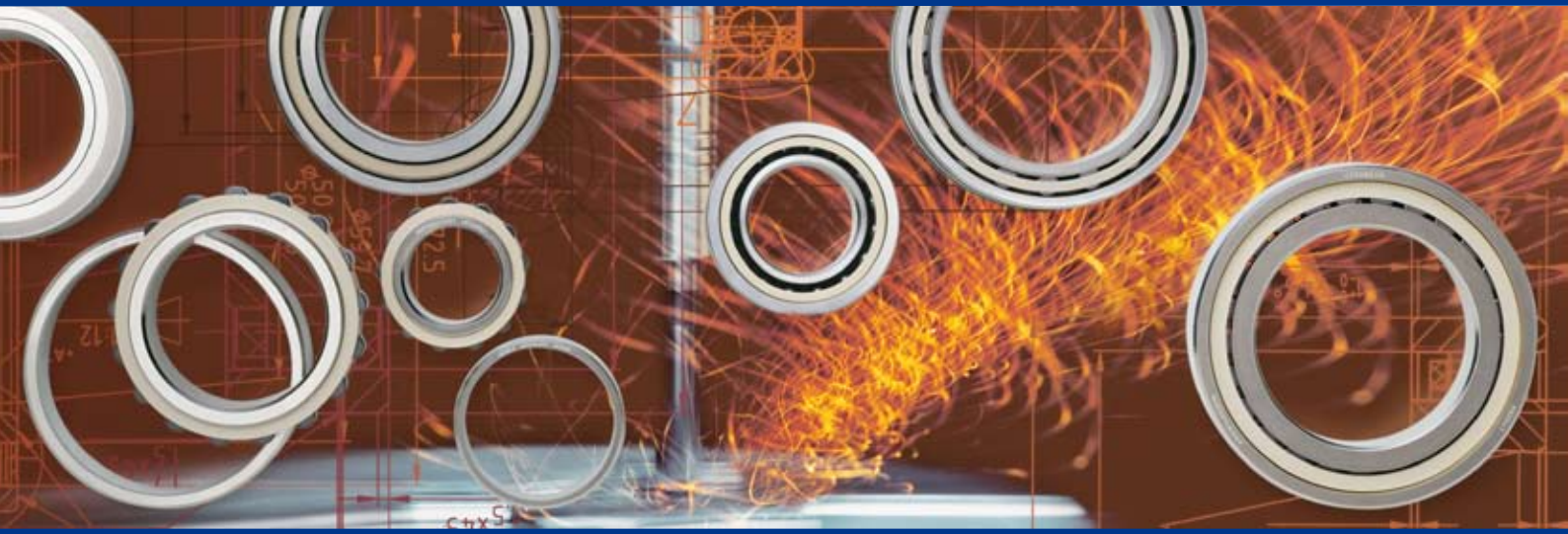


CEROBEAR®

ceramic bearing technology

— MinebeaMitsumi Group —



CEROBEAR SPINDLE BEARINGS FOR MACHINE TOOL APPLICATIONS

CEROBEAR SPINDLE BEARINGS

ABOUT CEROBEAR

Committed to the abbreviation CERamic in ROLLing BEARings, CEROBEAR GmbH is the renowned world leader in the design, manufacturing and marketing of bearings that feature highly advanced ceramic material technology.

CEROBEAR was founded in 1990 as a spin-off from the Fraunhofer-Institute of Production Technology at the Technical University of Aachen, Germany. Today, the company is still under owner's management and is located just outside Aachen in Herzogenrath, a small city near Cologne in the western-most part of Germany.

CEROBEAR operates an impeccable 3700m²/40000 sqft facility with state-of-the-art production, metrology and testing equipment, and we have a staff of more than 100 highly skilled technical employees.



