Hybrid Ceramic Bearing:

Ceramic hybrid ball bearings use ceramic balls. Ceramic balls weigh up to 40% less than steel balls, depending on size. This reduces centrifugal loading and skidding, so hybrid ceramic bearings can operate up to 50% faster than conventional bearings. This means that the outer race groove exerts less force inward against the ball as the bearing spins. This reduction in force reduces the friction and rolling resistance. The lighter ball allows the bearing to spin faster, and uses less energy to maintain its speed. Ceramic hybrid ball bearings use these ceramic balls in place of steel balls. They are constructed with steel inner and outer rings, but ceramic balls so they are known as hybrids.

Ceramic bearings offer a significant performance improvement from those made from traditional steel. Our ceramic bearings are manufactured from silicon nitride (Si3N4), an exceptionally hard non-metallic material rated for speeds to 2 million dN, offering a wide selection of benefits.

Hybrid Bearings have steel rings and ceramic balls. Si3N4 Ball is the most popular for the balls as it has only 40 percent of the density of bearing steel but is much harder giving greater wear resistance. Zirconia is heavier with 75 percent of the density of steel so is less suitable for hybrid bearings.. Hybrid bearings are also capable of higher speeds. Sometimes, excessive claims are made about the high speed capabilities of hybrid bearings. They can run faster than all steel bearings due to the lower centrifugal force generated by the ceramic balls but this is partially counteracted by the lower elasticity of the balls. As the balls are harder, the contact area between the balls and the raceway is smaller which causes a higher contact pressure. Under load, this can cause the raceways to wear faster than they would with steel balls. The speed increase for hybrid bearings is approximately 30 percent with adequate lubrication. Hybrid bearings can also operate better with limited lubrication as the lower friction material generates less heat but running speed should be reduced. Hybrid bearings are also less subject to ball skidding under inital acceleration due to the lower ball density.

Ceramic Ball Bearing Benefits

- **High speed, faster acceleration** comes from a material only 40% as dense as steel, yet strong enough to deliver 30-50% higher running speeds with reduced skidding and a lower volume of lubrication
- **Greater accuracy** is the result of balls with a 50% higher modulus of elasticity than steel. This greater rigidity means less of the deformation that leads to vibration and spindle deflection, thus increasing both component quality and productivity
- **Reduced friction** leads to a host of benefits: longer life, less lubrication, energy efficiency, reduced sound levels and less heat
- **Non-conductive** properties of a nonmetal like silicon nitride eliminate the pitting and fluting of raceways common in electric motor applications

- **Corrosion resistance** of silicon nitride makes it more effective than steel bearing balls in the presence of water or corrosive chemicals
- **Longer operating life** ...5 to 10 times longer than standard metal bearings

ceramic hybrid bearings features with:

1) High precision bearings,P4 ,P5 and P6.

2) Rings are made of refined Chrome steel.stainless steel 440C

3) Cage:Peek & PTFE cage .(can assure constant working under 250 centigrade)and peek cage also is the ideal cage for the high speed as it can provide the lubrication during bearing working, and it has the property of self-lubrications.However for normal applications, steel cage and Nylon cage is enough.

4) Balls: we use G3,G5 high precision Si3N4 ball for the high speed.

5) Radial clearance: Normal C0,or C3.

6) Not only for the high speed, but also Hybrid bearings has the insulation functions. Hence for the small size of bore dia.40mm , also can be used for the insulation bearing purpose.

7) Full ball hybrid also can be produce as per our production picture.

Inner and outer roller way is Chrome and stainless, rolling element is Si_3N_4 ZrO2 Balls Sic Ceramic Balls)

Hybrid bearings have advantages relative to steel bearings

1.High speed

Hybrid bearings can reach 3,500,000 DN in the condition of oil-mist lubrication, and can reach 1,200,000DN in the condition of grease lubrication, this owes to the greatly reduction of relative slip, wear extent and heat productivity.

2.Long service life

The service life of hybrid bearings is 3 to 5 times of that of steel bearings in suitable working conditions.

3.Self lubricating

Even in the condition of bad lubricating or no lubrication, hybrid bearings can ensure the bearings work regularly owe to its self lubricating.

4.Corrosion resistant

Hybrid bearings have good corrosion resistance, and can work regularly in the condition of corrosion.

5.High rigidness

The elastic ration of ceramics is 1.5 times of that of bearing steel, this highly increases the rigidity of bearing.

6.Low friction moment

Ceramics materials have low friction force, even in the condition of boundary lubrication, the surfaces are still very smooth, so its friction force is low and the rotation friction moment is low, also.

7.Wear resistant

The microhardness of ceramics can reach HV1700 kg/mm2, this highly increases the wear-resistance of bearings.

8.Light in weight

The weight of ceramics is lower 60% than that of steel, this decreases highly the centrifugal force and the whole bearing’s weight.

9.Special performance

All ceramic parts are non-magnetic and insulated.

FULL CERAMIC BEARINGS

Full Ceramic Bearings are made entirely of ceramic material and are superior to common steel bearings in many ways. Ceramic is the perfect material for any application seeking to achieve higher RPM's, reduce overall weight or for extremely harsh environments where high temperatures and corrosive substances are present. Applications such as cryopumps, medical devices, semiconductors, machine tools, turbine flow meters, food processing equipment, robotics and optics. Ceramic materials commonly used for bearings are Silicon Nitride (Si3N4), Zirconia Oxide (ZrO2), or Silicon Carbide (SiC.)

Because ceramic is a glass like surface it has an extremely low coefficient of friction and is ideal for applications seeking to reduce friction. Ceramic balls require less lubricant and have a greater hardness than steel balls which will contribute to increased bearing life. Thermal properties are better than steel balls resulting in less heat generation at high speeds. Full Ceramic bearings can have a retainer or full complement of balls, retainer materials used are PEEk and PTFE.

