Different Products Made From Silicon Carbide Abrasives, Their Characteristics, And Uses

Silicon carbide is a strong, sharp abrasive known for its hardness properties. It crystallizes into a closely packed covalent bond structure, forming a tetrahedral coordination among 4 silicon and 4 carbon atoms. The output material gains high strength due to tetrahedral units' tight stacking layout.

Chemical Properties of Silicon Carbide (SiC)

The chemical properties of silicon carbide include:

Maximum resistance to common inorganic and organic acids, salts, and alkali environments. The material can withstand prolonged exposures to these, except for acid fluorides and hydrofluoric acids.

Distinct electrical properties make it a suitable candidate for semiconductor applications.

It exhibits electrical resistance due to varying compositions by up to 7 orders of magnitude.

Physical Properties of Silicon Carbide

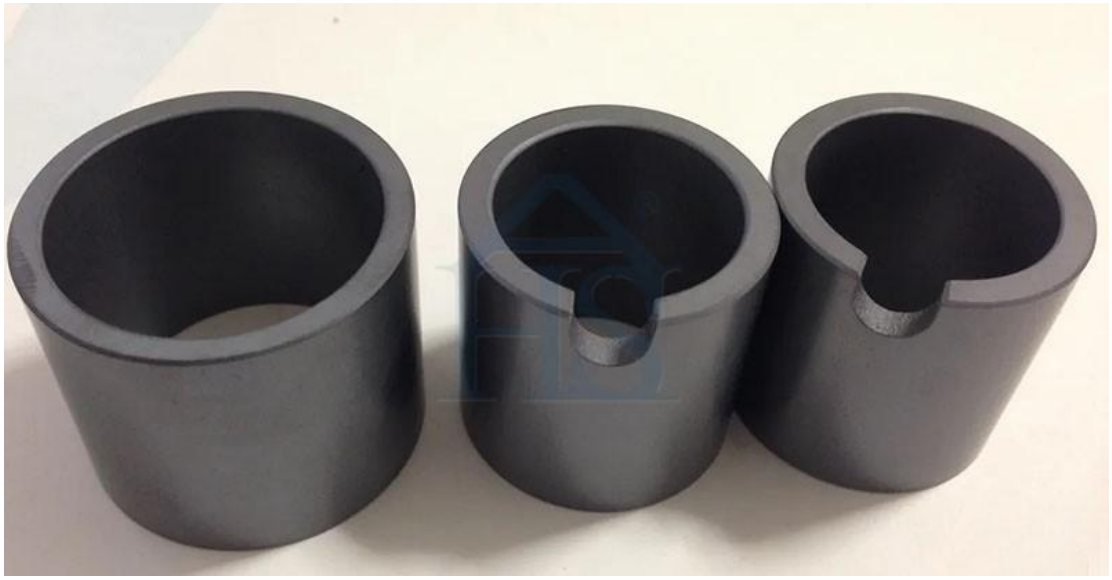
Silicon carbide exhibits the following physical properties:

- It has no odor of its own
- It can have grey, black, or green-colored powder forms
- The specific density is 3.21 grams per cubic centimeters
- It is not soluble in alcohol, acids, and water.

The most widespread use of silicon carbide is in the form of abrasives, thanks to the low cost and durability of the material. As an abrasive, it is used in several industrial processes, including grinding, honing, sandblasting, and water-jet cutting.

Different types of silicon carbide abrasives, their characteristics, and uses

Sintered Silicon Carbide



Sintered SiC (Silicon Carbide) is obtained as a self-bonded material when sintered in the presence of a sintering agent, e.g., Boron. Sintering is a heating process that can be achieved through recrystallization, hot pressing, microwave sintering, pressure-less sintering, and reaction sintering.

