USSynthetic®

Diamond Tilting Pad Thrust Bearings

Longer Life | Harsh Environments | No Seals

US Synthetic, the leader in diamond solutions, has teamed up with Waukesha Bearings, a global leader in engineered hydrodynamic bearings, to offer breakthrough performance in diamond tilting pad bearing technology.

Waukesha's innovative tilting pad thrust bearing design enables pumps and turbomachinery to safely carry the highest axial loads at high speeds and accommodate misalignment. Combining these benefits with the superior wear resistance of US Synthetic's world-class diamond technology, the diamond tilting pad thrust bearing provides superior bearing performance and extended life in equipment operating at high loads and speeds in low-viscosity lubricants, abrasive fluids or corrosive chemicals.

Critical Applications in Harsh Environments

Diamond tilting pad thrust bearings are ideally suited for:

Low-viscosity Fluids | Corrosive Fluids | Abrasive Fluids

Can operate at a wide range of speeds and loads. Diamond tilting pad thrust bearings have run at speeds up to 39 m/s and unit loads up to 16 MPa.

- Simplifies equipment and assemblies by eliminating the need for seals and separate lubrication systems.
- Can operate at a low coefficient of friction: between 0.01 and 0.08 in direct contact during starting mode. In hydrodynamic operation, friction is below 0.002.

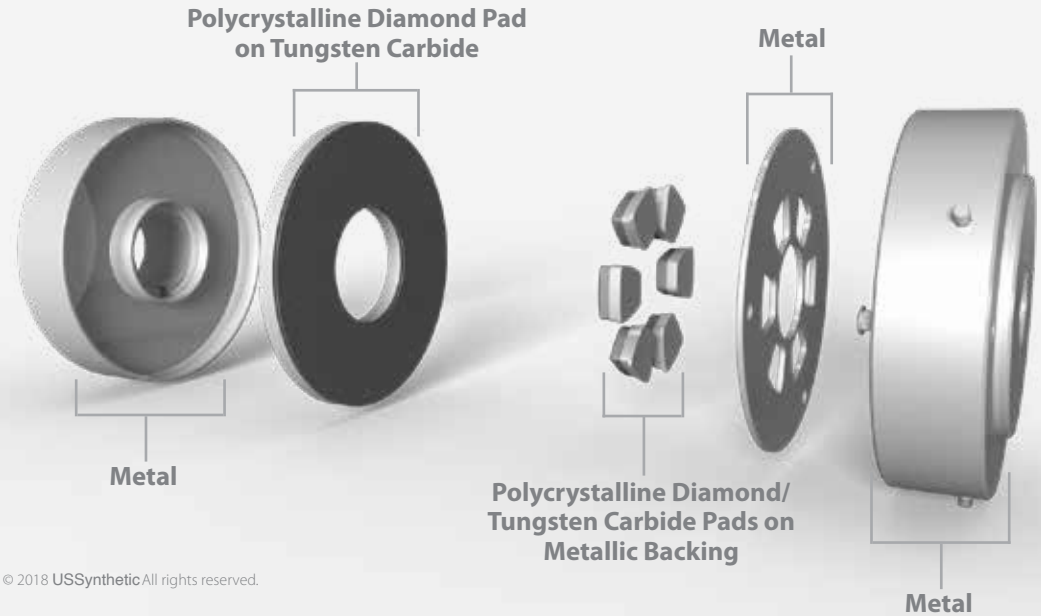
"In our initial testing, we threw sand and gravel into the PCD bearing to see how it would perform. It seemed to like it—just ground up the particles with no problem. In some ways, it actually worked better."

— Clayton Bear, President, New Energy Corp.

Why Diamond?

Abrasive particles, high temperatures, corrosive chemicals, and high loads can all contribute to bearing failure in rotating equipment. Polycrystalline Diamond (PCD) tilting pad thrust bearings improve overall bearing reliability in these harsh conditions while eliminating the need for seals.

PCD is not a diamond coating, but instead it is a thick, man-made diamond surface that is ideally suited for operation in process fluids where abrasive particles, like sand, can cause accelerated wear and failure with traditional bearing materials.



