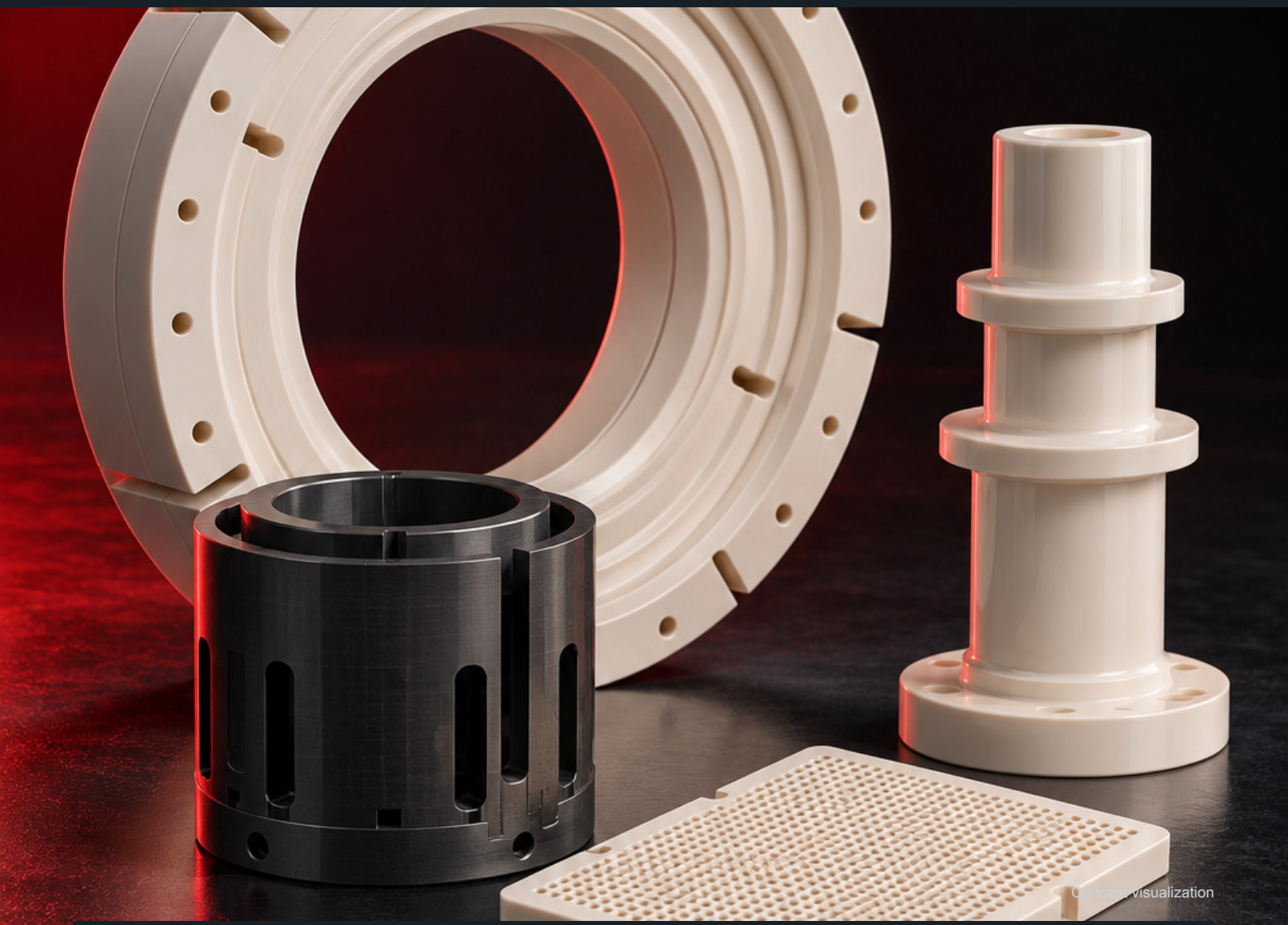
GREAT CERAMIC

MATERIALS & SELECTION GUIDE

ADVANCED CERAMICS



Concept visualization

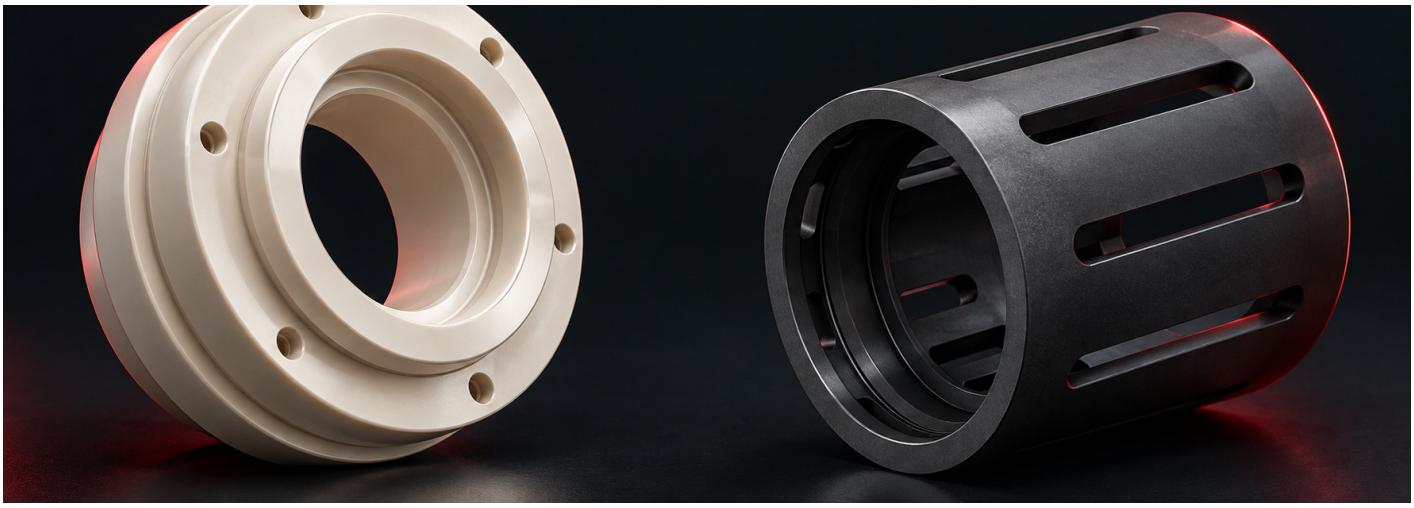
Understand the material.
Choose for the application.

9 material families / 28 grades and variants
Complete performance tables. Clear engineering choices.

START HERE

A material for a specific job.

Advanced ceramics are engineered by controlling composition and processing. Different materials solve different problems; no single ceramic does everything.



Concept visualization of precision ceramic parts

OXIDES

Alumina · ZTA · Zirconia · BeO

Insulation, wear and selected thermal or structural needs.

NITRIDES

AlN · Silicon nitride · BN

Heat transfer, mechanical duty or specialist hot processes.

CARBIDE & GLASS CERAMICS

SiC · Machinable glass ceramics

Hard wear surfaces or detailed machinable insulators.

FIND WHAT YOU NEED

Read the properties	03	Ceramics, metals & plastics	04
Explore the materials	05-13	Select by application	14
Complete data tables	15-21	Prepare your inquiry	22-23

READ THE DATA

What the numbers actually mean.

Read each value with its unit, test conditions and grade. A higher number is useful only if that property matters to the part.

Property	Plain-English meaning	Why it matters
Density	Mass for a given volume.	Weight and moving inertia.
Strength	Stress a test sample withstands before failure.	Load capacity; bending and compression are different tests.
Fracture toughness	Resistance to a crack growing.	Sensitivity to flaws, impact and sharp details.
Hardness / modulus	Hardness resists indentation. Modulus measures stiffness.	A hard part can still chip; a stiff part bends less.
Thermal conductivity	How readily heat travels through a material.	High for heat removal; low for thermal isolation.
Thermal expansion (CTE)	How much length changes as temperature changes.	Fits, bonded joints and thermal stress.
Maximum temperature	A stated limit under particular conditions.	Check atmosphere, exposure time and mechanical load.
Electrical properties	Resistivity: leakage resistance. Dielectric strength: breakdown field.	Insulation depends on thickness, temperature and geometry.