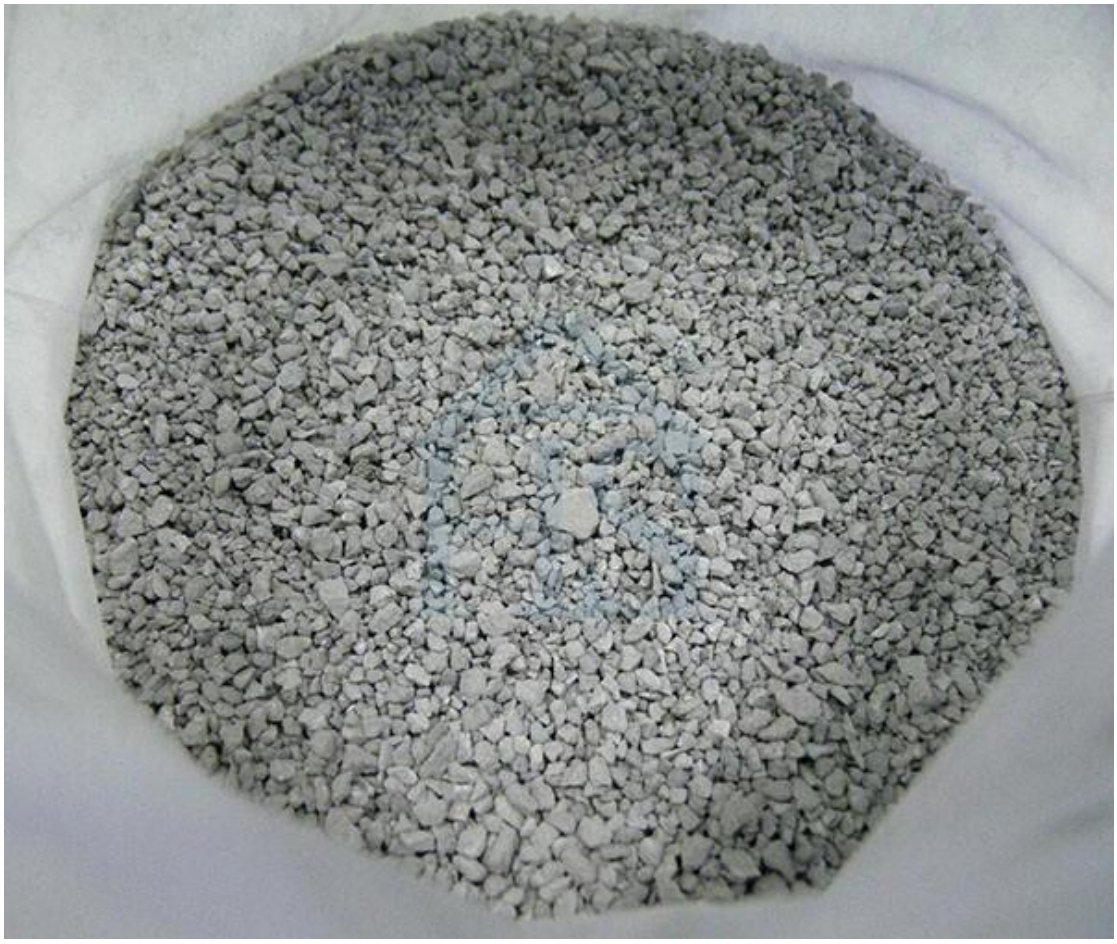
Sintered silicon carbide exhibits the following characteristics:

- Exceptional resistance to corrosion owing to the absence of binder.
- High strength that provides for superior abrasion resistance and wears.
- Creep resistance along with resistance to high temperatures up to the range of 1750°C
- Good resistance to thermal shock up to 125W/mK

Uses for sintered silicon carbide

- Chemical industry
- Pulp and Paper industry
- Power Generation
- Petrochemical industry
- Mining operations

Nitride bonded silicon carbide



Silicon carbide molecules bonded together by the use of silicon nitride. The material is relatively low on corrosion and wears resistance compared to the sintered silicon carbide. But it scores in terms of economic application, where high performance is not a prerequisite. And is common in the case of metal alloy components.

Characteristics that make nitride bonded silicon carbide ideal for use are:

