USSynthetic Bearings

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Diamond Bearings

longer life in harsh environments under extreme loads

Why Diamond Bearings?

Polycrystalline Diamond (PCD) bearings provide a high-performance alternative to conventional bearings. PCD bearings are ideally suited for operation in process fluids where abrasive particles can cause accelerated wear in roller or plain bearings. This results in increased life over other bearing alternatives.

Key elements of PCD:

- Extreme hardness (wear resistance)
- High thermal conductivity (heat removal)
- High strength
- High toughness
- Low friction

Construction and assembly:

- PCD inserts brazed into steel rings, using proprietary processes
- Various PCD pad shapes
- Customized designs

Configurations available:

- Thrust
- Radial
- Angular contact
- Spherical

Advantages of Diamond Bearings

PCD bearings are ideally suited for operation in:

Abrasive fluids | Corrosive fluids | High temperatures

- Operate effectively with PCD surfaces in direct contact and when surfaces are partially or fully separated by a fluid-film (mixed-mode and hydrodynamic lubrication).
- Can sustain extreme loads when operating in direct diamond-to-diamond contact when compared to other types of bearings.
- Deliver longer bearing life due to hard, wear-resistant diamond surfaces.
- Operate effectively at a wide range of speeds and loads. Diamond bearings have been run at speeds up to 12 m/s and loads up to 200 MPa in some oil and gas applications.
- Simplify equipment and assemblies by eliminating the need for seals and separate lubrication systems.
- In direct contact, PCD bearing friction is low (COF between 0.05 and 0.08). When operating hydrodynamically, friction in PDC bearings is below 0.002.

Types of Bearings and Properties

					Diamond[a]	
Factor	Fluid Film	Dry	Semilubricated	Rolling Element	Sliding Contact	Fluid Film
Start-up friction coefficient	0.25	0.15	0.1	0.002	0.1	0.1
Running friction coefficient	0.001	0.1	0.05	0.001	0.05	0.001
Velocity limit	High	Low	Low	Medium	High	High
Load limit	High	Low	Low	High	Very High	High
Life	Unlimited	Wear	Wear	Fatigue	Low Wear	Unlimited
Lubrication requirements	High	None	Low/none	Low	High	High
High temperature limit	Lubricant	Material	Lubricant	Lubricant	Material	Material
Low temperature limit	Lubricant	None	None	Lubricant	None	None
Vacuum	n/a	Good	Lubricant	Lubricant	N/A[b]	N/A
Damping capacity	High	Low	Low	Low	Low	High
Noise	Low	Medium	Medium	High	Medium	Low
Dirt/dust	Need seals	Good	Fair	Need seals	No Seals[c]	No Seals[c]
Radial space required	Small	Small	Small	Large	Small	Small
Cost	High	Low	Low	Medium	High	High

a - Polycrystalline Diamond and process fluid lubricated
b - Lubrication is generally required, but PCD is vacuum/dry application capable
c - Bearings are process lubricated and PCD is excellent with dirt and dust
Reference - Machine Design, M.M. Khonsari, E.R. Booser (2012)

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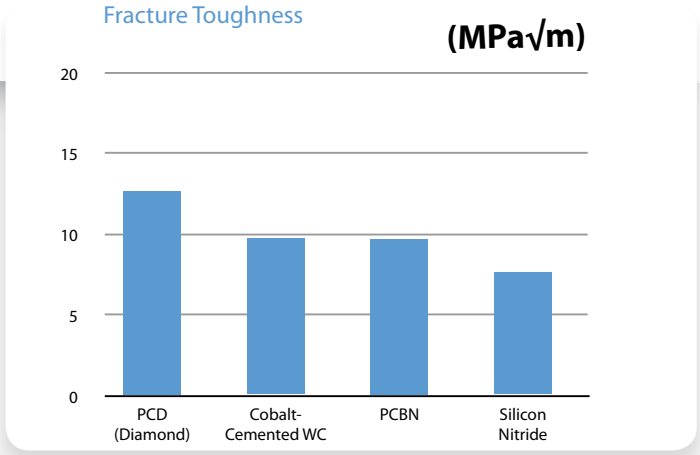
How we do things

