



CEROBEAR ROLLING BEARINGS FOR THE SEMICONDUCTOR, SOLAR & VACUUM INDUSTRY

CEROBEAR HYBRID BEARINGS

CEROBEAR GmbH is the renowned world leader in the design, manufacturing and application engineering of bearings that feature highly advanced ceramic material technology. Our CERamic ROLLing BEARings are used in the most challenging applications where standard steel rolling bearings are no longer capable of performing reliably.

In addition to serving market segments including Aerospace, Fluid Machinery, Food & Beverage, Motorsports, Oil & Gas, Machine Tools, CEROBEAR also designs and manufactures advanced bearings for the Semiconductor, Solar and Vacuum Industry.

With a team of more than 100 technically oriented employees and the most modern manufacturing technology, CEROBEAR rolling bearings are produced in Herzogenrath near Aachen, in the most western part of Germany.



CEROBEAR bearings are perfectly suited to fulfill the high demands of the semiconductor, solar and vacuum industries.



CEROBEAR corrosion resistant bearings

THE CEROBEAR DIFFERENCE

Simultaneous Engineering

- Specialist for joint bearing development from prototyping to production levels
- Close customer collaboration at every development stage from the design to serial usage
- Analysis, calculation and lifetime-prediction for bearings featuring ceramic components

Advanced Bearing Materials

- Leading expert in the manufacture of silicon nitride (Si_3N_4) and zirconia (ZrO_2) races and rolling elements
- High Nitrogen Steels with superior corrosion resistance at 60 HRC
- Advanced Polymers: PEEK, Vespel® DuPont™, Torlon® PAI, PCTFE etc.

Advanced Component Fabrication & Inspection

- In-house ball surface inspection yields outstanding reliability
- In-house ceramic roller fabrication with exceptional geometry flexibility
- Hard-turning for rings maximizes roundness & concentricity; enables complexity

Complete Design Consideration

- We specialize in customized designs and do standard bearings as well
- Custom fit and integration into all application requirements
- Assurance of maximum benefits from materials being used
- Maximize performance and service-life

Flexible, Quick and Highly Certified Manufacturing

- 8-16 weeks delivery for initial non-stocked orders, depending on the complexity of the part
- Complete traceability of every bearing and every part
- Certified according to the following international standards:
 - EN 9100 (Aerospace Standard)
 - DIN EN ISO 9001 (Industrial Standard)
 - DIN EN ISO 14001 (Environment)
 - BS OHSAS 18001 (Health & Safety)
 - DIN EN ISO 50001 (Energy)

Production Flexibility: Small Prototype Lots to Serial Production:

Even for 100% customized bearing designs we can provide small lots with MOQ = 10



CEROBEAR precision constant section bearings

OUR PRODUCTS

CEROBEAR's product range includes customized and standard bearings:

- **Hybrid rolling bearings**, a combination of steel rings and Si_3N_4 rolling elements
- **All-Ceramic rolling bearings** made of either Si_3N_4 or ZrO_2

In addition to our extensive bearing selection in ISO dimensions, we also customize bearing solutions for our customer application needs in a close cooperation with both, OEMs and end users.

CEROBEAR rolling bearings for the Semiconductor, Solar and Vacuum processing industry stand out primarily by

- low particle emission,
- high temperature durability and
- superior corrosion resistant materials, which are state-of-the-art in the rolling bearing business.



CEROBEAR all-ceramic ball bearings for demanding applications

MATERIALS AND TECHNOLOGY

In more than 20 years of close collaboration with world leading OEMs, CEROBEAR has developed a range of advanced bearing materials, mainly high grade steels and high strength ceramics, from which by unique manufacturing technologies customized bearing solutions for the semicon, solar and vacuum processing industries are manufactured.

CEROBEAR material specification:

The core components of CEROBEAR hybrid bearings are raceways made of specially heat treated High Nitrogen Steel and Si_3N_4 rolling elements. For extreme harsh conditions all-ceramic bearings with rings made of Si_3N_4 or ZrO_2 and Si_3N_4 rolling elements are available.