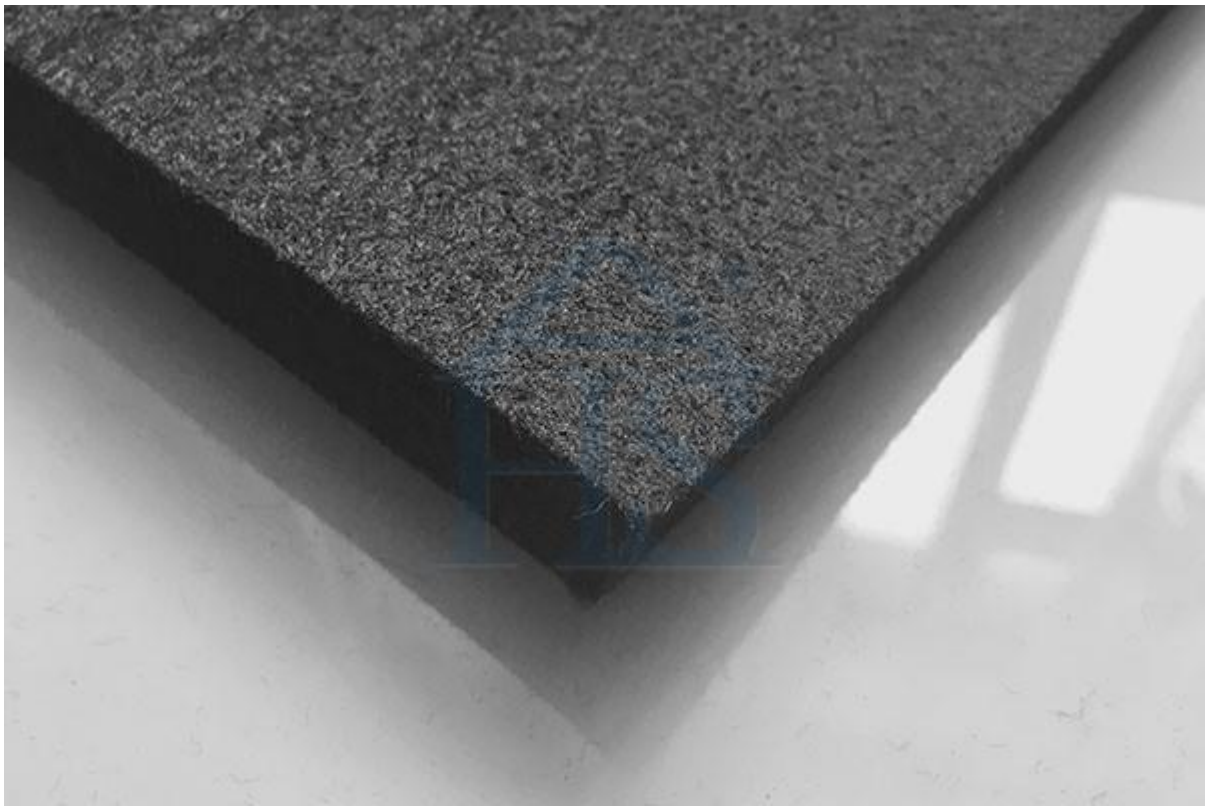
- Thermal shock resistance can be achieved with a relatively low economical cost of operation
- The material has resistance to erosion and spalling and can last longer in comparison to rubber and steel
- Like other silicon carbide-based abrasives, nitride-bonded silicon carbide too has excellent corrosion resistance
- It does not tend to crack or disintegrate under high temperatures

Uses for nitride bonded silicon carbide

- Mining industry
- Petrochemical industry
- Aluminum Processing operations
- Chemical processes

- Power Generation
- Red Metal processing – brass, bronze, and copper

Reaction bonded silicon carbide



Also known as siliconized silicon carbide, the silicon metal is 'infiltrated' to turn into a ceramic with thermal, mechanical, and electrical properties. The material works wonders when used as a liner for pipes, control flow chokes, and mining operations.

Characteristics of reaction bonded silicon carbide include:

1. Hardness in the range of 2500-2550 Knoop
2. High tensile strength as well as flexural strength
3. Good thermal conductivity accompanied by low thermal expansion
4. High resistance to corrosive fluids like acids and alkalis

Uses for reaction bonded silicon carbide

- Liners in pipes
- Low mass kiln supports

- Flow control chokes
- Burner nozzles and setters
- Mining industry
- High-precision components like laser mirror blanks and optical benches

Clay-bonded silicon carbide

Clay-bonded silicon carbide is obtained from a pressure-less sintering process involving silicon carbide dusting powder (raw material) and clay as a sintering additive. Silicon carbide is powdered in the ball mill to achieve consistent particle size as it also helps improve the overall density. The end product is an oxide-bonded silicon carbide abrasive material.

Characteristics of clay bonded silicon carbide include:

- High thermal conductivity
- The coefficient of thermal expansion manages to stay small in value
- The resistance to thermal shocks is great
- Resistance to wear isamazing

Uses for clay bonded silicon carbide

- Clay bonded silicon carbide is popularly used in the manufacture of ceramic kiln furniture
- Muffle furnace covers are prepared from the material for long-term use
- Furnaces across industries where furnace linings are subjected to high temperatures for extended periods
- Use as material for distillation tank in processes involving zinc distillation furnaces
- Cement industry

Silicon nitride bonded silicon carbide

Simply put, it is silicon carbide bonded by silicon nitride molecules. It is known for its hardness, which is second only to diamond.

Characteristics of silicon nitride bonded silicon carbide

- Superior hardness to the Mohs hardness of more than 9.
- High resistance to high temperature. The material retains the same strength and hardness at 1400C as it does at room temperature
- Low coefficient of thermal expansion with higher thermal conductivity
- Creep resistance at higher temperatures
- Lost cost of production

Uses for silicon nitride bonded silicon carbide

- Iron and steel industry

- Chemical industry
- Building and construction materials
- Energy savings, wherever feasible

Chemical vapor deposited silicon carbide

CVD silicon carbide combines chemical vapors with silicon carbide molecules using a linear growth process. The output material is so densely packed that its porosity is 0%.

