

Si₃N₄

Bearings and Rolling Elements

Ceralloy® Silicon Nitride has proven to be a highly effective material for use as rolling elements in hybrid bearings. Silicon nitride balls exhibit a pore free microstructure with high strength, fracture toughness and contact fatigue resistance that results in improved bearing performance.

Ceradyne silicon nitride rollers have precision-machined crowned profiles designed to minimize stresses in ceramic and metallic components. Silicon nitride cylindrical roller bearings run at higher speeds with reduced friction that leads to increased reliability and longer life.

The Ceradyne proprietary manufacturing process produces a highly cost effective silicon nitride with a unique microstructure that results in excellent wear resistance, a low coefficient of friction and superior wear compatibility with steel. These properties and the lightweight nature of silicon nitride translate to improved bearing performance and component life.

The use of Ceralloy® Silicon Nitride components has consistently improved performance and reliability in a number of engine and bearing applications. To meet the ever-increasing demands for better bearing performance and reliability, consider the proven Ceralloy® Silicon Nitride solution.



Properties

- Lightweight (60% Lighter than Steel)
- Excellent Wear Resistance
- Low Coefficient of Friction
- Contact Fatigue Resistant
- High Fracture Toughness
- Low Surface Porosity
- Electrical Insulator
- Non Magnetic

Applications

- Balls for Check Valves and Hybrid Ball Bearings
- Cylindrical Rollers for Hybrid Roller Bearings and Fuel Pumps
- Cam Rollers for Engines and Fuel Pumps

Property	Benefit
Lighter weight than steel	Higher speed
Higher contact fatigue resistance than steel	Extended life
Superior tribological properties versus steel	Reduced lubrication
Silicon nitride is inert to most environments	Corrosion resistance
Elastic modulus is 50% greater than steel	Higher stiffness
Silicon nitride can withstand temperatures to 1100 C.	Higher operating temperatures
Higher hardest than steel	Increased wear resistance
60% lighter than steel	Lower Inertia
Silicon nitride is an electrical insulator and is non magnetic	Unique properties

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Property	Ceralloy®147-31N
Process	Sintered Reaction Bonded
Density (g/cc)	3.2
% Theoretical Density	>99.5
% Open Porosity	0
Purity (% Si₃N₄)	92
Mechanical Characteristics	
Flexural Strength (MPa) @ RT	700-800
Weibull Modulus	15-50
Elastic Modulus (GPa)	310
Poisson's Ratio	0.27
Hardness HV (0.3) Kg/mm ²	1450
Fracture Toughness (MPam ^{1/2})	6.0
Abrasive Wear Resistance Parameter**	825
Thermal	
Thermal Expansion Coeff. 10 ⁻⁶ /°C: (RT-1000°C)	3.1
Thermal Conductivity (W/mK) @ 25°C	26
Thermal Shock Parameter (°C)***	610
Electrical	
Electrical Resistivity (ohm-cm)	10 ¹⁶
Dielectric Constant	8
Key Features	Strength, Hertzian Contact Strength, Structural Reliability, Net Shape Fabrication
Applications	Automotive Components, Roller Bearings, Wear Components, Cylindrical Rollers



* Property values are typical and should not be considered specifications.
 ** Abrasive Wear Resistance Parameter = Fracture Toughness^(0.5) * Hardness^(1.43) * Elastic Modulus^(-0.6)
 *** Thermal Shock Parameter = [Strength * (1-Poisson's Ratio)] / (Elastic Modulus * Thermal Expansion Coeff.)



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Ceradyne Advanced Technical Ceramics
 Ceradyne, Inc. (NASDAQ:CRDN) is a publicly traded corporation specializing in development and production of advanced technical ceramics. Manufacturing facilities are based in California, Georgia, Kentucky, Michigan, Germany and France. Ceradyne's advanced ceramics are sought for the most demanding applications in automotive, wear, semiconductor, orthodontic and armor industries.

Ceralloy® 147 Silicon Nitride components are produced in fully dedicated facilities using patented compositions and processing techniques. Plentiful raw materials are coupled with conventional, time-tested ceramic manufacturing processes that produce high quality, cost effective silicon nitride components.