Dielectric constant	Response to an electric field at a stated frequency.	Capacitance and RF behavior; lower is not always better.

A material value is not a finished-part guarantee.

Test specimens, surface finish, geometry and manufacturing affect results. The tables support early selection; confirm the grade and test method for critical requirements.

Symbols: “-” = not provided; “~” = approximate; “>” = greater than. Directional PBN values require an agreed reference direction.

COMPARE MATERIAL FAMILIES

Ceramics, metals or plastics?

Start with the operating conditions. Then compare the full part and its manufacturing route, rather than choosing by one headline property.

CERAMICS

Choose for demanding wear, insulation, heat or chemical conditions.

Allow for brittleness, finishing cost and careful assembly.

METALS

Choose for toughness, ductility, threads, joining and general structures.

Check corrosion, electrical conduction and hot-service limits.

ENGINEERING PLASTICS

Choose for low mass, insulation, complex shapes and useful compliance.

Check creep, temperature, moisture and thermal expansion.

Need	Ceramics	Metals	Engineering plastics
Impact & overload	Often fail with little warning; protect edges.	Many alloys can yield and absorb energy.	Often compliant; impact behavior varies.
Heat & stable shape	Many grades suit high heat; check shock and load.	Alloy-specific hot strength and expansion.	Check softening and long-term creep.
Electrical behavior	Many insulators; SiC is an important exception.	Normally conductive.	Often insulating; fillers can change this.
Heat transfer	Very wide range: insulating to conductive.	Often good conductors; alloy dependent.	Usually low; conductive grades exist.
Wear & chemicals	Hard grades can excel; confirm the mating pair and fluid.	Many alloys and coatings; corrosion varies.	Useful low-friction grades; fluid and load matter.
Making the part	Hard grades often need diamond finishing.	Widely machined, formed and joined.	Machined or molded; tooling depends on volume.

These are family-level tendencies, not rankings. Reinforced plastics, specialty alloys and composite ceramics can behave very differently. Compare life-cycle cost, including wear, downtime, inspection and replacement.