Characteristics of chemical vapor deposited silicon carbide

- High density for the value 3.18 grams per cubic centimeters
- Thanks to high density, the porosity is reduced to zero percent
- The material has an electrical resistivity of about 1500 μΩm

Black silicon carbide

It is a semi-friable, medium-density abrasive. The production may involve resin or vitrified points and wheels. It is commonly used to grind brittle surfaces.

Black silicon carbide has about 98.5% of silicon carbide. It is tougher than green silicon carbide.

Characteristics of black silicon carbide

- High resistance to wear
- Corrosion resistance, even at high temperatures
- The material exhibits superior refractoriness
- The material stays chemically stable even at high temperatures

Uses of black silicon carbide

- Used to process low tensile strength materials like glass, stone, refractory materials, ceramics, and non-ferrous metals.
- Abrasive applications in the glass industry and manufacture of sandpaper
- Ceramic industry
- Power production (desulfurization systems)
- Refractory applications

Green silicon carbide

It is known as the purest form of naturally occurring silicon carbide. It is obtained from grinding raw blocks on silica carbide as a fine powder. It has a medium density and is a friable abrasive. It contains more than 99% silicon carbide.

Characteristics of green silicon carbide

- The material exhibits strong oxidative resistance
- It remains stable in the presence of chemicals like strong alkalis and acids
- It is harder than black silicon carbide with 9.5 Mohs hardness
- High thermal resistance and strength at high temperatures up to 1900 C.

Uses of green silicon carbide

- Refractory industry
- Exterior painting of non-ferrous metals
- High-temperature seals and furnace parts
- Grinding and polishing operations

Products made from silicon abrasives

Silicon Carbide Powder

It is produced through a reaction and pyrolysis of vaporized polysiloxanes under high temperatures. As the process is easy and straightforward, it only requires a reaction chamber heated to about 1600C. It finds use in abrasive machining processes like sandblasting, grinding, and water-jet cutting. The semiconductor industry uses it for fine-grinding semiconductors. It is also helpful in the case of ferrous materials and ceramics polishing processes. Other applications include processes including honing, shaping, and polishing.

Silicon Carbide Sandpaper

Silicon carbide sandpaper is most commonly used in the automotive, marble, and stone industries. It helps with cost-effective operations like deburring glass and metal surfaces and refinishing wooden floors. The silicon carbide grits on the sandpaper are sharp and very hard. Plastics and medium-density fiberboards can easily be sanded with them.

Silicon Carbide Grinding Wheel

The hard and pointy silicon carbide grits are pasted onto the wheel surface for continuous and controlled grinding or abrasive operations. The base grinding wheel is typically made of composite materials with varying densities depending on the target operation. The continuous spinning wheel supports continuous fast-cutting applications. The target metal surfaces are generally softer metals like aluminum and cast iron.

Black silicon carbide particles are generally used for machining surfaces of plastics and stones. At the same time, the green silicon carbide particles are used to grind carbide materials.

Silicon Carbide Sharpening Stone

We commonly come across grading stones at our home used to sharpen the knives and scissors made from hard stainless steel. Hence silicon carbide sharpening stones come out as a tough material that can sharpen hard metals. It has a hardness in the range of 9-10 Mohs. Moreover, it can be used with water or oil as coolants and friction reduction mediums.

Silicon carbide sanding belts

Silicon carbide particles adhered to rapidly spinning belts are a durable option for fine grinding and sanding operations. The base sand cloth can have varying densities to support the silicon carbide abrasive action. They are instrumental in polishing soft metals like zinc alloys, copper alloys, and aluminum alloys.

Silicon carbide is made up of two components, silicon, and carbon. The cohesive bonding between the two leads to a hard, durable material that can be used for various abrasion applications. It is indeed a nature’ s wonder and very useful in several industrial and domestic operations.

Silicon Carbide Manufacturer

Henan Superior Abrasives as a silicon carbide manufacturer, our company produces black silicon carbide and green silicon carbide, Silicon Carbide Macro Grits particle size include F12 F16 F20 F22 F24 F30 F36 F40 F46 F54 F60 F70 F80 F90 F100 F120 F150 F180 F220, Silicon Carbide Powder particle size include F230 F240 F280 F320 F360 F400 F500 F600 F800 F1000 F1200,

Specific parameters can be accessed: https://www.silicon-carbides.com/silicon-carbide