Cyrol® ceramic bearing rollers

Needle, cylindrical, tapered and spherical rollers made in Germany

CeramTec
THE CERAMIC EXPERTS

New dimensions in roller bearing technology

Hybrid bearings have so far been equipped with ceramic balls only. CeramTec has now developed the "Cyrol®" product range and thereby broadened the application portfolio of hybrid bearings to include roller bearings. After the development of the production technologies for roller elements, CeramTec is able to produce needle, cylindrical, tapered and spherical rollers. Manufacturers of roller bearings or linear guides benefit from their special quality and price-performance structure. Instead of high-priced solutions and special applications, they can now offer their customers high-performance and precision products at marketable prices.

Hybrid bearings are essential to meet the wishes, requirements and needs of a fast-growing high-end market. Precision and outstanding material properties are the decisive factors for a successful implementation in the application. Ceramic roller elements from CeramTec are predestined for high-end applications and offer clear advantages due to the material properties of the SL 900 material specially developed for this purpose.

Possible fields of application

Bearings with ceramic rollers are used in a large number of branches and industries due to their superior properties:

- mechanical engineering (high-speed spindles, precision swivel joints),
- drive trains in automotive and rail applications,
- energy production,
- clean room technology,
- printing machines,
- chemical industry,
- textile industry,
- mining,
- and many other fields

In many cases, the use of ceramic rollers can extend the maintenance intervals or in some cases even make applications possible in the first place.

THE ADVANTAGES OF CYROL®

- High precision roller elements
- High wear resistance
- Chemical resistance
- High temperature resistance
- Non-magnetic
- Low density
  (about -40% relative to steel)

THE ADVANTAGES OF CERAMIC ROLLER ELEMENTS IN APPLICATION

- Prolonged service life
- Maximized permissible speeds
- Reduced abrasion
- Good dry running properties and thus better emergency running properties
- High electrical resistance
- Longer lubricant service life

Ceramic Roller Elements

Material requirements

The technical requirements for silicon nitride bearing rollers are outlined in the ASTM F 2730/F 2730M standard, which is used to classify rollers according to their material properties and geometry. Assuming that only rollers of the highest class are used in the context of medium and better quality bearing solutions, CeramTec meets this challenge.

The SL900 material meets all criteria of ASTM F 2730/F 2730M. This is also confirmed on the part of roller bearing manufacturers.

Geometry requirements

Ceramic bearing rollers are, of course, subject to the same requirements as metallic rollers when it comes to roundness and waviness of the lateral surfaces, because these two properties are essential factors for perfect bearing operation and control of running noise. Compared to the production of ceramic products used elsewhere, the specifications and tolerances for dimensional deviations in ceramic rollers are very narrow.

An example in accordance with ASTM F 2730/F 2730M

(Cylindrical roller with typical dimensions of Ø 12 mm and length 12 mm)

- Roundness < 1 µm
- Straightness in the cylindrical area: < 2.0 µm (convex)
- Roughness in the cylindrical area: < Ra 0.1
- Classification of the rolling elements:
  CeramTec: 1 µm classes in diameter
  CeramTec: 6 µm classes in length

Material data sheet

	Units	Silicon Nitride SL900
Material		Si_3N_4
Color		dark gray-black
General properties		
Density	g/cm³	3.20
Mechanical properties		
Bending strength (at 20 °C)	MPa	>800
Compression strength	MPa	3000
Fracture toughness K_{ic}	MPa $m^{1/2}$	6.0
Young's modulus	GPa	320
Vickers hardness HV 0.5		1500
Weibull modulus		15
Poisson number		0.26
Thermal and electrical properties		
Thermal conductivity (at 20 °C)	W/mK	30
Coefficient of linear thermal expansion	10^{-6} K^{-1}	
20 – 200 °C		2.5
20 – 400 °C		3.2
20 – 600 °C		-
Specific heat c_p (at 20 °C)	kJ/kgK	0.8
Electrical resistivity (at 20 °C)	Ω cm	$1x10^{14}$
Dielectric strength	kV/mm	-
Relative permittivity		8 (1 MHz)
Dielectric loss coefficient		$4x10^{-2}$ (1 GHz)
Thermal shock resistance	K	650
Maximum usable temperature, without load	°C	1200

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