Choose the simplest material that meets the duty.

A general-purpose bracket may be best in metal. A light insulating cover may suit a polymer. A hot, wearing or electrically demanding interface may justify a ceramic.

Alumina

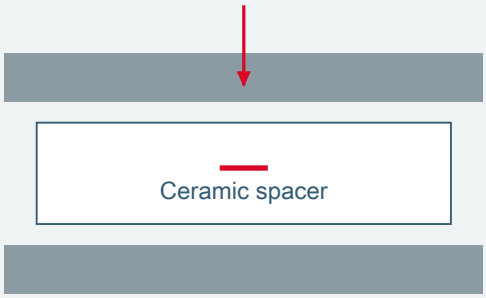
A practical starting point for insulation and wear parts.

Alumina combines electrical insulation, a hard surface and useful heat resistance. Start here when you need a reliable ceramic for a broad range of industrial parts, then compare the available purity levels.



Product examples

HOW IT WORKS



Separate conductive metal parts.

Al_2O_3

25-45	3.75-3.98	96-99.95%
W/(m·K)	g/cm³	Al_2O_3
Thermal conductivity, 25°C	Density	Listed purity levels

Why consider it?

It can replace a metal where electrical isolation is needed, or a plastic where heat and wear are too demanding. Typical parts include insulating spacers, guide tubes, substrates and pump components.

Which grade?

The table covers 96%, 99.7% and 99.95% alumina. Higher purity changes several properties, but it is not automatically the best value. Match the grade to temperature, electrical duty, surface finish and chemical exposure.

CHECK BEFORE YOU SPECIFY

Alumina is hard, but it is still brittle. Avoid impact, sharp inside corners and point clamping. Chemical resistance depends on the actual fluid, concentration and temperature.

Compare with ZTA for greater crack resistance, or AlN when heat removal is the main challenge.

DATA 15

ZTA

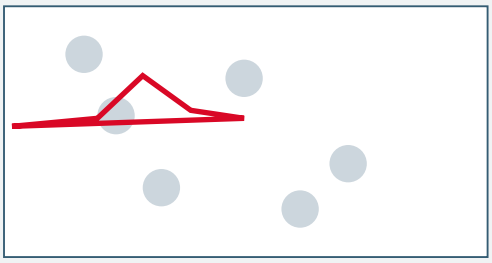
An alumina-based ceramic with added resistance to cracking.

Zirconia-toughened alumina contains zirconia within an alumina base. This combination is used when wear resistance is important and conventional alumina needs more resistance to crack growth.



Product examples

HOW IT WORKS



A tougher mix can resist crack growth.

$Al_2O_3 + ZrO_2$

600	7	4.1
MPa	MPa·√m	g/cm³
Flexural strength, 25°C	Fracture toughness	Density

Why consider it?

Consider ZTA for valve parts, pump components, wear pads and guides. It offers a different balance of hardness, strength and toughness from either alumina or zirconia alone.

Which grade?

Compare the actual formulation and test data. “ZTA” describes a family, not one universal recipe. The reference table lists one ZTA entry; confirm the offered grade and its properties before final design.

CHECK BEFORE YOU SPECIFY

Tougher does not mean unbreakable. ZTA still needs supported contact faces, controlled assembly loads and a suitable mating material for sliding or sealing service.

Choose between alumina, ZTA and zirconia by the wear mode, load and failure risk, not hardness alone.

DATA 15

Zirconia

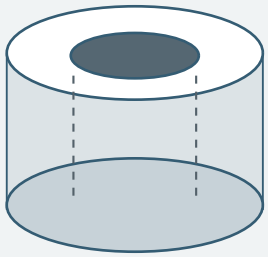
High strength and toughness for demanding mechanical parts.

Zirconia is often considered for compact parts that need high strength and better crack resistance than many conventional ceramics. It conducts heat slowly, which can help when the part should limit heat flow.



Product examples

HOW IT WORKS



A hard, finished bore guides a moving part.

ZrO_2

500-1,200	2	5.7-6.05
MPa	W/(m·K)	g/cm³
Listed flexural strength	Thermal conductivity, 25°C	Listed density

Why consider it?

Typical uses include locating pins, sleeves, plungers, guides and precision wear parts. Its higher density should be considered in moving assemblies.

Which grade?

3YZ is yttria-stabilized zirconia; Mg-PSZ is magnesia-partially-stabilized zirconia. Black zirconia is a separate listed entry. Stabilizer, microstructure and processing affect performance; color alone does not define a grade.

CHECK BEFORE YOU SPECIFY

Check hot-water or steam exposure, thermal cycling and the required service temperature for the specific grade. High room-temperature strength does not establish its long-term strength in service.

Compare with alumina for cost and insulation, or silicon nitride when low mass and thermal cycling matter.

DATA 16

Aluminum nitride

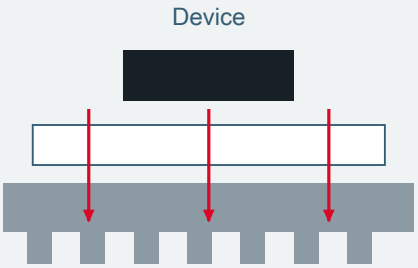
Move heat away while keeping electrical circuits isolated.

