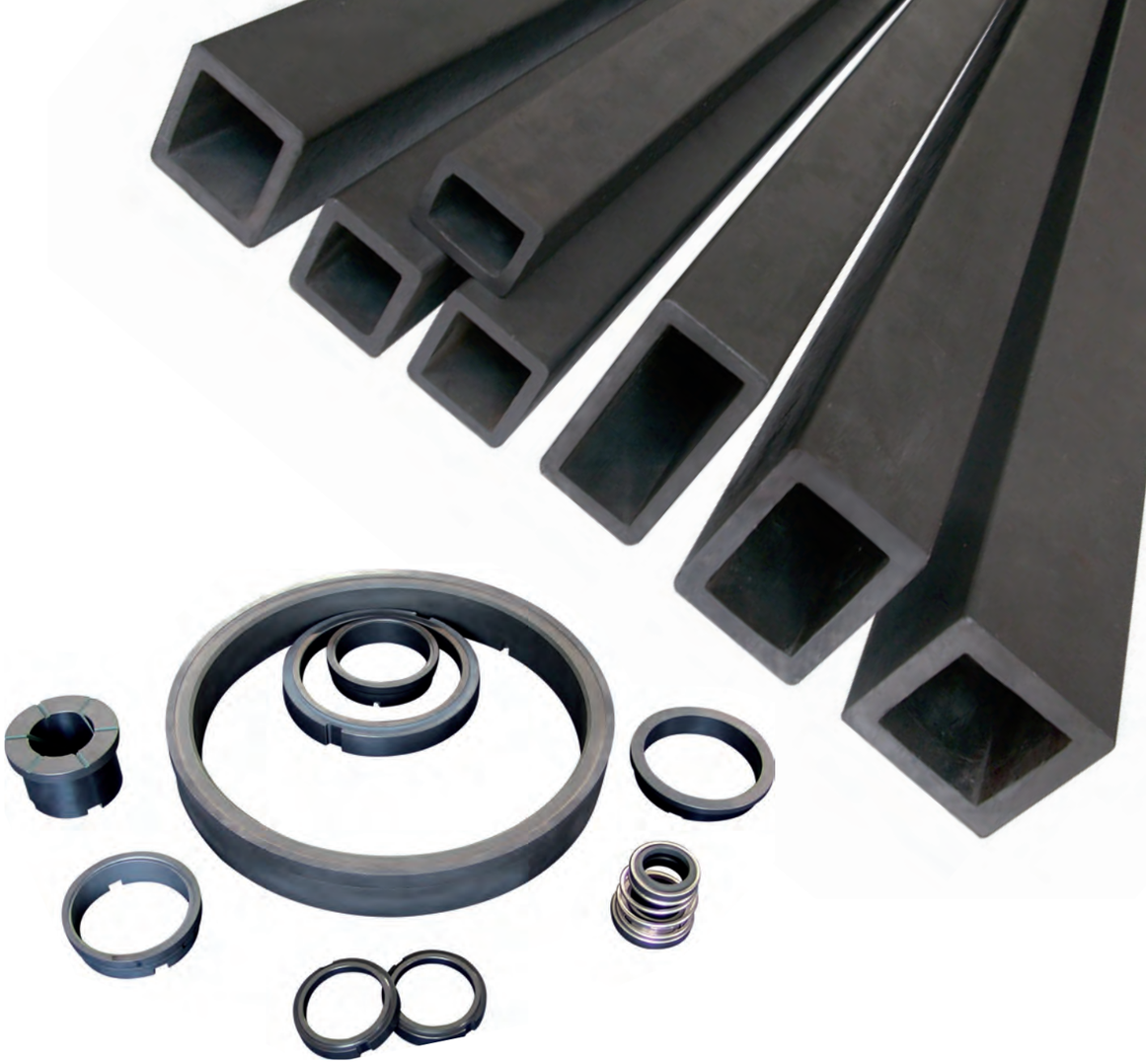
The growing range of silicon carbide components offers the industrial engineer high level performance in a number of crucial areas and is a fine example of the dynamic ability of ceramics to come up with solutions in new areas of manufacture and processing. IPS Ceramics offers:-

Recrystallised ReSiC has a lower mechanical strength than RBSiC and NBSiC, but offers what most other materials cannot – a working temperature of up to 1650°C (3000°F).

Silicon Infiltrated SiSiC and Reaction-bonded RBSiC is a very high strength material that is often used for support beams for kiln structures or kiln car systems. The beams are lightweight and remain straight after prolonged use. It can be used up to 1380°C (2500°F).

Oxide-bonded SiC offers many of the benefits of using SiC but at a reduced cost. It is mainly used for load-bearing items used in the temperature range 1300 – 1350°C (2400-2550°F) where good life is achieved.

