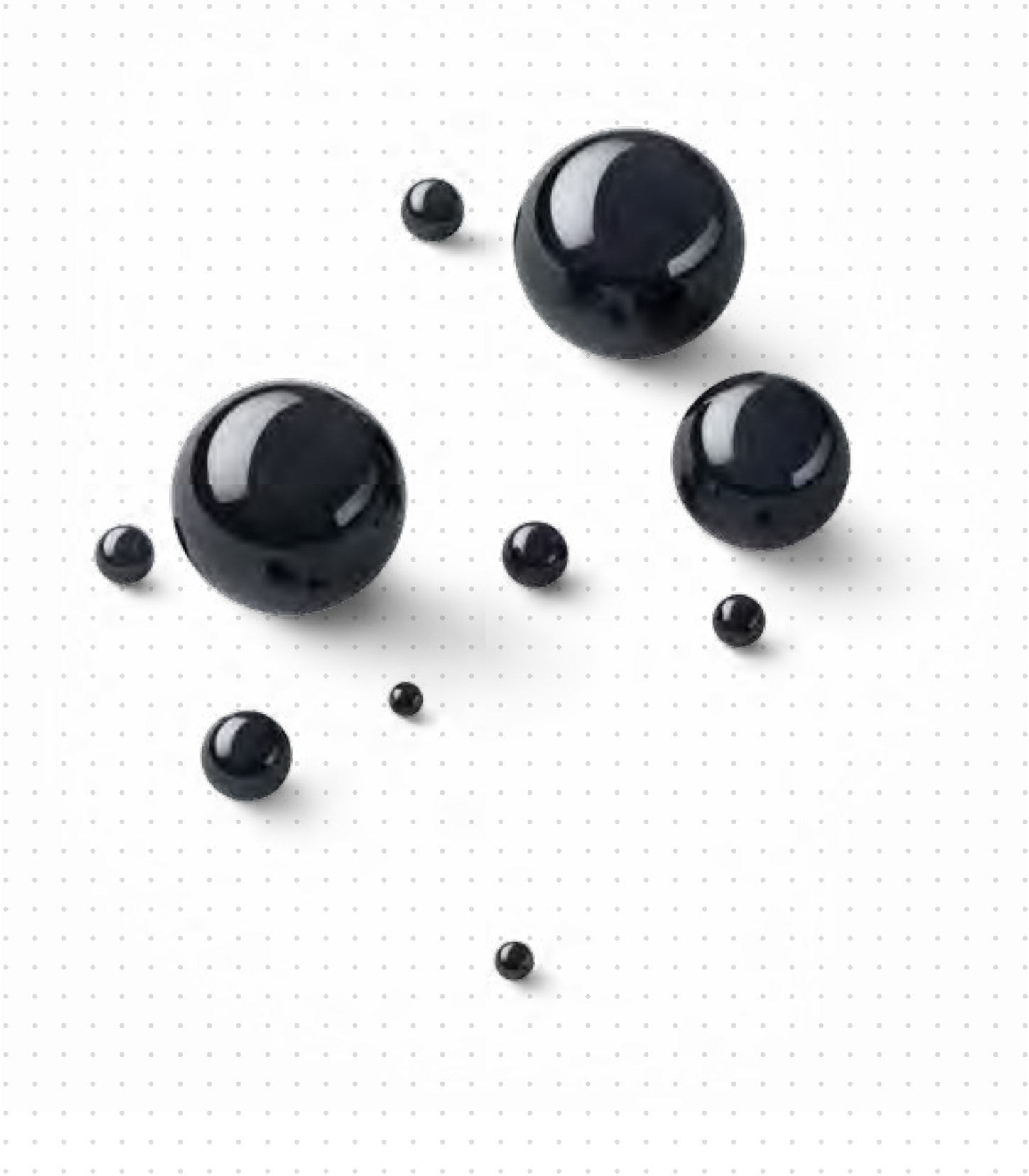




Cerbec® Silicon Nitride

Genuine Cerbec Ceramic Balls



Ceramic Balls for High-Performance and Severe-Duty Applications

Cerbec® silicon nitride balls outperform traditional all-steel bearing balls. With tailored material properties and finishing that maximize the benefits of using ceramics, Cerbec balls outperform in applications where steel balls degrade rapidly or where electrical insulation is required

Smoother Surface, Better Geometry, & Inert Material

- Decreased lube degradation
- No cold welding/adhesive wear
- Less friction
- Lower operating temperature
- Less wear
- Eliminates vibration-induced false brinelling

Lower Total Operating Cost

- Less wear equals longer bearing life
- Increased reliability reduces downtime and maintenance
- Reduced energy consumption

Harder & Stiffer

Cerbec balls are manufactured from a specially formulated CoorsTek silicon nitride. This unique material is 121% harder and 68% stiffer than traditional steel alloys, providing:

- Reduced ball/race contact area
- Less friction
- Resistance to hard particle contamination
- Higher rigidity
- Increased machine accuracy

Lighter Weight

Manufactured from high-quality silicon nitride, Cerbec balls are 58% lighter than steel alloys—lowering centrifugal force, reducing gyroscopic movement, and minimizing ball skidding. The lighter weight also causes less friction and lower raceway stress.