Aluminum nitride is useful when a component must transfer heat and provide electrical insulation at the same time. Electronic substrates and heat-spreading parts are common examples.



Product examples

HOW IT WORKS



Heat crosses an electrically insulating layer.

AlN

170-230	4.6	3.3
W/(m·K)	×10⁻⁶/K	g/cm³
Thermal conductivity, 25°C	Listed thermal expansion	Density

Why consider it?

A ceramic layer can separate a live device from a metal heat sink while passing heat through it. The final thermal performance also depends on thickness, contact area and the interfaces on both sides.

Which grade?

The listed AL170, AL200 and AL230 grades have room-temperature thermal conductivities of 170, 200 and 230 W/(m·K). Confirm surface finish, metallization, attachment method and the temperature range as well as the conductivity.

CHECK BEFORE YOU SPECIFY

Do not assume that the highest-conductivity grade gives the lowest assembly temperature. Poor contact can dominate the heat path. Check moisture exposure, cleaning chemistry and protective surface treatments.

Compare with alumina for less demanding heat loads. Evaluate BeO only with its specialist handling requirements.

DATA 17

Silicon nitride

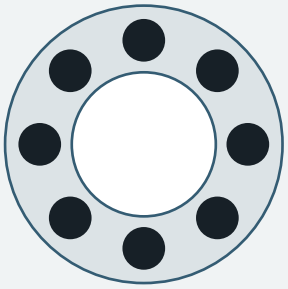
A low-mass ceramic for mechanical and thermal demands.

Silicon nitride combines relatively low density with high strength and useful toughness. It is considered for moving parts and for parts exposed to changes in temperature.



Product examples

HOW IT WORKS



Ceramic rolling elements carry contact loads.

Si_3N_4

700 / 900	3.2 / 3.3	3.0 / 2.8
MPa	g/cm³	×10⁻⁶/K
Flexural strength: GPSN / HPSN	Density: GPSN / HPSN	CTE: GPSN / HPSN

Why consider it?

Typical examples include bearing elements, rollers, locating parts and selected nozzles. Low thermal expansion can help with dimensional stability, but the assembly must still allow for the expansion of nearby metals.

Which grade?

GPSN means gas-pressure-sintered silicon nitride. HPSN means hot-pressed silicon nitride. These are manufacturing routes; the listed grades have different properties. Compare shape, available size, finishing needs and duty conditions.

CHECK BEFORE YOU SPECIFY

It is not a drop-in replacement for every steel bearing or shaft. Review contact stresses, mating surfaces, lubrication and impact. Confirm fatigue and thermal-cycle performance for the actual component.

Compare with zirconia for highly loaded parts, and with SiC when chemical exposure or heat transfer leads the decision.

DATA 17

Silicon carbide

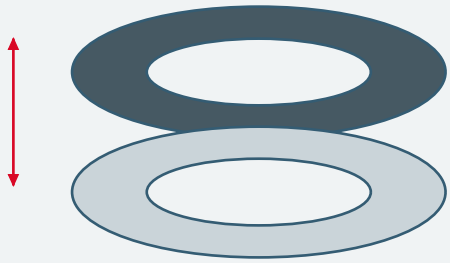
A hard, stiff ceramic for wear and harsh process conditions.

Silicon carbide is considered for sealing faces, sleeves, nozzles and other parts exposed to wear or demanding fluids. It also transfers heat much more readily than low-conductivity ceramics such as zirconia.



Product examples

HOW IT WORKS



Flat mating faces control a sealing interface.

SiC

28 / 20	102.6 / 150	3.1
GPa	W/(m·K)	g/cm³
Hardness: sintered / reaction-bonded	Thermal conductivity, 25°C	Listed density

Why consider it?

Hard contact surfaces can resist abrasive wear. Chemical compatibility and thermal behavior can make SiC attractive in pumps and process equipment, provided the grade and mating pair suit the duty.

Which grade?

Sintered SiC and reaction-bonded SiC are separate entries. Reaction-bonded grades typically contain residual silicon, which can affect chemical and temperature limits. Confirm the exact material, not just the name “SiC”.

CHECK BEFORE YOU SPECIFY

Do not assume SiC is an electrical insulator. The table shows much lower resistivity than the insulating oxide and nitride grades. For seals, also check flatness, lubrication, dry running and the mating face.

Compare with alumina or ZTA for wear service; choose using the fluid, particles, contact pressure and temperature.

DATA 21

Boron nitride

Machinable ceramics for insulation and specialist hot processes.

Hexagonal boron nitride is softer and easier to machine than many structural ceramics. It is used for selected hot-process fixtures, crucibles, nozzles and electrical insulators.



Product examples

HOW IT WORKS



Direction matters in a layered material.

BN

11
entries
BN grades and variants

30-50
MPa
Flexural strength: listed pure BN

32-40
W/(m·K)
Conductivity: listed pure BN

Why consider it?

Its layered structure can provide useful release and low-friction behavior. Whether a melt wets or attacks BN depends on the melt, atmosphere and grade. Check the actual process rather than assuming universal compatibility.

Which grade?

The table separates high-purity BN, pyrolytic BN (PBN), BN+AlN and six coded BN grades. PBN is deposited from a gas. Composite grade codes do not by themselves specify composition; ask for a grade-specific data sheet.