Full ceramic bearings can continue to operate under extremely high temperatures and are capable of operating up to 1800 Deg. F. Ceramic is much lighter than steel and many bearings are 1/3 the weight of a comparable steel bearing. Full ceramic bearings are highly corrosion resistant and will stand up to most common acids, they will not corrode in exposure to water or salt water. And finally full ceramic bearings are non-conductive.

The purpose of a radial bearing is to reduce rotational friction and support loads. This is achieved by using two races to hold the balls and to spread the load through the balls. As the bearing race rotates it causes the balls to rotate. The ball provides for substantially less rolling resistance and coefficient of friction than if two flat surfaces were rotating.

Single-row, Full ceramicl bearings are the most common bearing type, having a wide range of applications. Radial bearings are made with very high levels of precision and used in applications where rotational performance and low torque is necessary, but load is a secondary issue. Full ceramic bearings however do have higher load ratings for their size than shallow-groove ball bearings, but are also less tolerant of misalignment.

All-ceramic bearings have good to excellent corrosion resistance, are non-magnetic and,

apart from silicon carbide, are electrically insulating. All-ceramic bearings can be used in high to very high temperatures if supplied without a cage (full complement).
Electrical resistance: Si3N4 best, then ZrO2, then SIC which is conductive.
High temp resistance: SiC best (1100C), then Si3N4 (1000C), then ZrO2 (400C)
Corrosion resistance: SIC (excellent), then Si3N4 (very good) and ZrO2 (good)
Load capacity: SIC highest then Si3N4, then ZrO2
Fracture toughness: ZrO2 best, then Si3N4, then SiC

All-ceramic bearings have lower load and speed ratings than steel or hybrid bearings. The speeds are lower due to the lower precision and roundness of the rings and the loads are lower because the material is more brittle. Under heavy loads and particularly heavy shock loads, there is a risk of cracking. For the same reason, great care should be taken with interference fits. Zirconia is the least brittle so it will handle shock loads and very small interference fits better than the other ceramic materials with silicon carbide being the most brittle. Shock loads should be avoided with all-ceramic bearings. Great care should be taken when using ceramic bearings (especially silicon nitride and silicon carbide) on steel shafts at high temperature due to the difference in expansion coefficient and the relative brittleness of ceramics.

The characteristic of ceramic bearings

- Low density

Due to the low density, ceramic bearings have low centrifugal load, and create little heat so they can work in the conditions of higher speed.

- Suitable elastic ratio

The elastic ratio of ceramics is higher than that of steel, this can increase bearing’s dynamic stiffness, however, the elastic ratio should not be too high, otherwise, excessive elastic ratio will create stress concentration to decrease the bearing capacity.

- Low thermal expansion

This can make bearings insensitive to the changes of temperature, and is helpful to preventing the bearings from being jammed. According to hybrid bearings, the applicable rotation speed interval can be wider.

- High strength

High compressing strength is the requirement of bearing high contact stress (for ceramics, the compression strength are usually determined by the rupture modulus measured by three-point or four-point bending strength)

- High hardness and high toughness

Ceramics have high hardness and high toughness can achieve good surface smoothness, and can prevent the damage of impact and other outer particles.

- Good rolling fatigue performances

This performance is an absolutely necessary for bearings.

- Flaking failure pattern

If the rolling element fails in the working, it should be fatigue flaking, this pattern has sign before bearings being jammed, and is the least harmful failure pattern.

The ceramic bearings working in extreme conditions have some appended performances

- Resistance to elevated temperatures and stability

Ceramic bearings can keep their mechanical stability up to 800℃.

- Corrosion resistance

In the conditions of oxidation and corrosion, especially the contact zone where the oil film have been pushed off due to the repeat rotation, the material should have good oxidation and corrosion resistance.

Ceramic Balls Desctription:

We are special in making Silicone Nitride Balls (Si3N4 Balls,Zicronia Balls (ZrO2 Balls),Sic Ceramic Balls , Aluminum Oxside Valve (AI203) ceramic balls.

The Characteristic of Ceramic Balls

Compared with steel, ceramic materials are noted for their better or particular characters, such as wear-resistance, corrosion resistance, high temperature resistance, electrical insulation (except SiC), non-magnetic, high strength, high rigidity, and low specific gravity. These

properties qualify them for replacing steel to make bearings serve in conditions of higher speed, harsh environment and less lube, and decrease wear, noise, vibration and maintenance time of bearings, and eventually increase performance, reliability and life of bearings.

Ceramic materials, which can be used in making bearings, include mainly silicon nitride, ZrO_2, alumina (Al_2O_3), and silicon carbide . Si_3N_4 is first choice within the above mentioned ceramic materials due to its excellent characters (Table 1). And a properly engineered silicon nitride bearing ball fails in the same manner as a steel ball, flaking of the ball surface. But ZrO_2, Al_2O_3 and SiC fail in a crush form, a catastrophic failure.

The grades of ceramic balls (GB308-2002 ISO3290-1998)

Grade	Allowable ball diameter variation (um)	Allowable deviation from spherical form (um)	Surface roughness (Ra, um)
3	0.08	0.08	0.010
5	0.13	0.13	0.014
10	0.25	0.25	0.020
16	0.40	0.40	0.025
20	0.50	0.50	0.032
24	0.60	0.60	0.040
28	0.70	0.70	0.050
40	1.00	1.00	0.060
60	1.50	1.50	0.080

Application Fields of ceramic balls:

BEARING

Wheel & caster

High vacuum field

Roller skates, aeromodellings and motor-driven toys, etc in civil use

RC MODEL/RC HELICOPTER/RC BOAT

Aviation and airspace fields

The main shaft of machine tool.