Raceway materials:

Superior corrosion resistant High-Nitrogen-Steel, even improved by an anti-corrosion heat treatment, developed by CEROBEAR

- Corrosion resistance against harsh cleaning detergents containing e.g. H_2O_2 , PAA, isopropanol and acetone.
- Superior lifetime due to 2.5 x higher overrolling resistance compared to conventional bearing steel

Corrosion resistant high nitrogen steel (approved in 192h salt spray test)



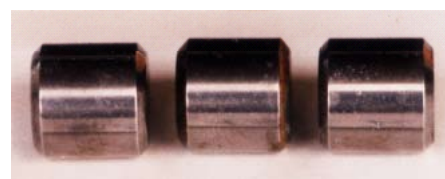
SAE 52100 ("conventional bearing steel")



SAE 52100 chromium plated



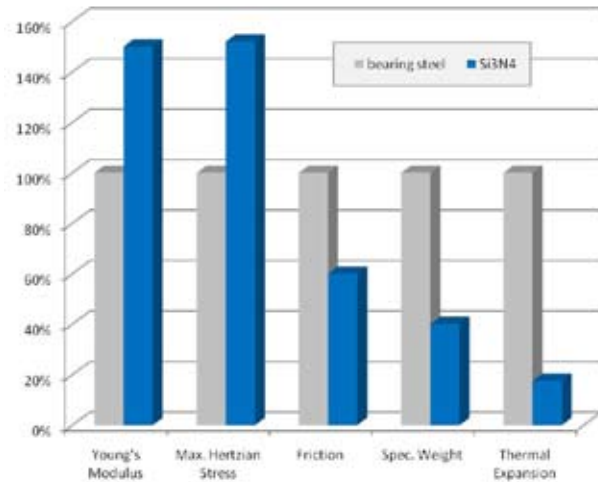
AISI 440 C ("corrosion resistant bearing steel")



High Nitrogen Steel (HNS)
CEROBEAR specification

Courtesy of: Energietechnik Essen

CEROBEAR HYBRID BEARINGS



Two specs of ceramics are available; pressure densified, high purity Si_3N_4 or ZrO_2 (Y-TZP zirconia):

- Absolute stable chemical structure ; Inert
- Extreme hardness of 1550 HV (~ 80 HRC) for Si_3N_4 , 1200 HV (~ 72 HRC) for ZrO_2
- Less wear and constant low friction

Rolling elements: Pressure densified, high purity Si_3N_4

- Absolute stable chemical structure ; Inert
- Extreme hardness of 1550 HV (~ 80 HRC)
- 40% lower coefficient of friction compared to conventional bearing steel
- Enables media lubrication or dry running (very good emergency operating properties)
- Less wear and constant low friction

Cage: Polyetheretherketone (PEEK), PTFE, PCTFE, Torlon, Vespel

- Chemical resistant against any cleaning detergents
- Temperature resistant up to 536 °F (~ 280 °C)
- Flexible
- Low friction

Lubricant: customized, depending on operating conditions

CEROBEAR offers a wide range of greases for very different applications. For example: ultra high vacuum, high temperature, cryogenic, high speed and many more.

Seals/Shields: customized, depending on operating conditions

CEROBEAR chooses from a range of materials the best option based on the application requirements. For example: FPM (Viton), NBR, PTFE, PCTFE, Monel or special EPDM compounds.



CEROBEAR hybrid constant section bearings

APPLICATIONS AND CONDITIONS

CEROBEAR hybrid and all-ceramic bearings are being used in the following semiconductor, solar and vacuum applications:

- | | |
|----------------------------------|---------------------------------|
| • Wafer cleaning / etching | • Plasma applications |
| • Thin-film coating applications | • Vacuum deposition systems |
| • Liquid pumps/ TMPs | • Cryo temperature applications |
| • Laser and e-beam lithography | • High temperature processing |
| • Positioning systems | • LED/OLED production equipment |
| • Wafer annealing | • Sputtering systems |
| • Furnace applications | • Radiation |

CEROBEAR ceramic bearings are capable to withstand the most challenging operating conditions in which conventional steel bearings under-perform and fail after short service-life.

CEROBEAR bearings offer superior properties:

- Resistance against cleaners
- Resistance against deionized water
- Resistance against process gasses
- Capability of running media lubricated or completely dry
- Constant and low friction
- Low particle emission, clean room qualification
- Customized designs possible, even at small quantities



Glass coating unit for coating of glass with LowE- and Solar-Control-Coating

With the friendly consent of Von Ardenne Anlagentechnik GmbH

ADVANCED BEARING TECHNOLOGY FOR THE SEMICONDUCTOR, SOLAR AND VACUUM INDUSTRY

Extreme operating conditions such as high temperature, ultra high vacuum or corrosive environment are some of the main challenges for bearings used in the semiconductor, vacuum and coating industry. CEROBEAR ceramic bearings do not just cope with them but are offering an added value in terms of 100% reliability and outstanding service-life. Especially in various coating and lithography applications, CEROBEAR bearings have proven their unique quality for more than a decade. Either used under vacuum conditions or in aggressive process gases, such as selenium or fluorine, CEROBEAR bearings are designed, to safely fulfill their function even under the hardest conditions. Extremely corrosion resistant, through-hardened bearing steels, carefully heat treated by a specifically in-house developed annealing process or highly corrosion resistant ceramic races, in combination with silicon nitride ceramic rolling elements enable totally new machinery designs where bearings can be exposed directly to the corrosive environment.