CHECK BEFORE YOU SPECIFY

Air and inert-atmosphere temperature limits differ greatly. PBN properties also depend on direction. Confirm the material orientation before using directional values in a design.

Choose BN for its particular process benefits; do not treat it as a hard load-bearing substitute for alumina or SiC.

DATA 18

Machinable glass ceramic

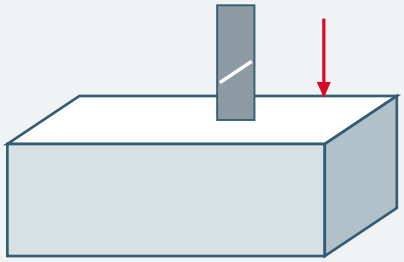
Complex insulating parts without machining a very hard ceramic.

Machinable glass ceramics can be cut with suitable conventional tools. They are useful for prototypes and low-volume insulating parts with holes, pockets or other detailed features.



Product examples

HOW IT WORKS



Cut detailed features with suitable tools.

MGC

94 / 110	1.5 / 1.6	2.52 / 2.6
MPa	W/(m·K)	g/cm³
Flexural strength: Macor / MGC	Thermal conductivity, 25°C	Density: Macor / MGC

Why consider it?

Typical parts include instrument supports, insulating spacers, vacuum fixtures and laboratory components. Machining the finished material avoids a firing step after the final features are cut.

Which grade?

The reference table lists Macor and MGC separately. Macor is a trade name; MGC is a broader description. Do not assume the two entries are interchangeable. Confirm the supplied product, grade and required documentation.

CHECK BEFORE YOU SPECIFY

Easy machining does not mean metal-like toughness. Thin edges can chip. Check load, vacuum cleanliness, chemical exposure and whether a temperature rating is continuous or short-term.

Compare with BN for hot-process fixtures, or alumina when strength, wear or production economics become more important.

DATA 21

Beryllium oxide

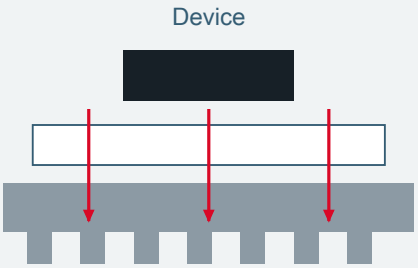
A specialist option for heat transfer with electrical insulation.

Beryllium oxide combines high thermal conductivity with electrical insulation. It is used in selected electronic, RF and thermal-management components where these properties justify a specialist material.



Product examples

HOW IT WORKS



Heat crosses an electrically insulating layer.

BeO

200	2.86	40
W/(m·K)	g/cm³	kV/mm
Thermal conductivity, 25°C	Density	Listed DC dielectric strength

Why consider it?

Typical formats include insulating substrates, heat-transfer components and electronic package parts. Evaluate the complete assembly, including attachment, thermal cycling and the required electrical performance.

Which grade?

The table includes one BeO reference entry. Confirm the offered grade and its test conditions. Compare AlN and alumina early in the selection process, including fabrication, handling and end-of-life requirements.

CHECK BEFORE YOU SPECIFY

BeO dust and fumes are hazardous if inhaled. Grinding, drilling or other dust-generating work requires specialist facilities and controls. Obtain the current safety data sheet; do not rework BeO in an ordinary workshop.

Select BeO only when the application and the supply chain can support the required material and handling controls.

DATA 16

CHOOSE BY APPLICATION

Start with the problem to solve.

Use these examples to build a shortlist. Final selection depends on the grade, part geometry and real operating conditions.

Your main need	Candidates to discuss	What to check next
Electrical isolation	Alumina, AlN, BN, glass ceramics; specialist BeO	Voltage, temperature, creepage distance and cleanliness.
Remove heat from electronics	AlN; selected alumina or specialist BeO	Heat load, thickness, interfaces and attachment.
Wear in pumps and valves	Alumina, ZTA, zirconia, SiC	Fluid, particles, mating surface and lubrication.
Low-mass mechanical parts	Silicon nitride; other grades by duty	Contact stress, impact, fatigue and balance.
Hot-process fixtures	Alumina, BN, SiC or Si_3N_4 by conditions	Atmosphere, cycles, load and chemical compatibility.
Detailed insulating prototypes	Machinable glass ceramic; BN where suitable	Strength, edge integrity, temperature and volume.

01

Set the limits

Temperature, medium, load and electrical duty.

02

Compare grades

Use the data tables to narrow the options.

03

Validate the part

Review the drawing and test representative parts.

Sometimes the best answer combines materials.

A ceramic wear insert in a metal holder, or an insulating ceramic layer on a metal heat sink, can place each material where its properties are most useful.

Oxides: alumina & ZTA

Typical reference values for initial material comparison. Specify the actual grade and confirm critical properties before production.