Nitride-bonded NBSiC offers properties that are fairly similar to RBSiC (high strength and low creep) but can be safely used to a higher temperature of 1450°C (2650°F). It is often used for batts, tiles or plates.



The latest addition to our silicon carbide family is the sintered variety (SSiC).

This material is used for engineering components where a very high strength is required. SSiC can be machined to very tight tolerances and a very high degree of polishing is obtainable. This makes it an impressive performer in terms of sliding/friction and in any application where an ultra-hard and super wear resistant surface is required (e.g. seals and pump components).

SSiC also exhibits an unusually high thermal conductivity while at the same time offering low thermal expansion characteristics. For high temperature heat treatment, firing or sintering applications, IPS Ceramics can supply batts, setters, tubes, beams and saggars to meet your kiln furniture requirements up to 1650°C (3000°F).

SILICON CARBIDE

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	Units	Oxide Bonded	SiSiC	NbSiC	ReSiC	Sintered SiC
Max use temperature	°C	1400	1380	1450	1650	1600
	°F	2550	2500	2650	3000	2900
Density	g/cm^3	2.7	3.1	2.8	2.7	3.1
Open Porosity	%	8	<0.5	13	15	<0.5
Bending Strength	MPa	35	250	160	90	400
Modulus of Elasticity	GPa	200	325	200	250	425
Thermal conductivity	W/mK	15	45	25	25	70
Coefficent of thermal expansion	10^{-6} /K	4.5	4.5	4.7	4.8	4

Steatite is used extensively for insulation in the electrical and electronic industries. It is a lower cost material than alumina, but has excellent electrical resistance properties (which are retained at high temperatures) along with moderate mechanical strength.

Steatite's low contraction on firing allows us to produce components to precise tolerances. Both small and highly detailed shapes can be achieved using cost efficient production techniques, making steatite a good choice for the volume manufacture of insulating components.

Due to its excellent dielectric properties, steatite has been used for many years in both large-scale electrical systems and electronics/domestic appliances.

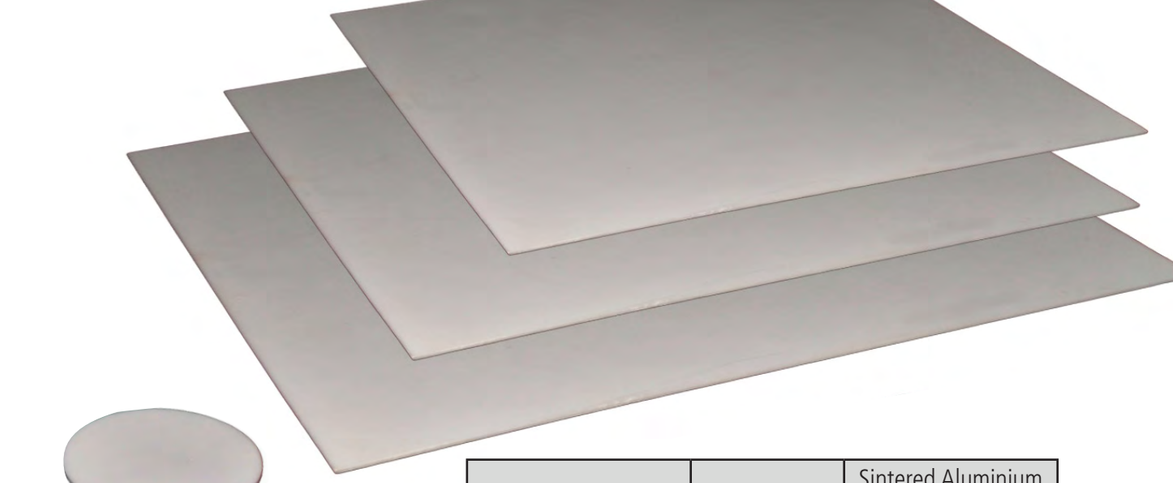
It has both a high volume resistivity and high dielectric strength making it ideal for the production of electrically insulating components.

Steatite ceramics have a low dielectric loss allowing their use for electrical insulation where radio and microwave frequencies are present.

This low-loss property makes steatite the material of choice for insulation of broadcast antennae (e.g. guy-strain insulators). Steatite parts show good wear and corrosion resistance and can be supplied either glazed or unglazed.

