



CEROBEAR SPINDLE BEARINGS FOR MACHINE TOOL APPLICATIONS

CEROBEAR SPINDLE BEARINGS

With a team of over 120 highly qualified employees and state-of-the-art machine tools and production technology, CEROBEAR is global leading manufacturer of ceramic rolling bearings and hybrid rolling bearings. 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 concentricity, speed coefficient and stiffness. These demands are fulfilled by CEROBEAR rolling bearings to an extremely high degree.



CEROBEAR hybrid spindle roller bearing for direct oil lubrication



Shielded version of CEROBEAR hybrid spindle roller bearing

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.

As well as an extensive standard programme, CEROBEAR develops problem solutions for any type of application in close collaboration with 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 from a conical bearing position on the shaft, optimal, precision positioning of the radial bearing clearance is possible when assembling.

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 to compensate for 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



CEROBEAR hybrid spindle roller bearing for high-speed applications

spindle ball bearings and ball lining 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 lining 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.

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.



CEROBEAR hybrid spindle roller bearings in different sizes

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.

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 to 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.



CEROBEAR roller bearing and silicon nitride rollers

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 running 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 X 102 CrMo 17 (1.3543) or the conventional roller-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 ceramic deep groove ball bearing



CEROBEAR rolling bearing with anti-rotation device



CEROBEAR hybrid spindle roller bearing - extract of shielded version

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.

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 300 mm.

As well as the ISO series bearings, CEROBEAR also produces custom-made hybrid spindle roller bearings for your particular need. 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



CEROBEAR hybrid spindle bearing for highest demands



We welcome enquiries from around the world and look forward to hearing from you. For more information on CEROBEAR and our unique technology and products, please visit our website or contact us directly:

CEROBEAR GmbH
Kaiserstrasse 100
52134 Herzogenrath
GERMANY

Phone: +49 - 2407 - 9556 - 0
Fax: +49 - 2407 - 96224
Email: cb-sales@Cerobear.de
www.cerobear.de