CEROBEAR all-ceramic bearings for coating applications & wafer processing

Starved Lubrication / Media Lubrication / Dry Run:

Ultra high vacuum or coating applications require equipment which does not pollute the product in any way. In conventional

rolling bearings the lubricant acts as a source of pollution e.g. by outgassing. Steel rolling bearings need to be lubricated by grease or oil, otherwise they fail by an adhesive wear mechanism known as galling. In standard bearings the grease is detained by seals, which often wear out and tend to leak on the long-term. In CEROBEAR hybrid and all-ceramic bearings, galling is physically not possible, because ceramic provides a completely stable chemical structure which is inert and thus not capable of reacting with the steel of the races. As a consequence CEROBEAR rolling bearings have lower requirements for lubricant. They can be operated with process media and in a lot of applications they run totally dry.



CEROBEAR High temperature resistant bearings

Easy Machinery Integration:

The implementation of CEROBEAR hybrid and all-ceramic bearings into existing machines does not require any modifications to the mating parts in general. CEROBEAR engineers design each bearing solution particularly to the environment and application. An easy integration is the customers benefit.

Reduced Total Cost of Ownership:

In many areas standard steel bearings present the weakest link and define the down-time of the entire production process. Scheduled, but short service outages and unplanned stops caused by avoidable bearing failures result in lower productivity and margin. The investment in CEROBEAR's advanced bearing technology offers a variety of advantages. The superior service life of CEROBEAR hybrid bearings enhances machine availability and thus reduces the total cost of ownership. For this reason, the world's leading coating equipment OEMs trust in CEROBEAR's unrivaled products and engineering services for more than 10 years.



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

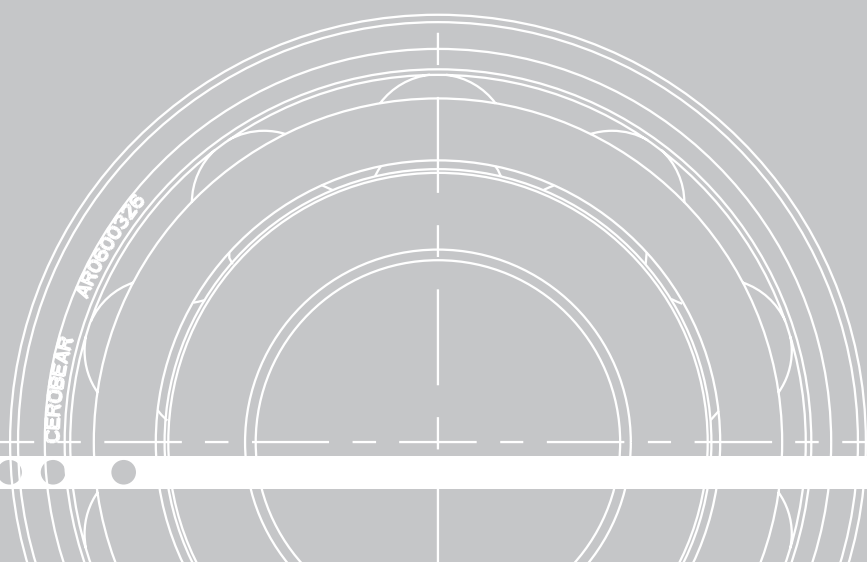
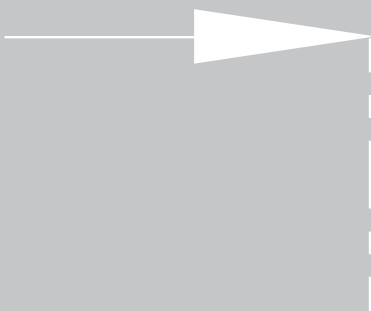
For more information on CEROBEAR and our unique technology and products, please contact us:

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