PROPERTY	UNIT	Alumina 96%	Alumina 99.7%	Alumina 99.95%	ZTA
Compressive strength	MPa	2000	2000	3500	2500
Density	g/cm^3	3.75	3.95	3.98	4.1
Flexural strength at 25°C	MPa	200-300	250-350	500-600	600
Fracture toughness, K_{IC}	$MPa \cdot m^{1/2}$	4.5	4	4.5	7
Hardness	GPa	12	14	18	16
Young's modulus	GPa	300	370	400	335
Thermal conductivity at 25°C	W/(m·K)	25	33	45	20
CTE, 25-1000°C	$10^{-6}/K$	6.3	6.5	7.5	7
Maximum temperature in air	°C	1600	1700	1750	1500
Maximum temperature in inert atmosphere	°C	1600	1700	1750	1500
Dielectric constant at 1 MHz	-	9.8	9.9	9.9	10
Dielectric strength (DC)	kV/mm	9	11	16	16
Volume resistivity at 25°C	Ω·cm	$>10^{14}$	$>10^{14}$	$>10^{16}$	$>10^{16}$

“~” means approximate; “>” means greater than; “-” means not provided, not zero. Strength and hardness depend on test method, specimen and surface condition.

Values can vary with batch, shape and size and are not guaranteed limits. Maximum temperatures require confirmation of exposure time, atmosphere and load. CTE intervals also need grade-specific confirmation.

Oxides: zirconia & BeO

Typical reference values for initial material comparison. Specify the actual grade and confirm critical properties before production.

PROPERTY	UNIT	Zirconia 3YZ	Zirconia Mg-PSZ	Black zirconia	BeO
Compressive strength	MPa	2000	2000	2000	1700
Density	g/cm^3	6.05	5.7	6.0	2.86
Flexural strength at 25°C	MPa	1200	500	1000	200
Fracture toughness, K_{IC}	$MPa \cdot m^{1/2}$	8	8	8	2
Hardness	GPa	13.5	11	12	12
Young's modulus	GPa	200	200	200	300
Thermal conductivity at 25°C	W/(m·K)	2	2	2	200
CTE, 25-1000°C	$10^{-6}/K$	10	9	10	8
Maximum temperature in air	°C	800	800	800	1800
Maximum temperature in inert atmosphere	°C	1000	1500	1500	2000
Dielectric constant at 1 MHz	-	29	20	20	6.7
Dielectric strength (DC)	kV/mm	18	10	18	40
Volume resistivity at 25°C	Ω·cm	$>10^{12}$	$>10^{12}$	$>10^{12}$	$>10^{14}$

“~” means approximate; “>” means greater than; “-” means not provided, not zero. Strength and hardness depend on test method, specimen and surface condition.

Values can vary with batch, shape and size and are not guaranteed limits. Maximum temperatures require confirmation of exposure time, atmosphere and load. CTE intervals also need grade-specific confirmation.

Nitrides: AlN & silicon nitride

Typical reference values for initial material comparison. Specify the actual grade and confirm critical properties before production.

PROPERTY	UNIT	AlN AL170	AlN AL200	AlN AL230	Si_3N_4 GPSN	Si_3N_4 HPSN
Compressive strength	MPa	2100	-	-	3000	3000
Density	g/cm^3	3.3	3.3	3.3	3.2	3.3
Flexural strength at 25°C	MPa	400	400	400	700	900
Fracture toughness, K_{IC}	$MPa \cdot m^{1/2}$	3.0	3.0	3.0	6.0	7.0
Hardness	GPa	11	11	11	14	16
Young's modulus	GPa	330	330	330	280	310
Thermal conductivity at 25°C	W/(m·K)	170	200	230	20	30
CTE, 25-1000°C	$10^{-6}/K$	4.6	4.6	4.6	3.0	2.8
Maximum temperature in air	°C	1200	1200	1200	1100	1200
Maximum temperature in inert atmosphere	°C	1350	1350	1350	1300	1400
Dielectric constant at 1 MHz	-	9.0	9.0	9.0	7.5	8.5
Dielectric strength (DC)	kV/mm	>15	>15	>15	20	18
Volume resistivity at 25°C	Ω·cm	$>10^{14}$	$>10^{14}$	$>10^{14}$	$>10^{15}$	$>10^{14}$

"~" means approximate; ">" means greater than; "-" means not provided, not zero. Strength and hardness depend on test method, specimen and surface condition.

Values can vary with batch, shape and size and are not guaranteed limits. Maximum temperatures require confirmation of exposure time, atmosphere and load. CTE intervals also need grade-specific confirmation.

Boron nitride: purity & PBN

Typical reference values for initial material comparison. Specify the actual grade and confirm critical properties before production.

PROPERTY	UNIT	BN 99% (HP)	BN 99.5%	BN 99.8%	Pyrolytic BN (PBN)
Compressive strength	MPa	120	120	120	154 ∥ / 550 ⊥
Density	g/cm^3	2.0	2.1	2.2	2.1-2.2
Flexural strength at 25°C	MPa	30-40	45	50	80 ∥ / 173 ⊥
Fracture toughness, K_{IC}	$MPa \cdot m^{1/2}$	2.6	~3	~3	-
Hardness	GPa	0.25	~0.4	~0.5	-
Young's modulus	GPa	40	45	50	25 ∥ / 90 ⊥
Thermal conductivity at 25°C	W/(m·K)	32	35	40	2 ∥ / 60 ⊥
CTE, 25-1000°C	$10^{-6}/K$	2.5	2.6	2.8	1.0 ∥ / 4.5 ⊥
Maximum temperature in air	°C	850	900	900	900
Maximum temperature in inert atmosphere	°C	2000	2000	2000	2100
Dielectric constant at 1 MHz	-	4-5	~4	~4	3.4 ∥ / 5.2 ⊥
Dielectric strength (DC)	kV/mm	>40	>40	>40	>50
Volume resistivity at 25°C	Ω·cm	$>10^{13}$	$>10^{13}$	$>10^{13}$	$>10^{15}$

PBN: ∥ and ⊥ denote directional values. The reference axis is not defined in this comparison data; confirm orientation before design use. "-" means not provided, not zero.