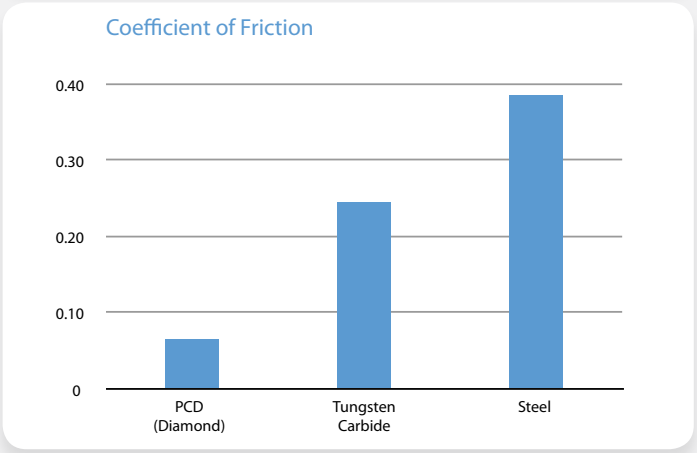
Our application engineers work closely with each customer to design customized solutions for each application. Factors like expected loads, speeds, environment, and dimensional envelopes are important considerations in the design process.

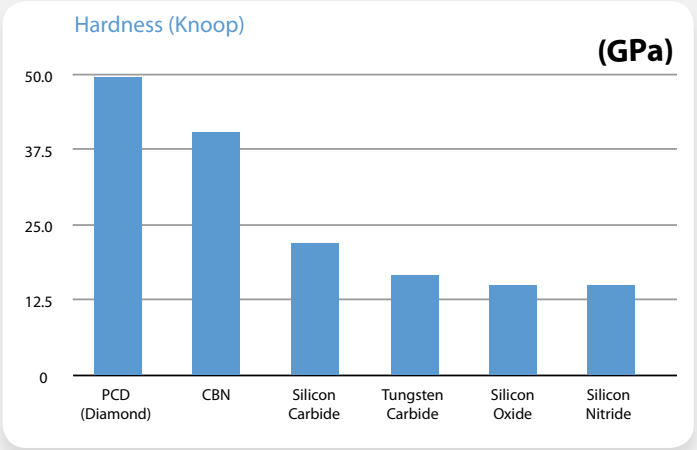
Test data gathered in our laboratory bearing test stand allows our engineers to estimate the performance of each bearing in specific operating environments. Customized tests can also be designed and carried out to replicate expected conditions in many applications.

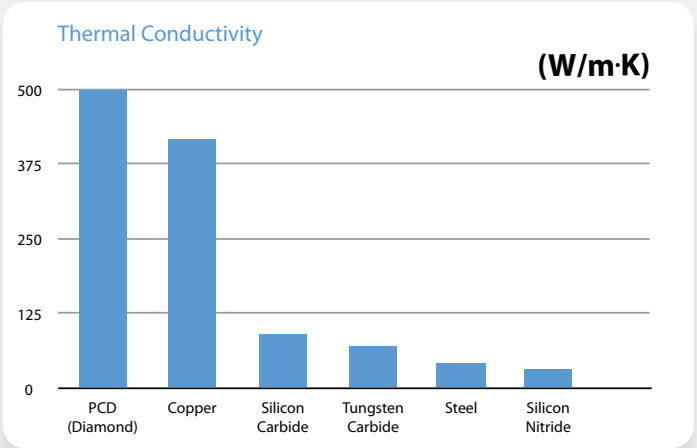
Diamond as a Bearing Material

Polycrystalline diamond is known for its high thermal conductivity, low coefficient of friction, high toughness and other preferred physical and mechanical properties. Having a bearing material with high thermal conductivity reduces localized temperature extremes that lead to bearing degradation. During starting and stopping, 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. In sliding bearings, low coefficients of friction are desired in order to decrease heat generation and reduce power loss. A bearing material exhibiting large fracture toughness will decrease the likelihood of race damage during extreme operating conditions. Because of its extreme hardness, polycrystalline diamond is ideally suited to resist wear from abrasive particles in lubricants and process fluids.









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