

**SPECIALIZED
IN POWDERED
MATERIALS**



CNPC POWDER

SILICON NITRIDE

The requirement by a variety of industries for materials that can operate at elevated temperatures and in adverse environments has led to a number of breakthroughs in materials production. One such material is Silicon Nitride or Si_3N_4 . Si_3N_4 produces a unique microstructure for high-temperature precision applications.

SILICON NITRIDE POWDER



Superalloys and heavy metals which were the subject of our recent publication, are used in high strength high-temperature environments. Many turbines and engines use these parts in critical components. However, as the cost of energy has risen, there comes a point where the cost of operating at high temperature and cooling metallic parts does not make economic and/or environmental sense. In these cases, the use of a ceramic like Si_3N_4 becomes more cost effective. As well it can also be used when magnetic fields impede the use of metallic parts.

Silicon Nitride offers a host of material properties that have various applications including:

- Thermal Shock Resistance
- Low Thermal Conductivity
- Corrosion Resistance
- Chemical Resistance
- Long Part/Tool Life
- Wear Resistance
- Good Tribological Properties
- High Fracture Strength
- High Hardness
- High Operating Temperature
- Low Friction
- Electrical Insulator

BEARINGS

When operating for extended periods in environments that see high or dramatic and rapid temperature change Si_3N_4 , can provide solutions over stainless steels. Si_3N_4 also requires less upkeep, and for exhaustive industries like power generation, electric powertrains, or high-speed axles or shafts, these bearings can help to reduce maintenance and down-time for your machinery.

Si_3N_4 's ability to maintain shape at temperatures above 1000 degrees Celsius, low friction, high levels of precision mean that in emergency or dry running situations the bearings can operate much better than metallic bearings. Tribologically this helps when pumps run dry, because the impeller shaft can continue to turn without deforming and causing damage to the housing or impeller.

Si3N4

Si3N4 is produced through a reaction of Silicon and Nitrogen at temperatures of 1400 degrees Celsius. The production process will determine post-sintering shrinkage of Si3N4 parts.

There are three processes to create Si3N4:

- Carbothermal reduction.
- Direct Nitridation.
- Diimide Decomposition.

Given the previously mentioned qualities that Silicon Nitride has, it has become very useful for several applications.

- Cutting tools
- Bearing rollers and guides
- Engine guides
- Valves
- Sealing rings
- Welding nozzles
- Crucibles
- Turbine parts

These applications have a wide variety of applications in a number of industries. We will highlight a few of them here, but Silicon Nitride's applications go beyond what is presented.



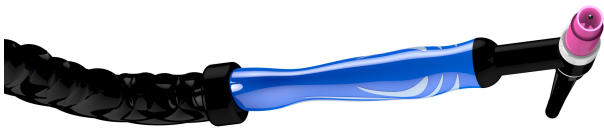
CUTTING TOOLS

In cutting tools Si3N4 has the ability to operate well beyond the abilities of some carbide blades due to its thermal, and tribological properties. This means that a Si3N4 tool can operate at speeds approaching 30 times Carbide speeds without the need for cooling or lubrication. The hardness of the material also ensures that the tool's life will be much greater than a carbide equivalent when cutting cast iron or other materials.

Si3N4 also has the ability to machine certain super alloys which make it a good option of advanced parts production, and after work for sintered parts. This can prove invaluable for conventional parts production.

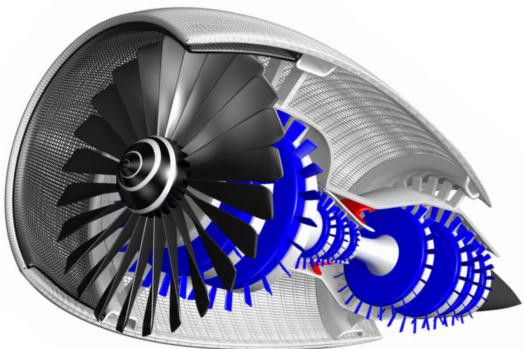
NOZZLES

In applications like welding Si₃N₄ nozzles can produce great results owing to their thermal properties, hardness, and chemical and corrosion resistances. These properties permit an improvement on weld seams, which improve weld quality. Slag buildup on nozzles is also reduced and permits longer running time with fewer costly stoppages. The hardness and thermal shock of silicon nitride means reduced spalling and cracking which pollute the weld and reduce weld strength.



TURBINE BLADES

Si₃N₄ offers the ability to reduce weight and complexity for small turbine blades. The use of Si₃N₄ eliminates complicated cooling channels to regulate temperature for metal turbine blades, and due to its thermal and tribological properties can improve overall reliability for the turbine.



**CNPC'S SILICON
POWDER**



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CNPC POWDER accounts with an ample range of high-quality powders including silicon powder to fit your powder needs for advanced ceramic and carbide applications. Please review our CNPC POWDER catalog and start a conversation with us today.

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