Values can vary with batch, shape and size and are not guaranteed limits. Maximum temperatures require confirmation of exposure time, atmosphere and load. CTE intervals also need grade-specific confirmation.

Boron nitride: composites I

Typical reference values for initial material comparison. Specify the actual grade and confirm critical properties before production.

PROPERTY	UNIT	BN+AlN	BN-B	BN-C	BN-D
Compressive strength	MPa	110	130	225	220
Density	g/cm^3	2.25-2.35	2.40-2.50	2.80-2.90	2.80-2.90
Flexural strength at 25°C	MPa	65	85	115	120
Fracture toughness, K_{IC}	$MPa \cdot m^{1/2}$	-	-	-	-
Hardness	GPa	-	-	-	-
Young's modulus	GPa	-	-	-	-
Thermal conductivity at 25°C	W/(m·K)	30	30	20	80
CTE, 25-1000°C	$10^{-6}/K$	2.0	2.8	3.5	2.8
Maximum temperature in air	°C	1000	1000	1000	1000
Maximum temperature in inert atmosphere	°C	1800	1800	1800	1800
Dielectric constant at 1 MHz	-	-	-	-	-
Dielectric strength (DC)	kV/mm	-	-	-	-
Volume resistivity at 25°C	Ω·cm	$>10^{13}$	$>10^{12}$	$>10^{12}$	$>10^{13}$

BN codes identify separate listed grades; composition is not defined by the code alone. Request the grade-specific data sheet. “-” means not provided, not zero.

Values can vary with batch, shape and size and are not guaranteed limits. Maximum temperatures require confirmation of exposure time, atmosphere and load. CTE intervals also need grade-specific confirmation.

Boron nitride: composites II

Typical reference values for initial material comparison. Specify the actual grade and confirm critical properties before production.

PROPERTY	UNIT	BN-S	BN-S2	BN-S+
Compressive strength	MPa	380	420	480
Density	g/cm^3	2.20-2.30	2.55-2.65	2.75-2.85
Flexural strength at 25°C	MPa	150	220	320
Fracture toughness, K_{IC}	$MPa \cdot m^{1/2}$	-	-	-
Hardness	GPa	-	-	-
Young's modulus	GPa	-	-	-
Thermal conductivity at 25°C	W/(m·K)	40	40	40
CTE, 25-1000°C	$10^{-6}/K$	2.7	2.7	2.7
Maximum temperature in air	°C	1000	1000	1000
Maximum temperature in inert atmosphere	°C	1800	1800	1800
Dielectric constant at 1 MHz	-	-	-	-
Dielectric strength (DC)	kV/mm	-	-	-
Volume resistivity at 25°C	Ω·cm	$>10^{13}$	$>10^{13}$	$>10^{13}$

BN codes identify separate listed grades; composition is not defined by the code alone. Request the grade-specific data sheet. “-” means not provided, not zero.

Values can vary with batch, shape and size and are not guaranteed limits. Maximum temperatures require confirmation of exposure time, atmosphere and load. CTE intervals also need grade-specific confirmation.

SiC & machinable glass ceramics

Typical reference values for initial material comparison. Specify the actual grade and confirm critical properties before production.

PROPERTY	UNIT	Sintered SiC	Reaction-bonded SiC	Macor	MGC
Compressive strength	MPa	2500	2500	345	450
Density	g/cm^3	3.1	3.1	2.52	2.6
Flexural strength at 25°C	MPa	410	400	94	110
Fracture toughness, K_{IC}	$MPa \cdot m^{1/2}$	4.6	4.0	1.5	1.8
Hardness	GPa	28	20	2.3	2.5
Young's modulus	GPa	350-400	350	66.9	70
Thermal conductivity at 25°C	W/(m·K)	102.6	150	1.5	1.6
CTE, 25-1000°C	$10^{-6}/K$	4.02	4.5	9.0	9.2
Maximum temperature in air	°C	1200	1380	800	850
Maximum temperature in inert atmosphere	°C	1900	1380	1000	1050
Dielectric constant at 1 MHz	-	-	8.0	6	6.2
Dielectric strength (DC)	kV/mm	-	-	62	65
Volume resistivity at 25°C	Ω·cm	10^2-10^{11}	10^2-10^3	$>10^{17}$	$>10^{17}$

SiC resistivity varies widely; do not assume electrical insulation. Macor and MGC are separate entries. “-” means not provided, not zero.

Values can vary with batch, shape and size and are not guaranteed limits. Maximum temperatures require confirmation of exposure time, atmosphere and load. CTE intervals also need grade-specific confirmation.