Lower Thermal Expansion

- Reduced contact angle change
- Stable running pre-load
- Minimal ball deformation

Corrosion & Electrical Resistance

- No electrical arcing through balls
- Increased durability in harsh environments
- Decreased raceway pitting

Additional Benefits

- Minimal lubrication required
- Reduced startup and running torque
- Lower noise and vibration
- Expanded design possibilities available to solve technical challenges
- Higher operating speeds possible



ASTM F2094 Si ₃ N ₄ BALL SPECIFICATION					
Grade	Allowable Ball Diameter Variation	Allowable Deviation from Spherical Form	Maximum Surface Roughness Ra	Allowable Lot Diameter Variation	Basic Diameter Tolerance
3C	0.08 (3)	0.08 (3)	0.004 (0.15)	0.13 (5)	+/- 0.51 (+/- 20)
5C	0.13 (5)	0.13 (5)	0.005 (0.20)	0.25 (10)	+/- 0.76 (+/- 30)
5 Steel For Comparison	0.13 (5)	0.13 (5)	0.02 (0.8)	0.25 (10)	+/- 1.0 (+/- 40)

Units of measure = micron (micro-inch)

Cerbec Ball Processing

Cerbec bearing balls are produced utilizing high-purity raw silicon nitride materials with highly controlled milling preparation to guarantee consistent chemistry and particle size. Additionally, the Cerbec manufacturing process includes:

- Spray drying for flowability and packing density
- Forming to uniform compaction
- Pre-firing to remove binders
- Hot Isostatic Press (HIP) densification for proper microstructural development – resulting in greater hardness, toughness, and less rolling contact fatigue
- Lapping for consistent geometry, surface finish, and surface quality
- Quality control – Cerbec balls undergo an intensive final inspection to ensure incomparable quality



CoorsTek engineers precision Cerbec balls in sizes ranging from large application bearings in wind turbines to micro-bearings in dental drills, with a diameter range from 50 mm (2 in) to 0.5 mm (0.02 in).

WHY CERBEC CERAMIC BALLS?			
Property	Typical Steel	Cerbec Si ₃ N ₄	Cerbec Difference
Density [g/cc]	7.6	3.2	-58% Lighter
Hardness [Vickers]	700	1550	+121% Harder
Elastic Modulus [GPa]	190	320	+68% Stiffer
Thermal Expansion Coefficient, 1 X 10 ⁻⁶ / °C [RT to 1000°C]	12.3	3.7	-70%
Max Use Temp [°C]	320	1000	+680°C
Surface Finish, Grade 5 [micron]	0.02	0.005	+75% Smoother

CERAMIC SILICON NITRIDE TYPICAL PROPERTIES

Material	NBD-200*	SN-101C**
Sintering Aid	MgO	Y ₂ O ₃ ; Al ₂ O ₃
Density [g/cm ³] (% Theoretical)	3.16 [> 99.9%]	3.21 [> 99.9%]
RT Flexural STrength [MPa]	>900	>1000
Weibull Modulus	15	15
Elastic Modulus [GPa]	320	310
Poisson's Ratio	0.26	0.27
Vicker's Hardness HV10	1550	1550
Fracture Toughness [MPa m ^{1/2}]	6	6.5
Thermal Expansion Coefficient (1 X 10 ⁻⁶ / °C [RT to 1000°C])	2.9	3.7
Thermal Conductivity ([W/m K] @ 25°C)	29	34
Electrical Resistivity [ohm-cm]	10 ¹⁴	10 ¹⁴
Dielectric Constant @ 1MHz	8.0	8.0
Corrosion 5% HF Solution, 500 Hours Weight Loss/Surface Area [g/cm ²]	0.68	0.10
Corrosion 5% HCL Solution, 500 Hours Weight Loss/Surface Area [g/cm ²]	0.0002	0.0036

*NBD-200 typical for balls 3.175 mm (0.125") diameter or smaller

**SN-101C typical for balls greater than 3.175 mm (0.125") diameter

APPLICATIONS

HIGH SPEED



Machine tool spindles



Dental handpieces

EXTREME TEMPERATURES



Space satellites

ELECTRICAL RESISTANCE



Electric motors and generators

LOW FRICTION



Bicycles, in-line skates



Wheel, clutch, transmission bearings

EXTREMELY LOW LUBE



Turbomolecular pumps

LIGHTWEIGHT



Jet engines and wing flap ballscrew actuator

Charts intended to illustrate typical properties. Property values vary with method of manufacture, size, and shape of part. Data contained herein is not to be construed as absolute and does not constitute a representation or warranty for which CoorsTek assumes legal responsibility. CoorsTek and Cerbec are registered trademarks of CoorsTek, Inc.

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