

SMB BEARINGS

Full Ceramic Bearing Selection Guide

Zirconia (zro2) versus silicon nitride (si3n4) - a guide to selecting the correct ceramic bearing material

Full ceramic bearings have many advantages but, given their high cost, it's very important to be sure that they will suit your specific application. To help you choose the right bearing, we explain what full ceramic bearings can and can't do and give some tips on how to choose the right ceramic material.

Our full ceramic ball bearings can be supplied with rings and balls made from zirconia (ZrO₂) or silicon nitride (Si₃N₄). They are available as full complement (no cage) or with a cage made from PEEK or PTFE. PEEK cages perform better than PTFE cages in most applications due to their greater strength. Full ceramic bearings have lower speed and load ratings than chrome steel or 440 grade stainless steel bearings. This is because, although they are much harder than steel, they are more brittle, particularly silicon nitride. This increases the likelihood of sudden failure at higher speeds or loads. It is also more difficult to achieve the inner and outer ring roundness that is found with high precision steel bearings. However, they still have much higher ratings than some of the other highly corrosion resistant materials such as plastic or 316 stainless steel.

One benefit of full ceramic bearings is that they have excellent corrosion resistance to seawater and most chemicals, including acids and alkalis. They are found in the chemical industry, food and beverage industry, marine applications, chlorine systems, film processing equipment and fuel handling equipment. Full ceramic bearings are also suitable for extreme low temperature performance which is why they can be found in cryogenic applications. They can also withstand very high temperatures so they are often used in furnace applications. As they are non-magnetic, they are suitable for motors used in MRI scanners, magnetometers, semi-conductor manufacturing equipment or any application in which the bearings may be exposed to a strong magnetic field. These bearings are also non-conductive.

Full ceramic bearings are much more expensive than steel bearings which is why they are normally used in more hostile environments. You can download technical drawings on all of our products from the relevant product pages which can be accessed from the "SMB product range" page here: <http://www.smbbearings.com/products/smb-product-range.html>

For help in choosing the best ceramic bearing material for your application, please take a look at the comparison chart below which highlights the advantages and disadvantages of the two ceramic bearing types we keep in stock.

ZrO ₂ / zirconia (CCZR)	Si ₃ N ₄ / silicon nitride (CCSI)
	
😊 Resistant to acids & alkalis	😊 Resistant to acids & alkalis
😊 Resistant to water, salt water	😊 Resistant to water, salt water
😊 Suitable for 400°C if full complement or 250°C with PEEK cage	😊 Suitable for 800°C if full complement or 250°C with PEEK cage
😊 Non-magnetic and electrically insulating	😊 Non-magnetic and electrically insulating
😊 75% of the weight of steel bearings	😊 40% of the weight of steel bearings
😊 Higher fracture toughness so can withstand small shock loads	😊 More expensive than zirconia
😊 Thermal expansion very similar to steel so no problems with inner/outer ring fits if shafts or housings are steel	😊 Very low thermal expansion so pay attention to changes in inner/outer ring fits if shafts or housings are not Si ₃ N ₄
😞 Can degrade after time if used with very hot water or steam	😞 Avoid shock loads
😞 Not suitable for low noise applications	😞 Not suitable for low noise applications