	Units	Steatite (C220 - L3)	Steatite (C221 - L5)
Max use temperature	^{O}C	1000	1200
	^{O}F	1800	2200
Density	g/cm^3	2.6	2.8
Open Porosity	%	<0.5	<0.5
Bending Strength	MPa	130	140
Modulus of Elasticity	GPa	100	100
Thermal conductivity	W/mK	2.5	2.5
Coefficent of thermal expansion	10^{-6} /K	7	8
Volume Resistance	(Ω.cm)	$>10^{11}$	$>10^{12}$
Dielectric constant	-	5.5	6
dielectric strength	(kV/mm)	10	20

STEATITE



Aluminium nitride is a specialist material for the most demanding applications. It has the highest thermal conductivity of any ceramic material, on a par with most metals; however it also provides electrical insulation. This makes it the top-of-the-range choice for the most demanding of heat sink applications.

	Units	Sintered Aluminium Nitride
Max use temperature	^{O}C	1000
	^{O}F	1800
Density	g/cm^3	3.3
Open Porosity	%	<0.5
Bending Strength	MPa	200
Modulus of Elasticity	GPa	325
Thermal conductivity	W/mK	170
Coefficent of thermal expansion	10^{-6} /K	5.5
Volume Resistance	(Ω.cm)	$>10^{15}$
Dielectric constant	-	9
dielectric strength	(kV/mm)	30

It is stable up to 1000°C (1800°F) in air and 1900°C (3450°F) in inert atmospheres. The thermal expansion coefficient of aluminium nitride is lower than that of common heat sink materials such as aluminium and alumina. The thermal expansion coefficient is a close match to the expansion of common semiconductor substrate materials, making it ideal for the mounting of large semiconductor devices. Aluminium Nitride is the very best ceramic commercially available for heat sink applications. It is often used in microelectronics, lighting, power, optics and the ever growing field of renewable energy.

IPS Ceramics offers two grades of aluminium nitride:-

Machinable, for excellent thermal conductivity of 90 W/mK

Fully-sintered, for exceptional thermal conductivity of 170 W/mK

ALUMINIUM NITRIDE

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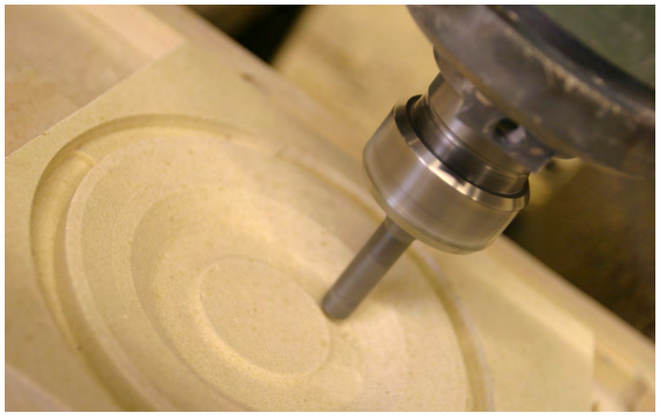

IPS Ceramics manufactures a low density, porous, cordierite material that can be easily machined.

Our LWS machinable cordierite can be supplied as either CNC machined components (to suit your specific design) or as blanks to allow you to machine your own items.

Choose IPS Machinable Ceramic for machined components, you can request single items or small quantities.

We can work from your own AutoCAD or SOLIDWORKS design files or our in-house team can prepare a bespoke design based on your concept.

We also offer blanks for sale should you wish to machine your own components.

	Units	Machinable Cordierite
Max use temperature	^{0}C	1300
	^{0}F	2400
Density	g/cm^{3}	1
Open Porosity	%	60
Bending Strength	MPa	
Modulus of Elasticity	GPa	15
Coefficent of thermal expansion	10^{-6}/K	3

CERAMIC DESIGN & PROTOTYPING

IPS Ceramics has a long history of supplying cordierite kiln furniture to the ceramics industries around the world going back over 60 years. We understand your production issues in detail, whether you manufacture tableware from bone china, earthenware, fine china or porcelain. We are a supplier to major producers of sanitaryware, hotelware, heavy clay products and technical ceramics.

Choose IPS Ceramics for Cordierite Refractories Kiln Furniture

Our cordierite kiln furniture is manufactured to be porous / low density which does limit its mechanical strength compared to other ceramics; however, it is often the most cost effective material for producing supports for firing, sintering and other heat treatment processes operating at temperatures between 1000 -1300^{o}C (1800-2400^{o}F).

Our cordierite materials have been developed over several decades to give optimum performance:-

- Very low creep rates – giving long-life setters, cranks, batts and support systems used in a wide range of heat treatment processes working at temperatures up to 1300^{o}C (2400^{o}F)
- Extremely resistant to thermal shock cracking, allowing use where very rapid heating and cooling rates are present
- Stable at high temperatures; products can be thermally cycled hundreds (sometimes thousands) of times without degradation
- Low density, giving lightweight setters, cranks and batts that save energy in every firing

CORDIERITE

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