Make the next discussion specific.

Send the drawing and the operating conditions together. This helps connect the material choice to a part that can be made, inspected and used reliably.

01

What must the part do?

Describe the failure you want to prevent: wear, heat, leakage, corrosion, deformation or loss of insulation.

02

What will it experience?

Give minimum and maximum temperatures, cycles, atmosphere, fluids, pressure, loads and any impact or vibration.

03

What touches the ceramic?

Identify mating metals, plastics or ceramics. Explain the fit, clamping, bonding, sliding contact or seal.

04

What must be controlled?

Mark critical dimensions, finish, flatness, edge quality, electrical requirements and cleanliness on the drawing.

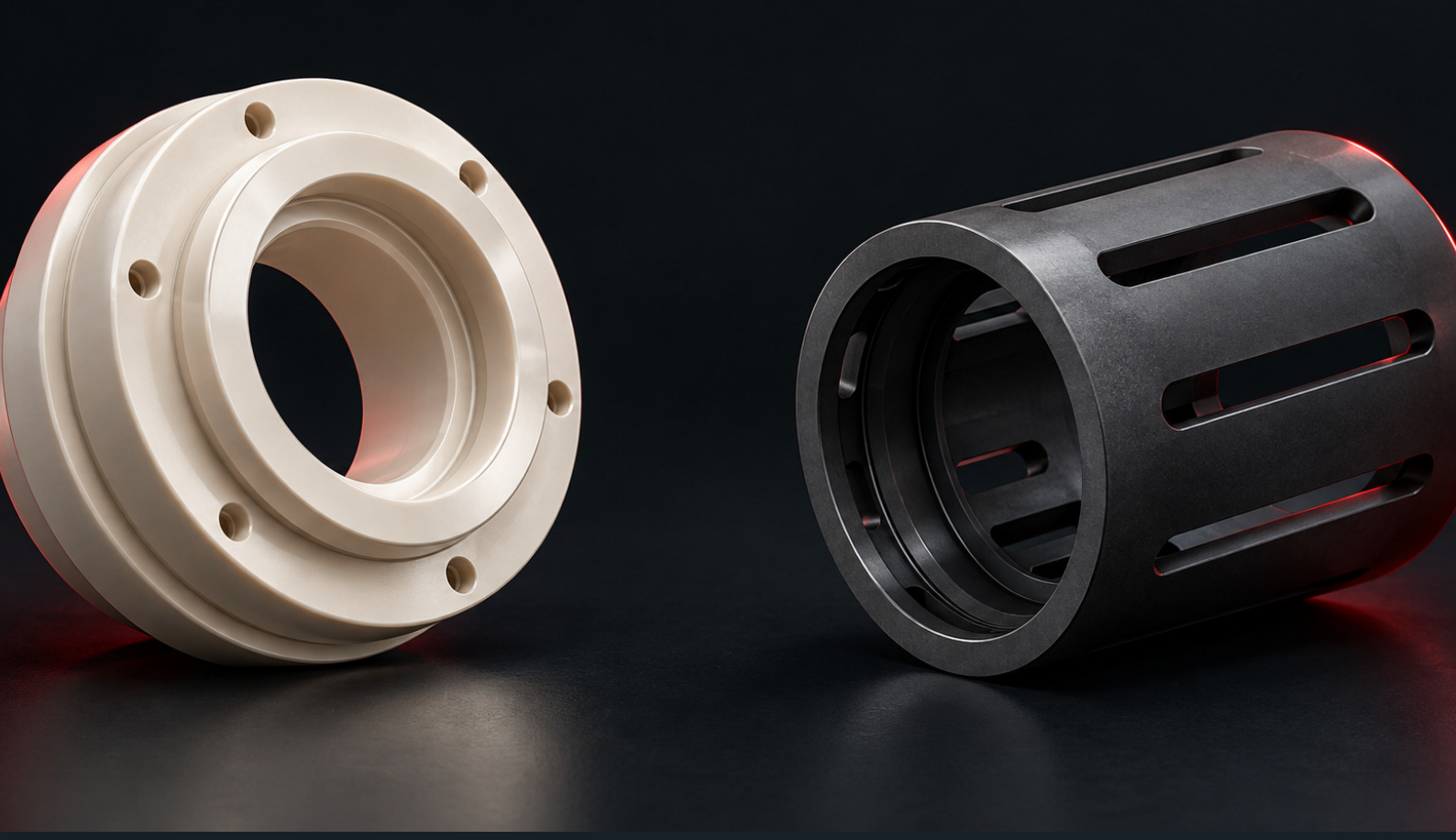
05

How will success be checked?

State prototype and production quantities, inspection needs, traceability, applicable standards and acceptance tests.

A useful first inquiry

Attach a PDF drawing and a 3D file if available, the candidate material or current part material, key operating conditions, quantities and target delivery date.



Choose the material. Engineer the part.

Great Ceramic supports material selection and custom ceramic components for industrial applications.

MATERIALS

Compare grades against the real operating conditions.

COMPONENTS

Review geometry, machining, finish and assembly.

NEXT STEP

Send your drawing and application requirements.

great-ceramic.com

Contact our team

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