Shielded version of CEROBEAR hybrid spindle roller bearing



CEROBEAR bearings are used in high-performance areas in the most diverse of industries, where steel bearings can no longer fulfil the demands. One of these industries is the machine tool industry, with particularly high demands concerning accuracy, speed coefficient and stiffness. These demands are fulfilled by CEROBEAR rolling bearings to an extremely high degree.

The material combination of ceramic/steel is superior to conventional steel bearings in many areas of rolling bearing technology. By using bearings with ceramic components higher revolutions and stiffnesses, reduced wear and lower heat development can be achieved.

In addition to an extensive standard programme, CEROBEAR develops solutions for any type of application in close collaboration with the customers.

APPLICATION

Hybrid spindle roller bearings are an ideal alternative to conventional bearing concepts of machine tool spindles with spindle ball bearings. Two different fields of use are conceivable for the hybrid spindle roller bearings:

- The use as floating bearing on the rear end of the spindle and
- The installation of a roller bearing on the spindle nose, in addition to the spindle bearing package.

With help of a conical bearing seat on the shaft, precise positioning of the radial bearing clearance is possible during assembly.



CEROBEAR hybrid spindle roller bearing for direct oil lubrication

HYBRID SPINDLE ROLLER BEARING AS FLOATING BEARING

Hybrid spindle roller bearings are the best floating bearing solution for radial support at the rear end of machine tool spindles. The job of the floating bearing on a spindle is to facilitate axial movement compensating thermal effects such as spindle extension. As well as this axial movement, it is also necessary to achieve a sufficiently high radial stiffness so that the bearing withstands the appearing operational forces. When using spindle ball bearings, this is only possible using a complex system of two bearings and a ball lining for axial mobility.

The hybrid spindle roller bearing offers a significantly simpler solution. With one bearing, the entire unit of the floating bearing side made up of spindle ball bearings and ball sleeve can be replaced. Due to the internal geometry of the bearing with a smooth inner or outer ring, axial movement is possible without any problems at all.

In terms of the entire system of the spindle, using a hybrid spindle roller bearing as a floating bearing simplifies the construction and creates a clear cost reduction:

- The number of necessary components is reduced and
- The assembly of the bearing is simpler than with the ball sleeve system, despite the necessary positioning of the floating bearing.

The good operating performance of hybrid spindle roller bearings means the bearing lasts longer, thus reducing the necessary spindle revisions and operating costs. The advantages of this bearing solution are particularly noticeable in spindles used in the high-speed cutting sector, such as in aluminium machining.



CEROBEAR hybrid spindle roller bearings in different sizes

HYBRID SPINDLE ROLLER BEARING TO INCREASE STIFFNESS ON THE SPINDLE NOSE

Another possible use for hybrid spindle roller bearings is installing them into the spindle nose. In doing this, the bearing is mounted on the spindle at the front in addition to the spindle bearing package in order to considerably increase the stiffness of the front spindle part. With cylindrical rollers made of ceramic, the stiffness of the spindle can be considerably increased, which ensures a good dynamic performance.

This solution is primarily suitable for use in heavy duty machining, where high forces are created on the spindle at moderate rotational speeds due to the large material removal.

CEROBEAR SPINDLE BEARINGS



CEROBEAR roller bearing and silicon nitride rollers

ADVANTAGES OF USING SILICON NITRIDE

As a material for the rolling elements of the hybrid bearings as well as the rings and rolling elements of the ceramic bearings, the ceramic high-performance material silicon nitride (Si_3N_4) is used. This nitride ceramic has already proven itself in many areas of rolling bearing technology, thanks to its outstanding material characteristics. Silicon nitride is brilliantly suited for use in high-performance rolling bearings due to its material properties. The density of the ceramic, which is about 60% lower compared to steel, leads to lower centrifugal forces during use, thus achieving higher operational speeds.

As a result of the higher elasticity modulus of silicon nitride, the deformation of the ceramic components is lower when put under strain. In comparison to conventional steel rolling bearings, this leads to a considerably higher stiffness of CEROBEAR hybrid and ceramic bearings.