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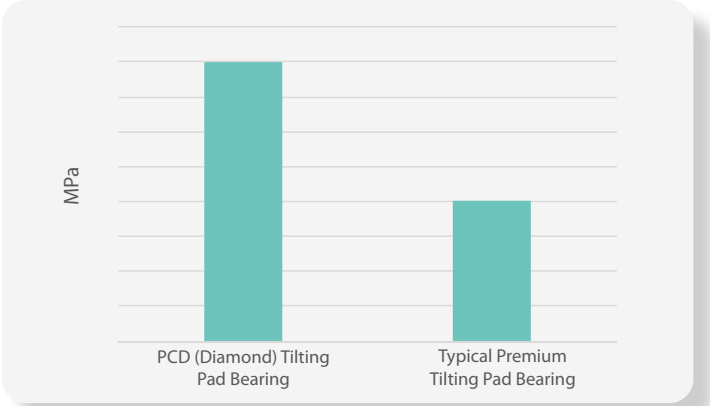
Diamond Tilting Pad Thrust Bearing Performance

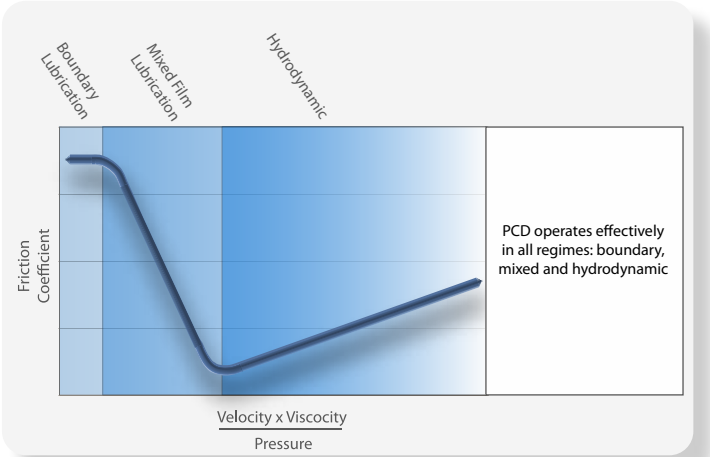
Application engineers at US Synthetic and Waukesha Bearings work closely with each customer to design a customized solution for each application. Factors like expected loads, speeds, environment, and dimensional envelopes are important considerations in the design process.

Test data gathered from laboratory bearing test stands and in-house analysis codes allows our engineers to accurately predict bearing performance in specific operating environments.

Rated Unit Load Capacity



Stribeck Curve



Diamond as a Bearing Material

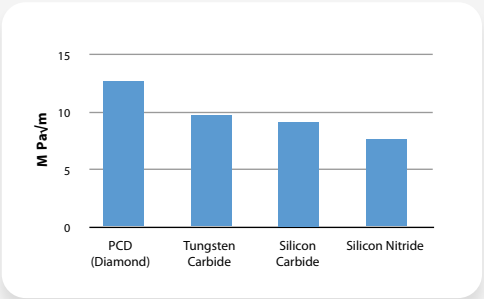
Polycrystalline Diamond (PCD) is known for:

- **High thermal conductivity**
- **Low coefficient of friction**
- **High hardness and fracture toughness**

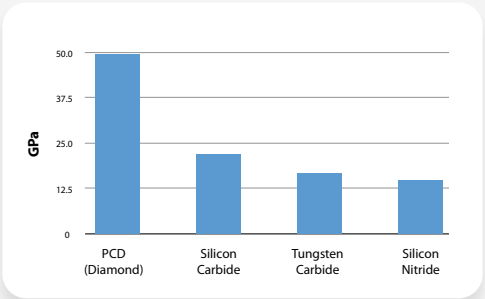
Having a bearing material with high thermal conductivity reduces localized temperature extremes that lead to bearing degradation. During startup and shutdown, high thermal conductivity will reduce the likelihood of localized welding between bearing surfaces, which in turn leads to scoring and galling of the bearing surface.

A low coefficient of friction is desired in order to decrease heat generation and reduce power loss. Furthermore, a bearing material exhibiting large fracture toughness will decrease the likelihood of damage due to shock loading. Because of its extreme hardness, PCD is ideally suited to resist wear from abrasive particles in lubricants and process fluids.

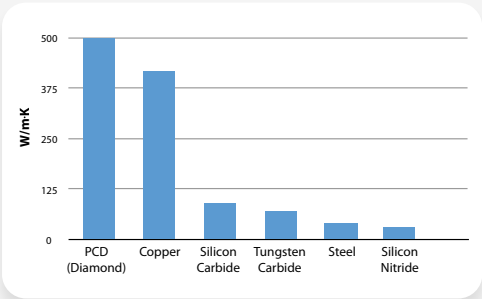
Fracture Toughness



Hardness (Knoop)



Thermal Conductivity



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