Due to the materials used, a contact of the over-rolling counterparts under mixed friction is unproblematic, which means it is possible to use the minimum amount of lubrication.

The effects known from steel rolling bearings, such as smearing, cold welding and fretting are eliminated in the material coupling of ceramic/steel in hybrid rolling bearings and in pure ceramic rolling bearings. For these reasons, CEROBEAR bearings have ideal emergency operating properties so that if the lubrication intake is temporarily disrupted, this is no problem for the bearing. Longer lifetimes and increased reliability are achieved as a result. The lifecycle costs in the application can be reduced.

MATERIALS FOR RINGS AND CAGES

High nitrogen bearing steels are used as material for the rings of the hybrid bearings.

For the highest demands on corrosion and wear resistance, Cronidur 30 (1.4108) or X.D15N.W (1.4123) are used.

For lower demands, it is also possible to use the corrosion-resistant material AISI 440C or the conventional bearing steel 100Cr6 (1.3505).

PEEK, a high temperature thermoplastic, is generally used for the cages. This cage material used by CEROBEAR is characterised in particular by the following characteristics:



CEROBEAR hybrid spindle roller bearing - extract of a PEEK cage with rollers

- Good tribological properties
- Good mechanical rigidity
- High durability
- High temperature stability
- Good resistance to wear
- Chemical consistence against lubrications and ambient media
- Interception of impact loads (impact strength)
- Low water absorption capacity

For applications, in which the standard material PEEK is not suitable due to constraints of the case of operation, there also exists the opportunity to use alternative cage materials, such as brass, PI or PAI.



CEROBear rolling bearing with anti-rotation device



CEROBear hybrid spindle roller bearing - extract of shielded version

DESIGNS

CEROBear hybrid spindle roller bearings are produced in N, NU and NN designs with cylindrical and conical bores. The possible bearing sizes range from a bore diameter of 15 mm to an external diameter of 420 mm.

As well as ISO series bearings, CEROBear also produces custom-made hybrid spindle roller bearings for your particular needs. The following points show an extract for the adjustment of our bearings to your needs:

- Adjustment of bearing play (Standard: C1)
- Adjustment of bearing tolerances (Standard: SP)
- Any modification of bearing dimensions
- Adjustment of bearing stiffness by varying the number of rolling elements
- Use of special materials
- Adjustment of bearing sealing
- Anti-rotation devices
- Bearings with oil bore for direct oil lubrication
- Bearings with steel rolling elements

OTHER ROLLING BEARINGS

In addition to the spindle roller bearings described above, CEROBear also produces other types of bearings for use in machine tools or other applications with high demands. This spectrum ranges from conventional spindle bearings over specially adapted spindle bearings to meet the highest demands up to high-precision tapered roller bearings for special machines. The versatility of material and design described above is also available for these types of bearings.



CEROBear hybrid spindle bearing for highest demands



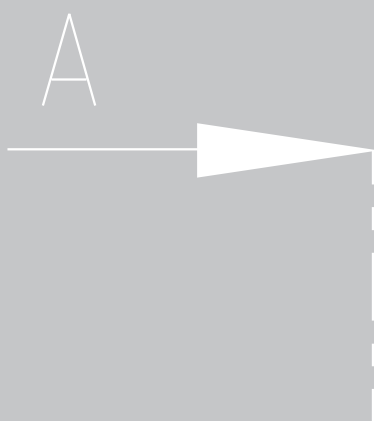
We welcome your enquiries from around the world and look forward to hearing from you.

For more information on CEROBear and our unique technology and products, please contact us:

CEROBEAR GmbH
Kaiserstrasse 100
52134 Herzogenrath
GERMANY

Phone: +49 2407 95 56 - 0
Fax: +49 2407 96 22 4
Email: cb-sales@cerobear.de
www.cerobear.com

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