

Bearing materials

Objectives: At the end of this lesson you shall be able to

- **state the properties of plain bearing materials**
 - **name the different materials commonly used for making plain bearings**
 - **state the characteristics of different bearing materials.**
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The materials used for plain bearings will have properties according to the operating conditions.

In general the bearing materials should have the following properties.

- Good thermal conductivity to carry away heat from the bearing.
- Resistance to corrosion from atmosphere or lubricants.
- Strength to carry the loading of the shaft or sliding member without permanent deformation.
- Ability to operate in the required temperature range.
- Ability for dirt and other foreign matters to embed on the surface and thus prevent seizing of the shaft or sliding member.
- Ability to resist wear.
- Ability to deform slightly for compensating minor mis-alignments and surface irregularities.

Bearing materials (Plain bearings)

White metal

White metals of different composition are used for a various applications.

White metals are either tin or lead-based. Tin-based white metals are often referred to as babbitt metals.

White metal bearing alloys also contain small amounts of copper and antimony in varying proportions.

White metal bearings have low load carrying capacity, when compared with other bearing materials. The strength of this metal decreases considerably with increasing temperature. To overcome these defects, a layer of high strength fatigue-resistant material is introduced between the thin white metal layer and a steel backing.

Cadmium based alloy

These alloys have greater resistance to fatigue than white metal bearings, but have poor resistance to corrosion. These alloys usually contain small amounts of nickel, copper and silver.

Bearings made out of these alloys can work at higher temperature and have higher load carrying capacity.

Copper lead alloys

This contains copper and lead. This has a higher load carrying capacity than cadmium based alloys and the operating temperature is higher than for white metal bearings. This alloy is used in heavy duty applications like main and connecting rod bearings and in moderate load and speed applications in turbine and electric motors.

Lead bronze and tin bronze

Lead bronze will contain approximately up to 25% lead and the tin bronze up to 10%. They can be used as single material without any overlay or steel backing.

These bearings find application for intermediate load and speed requirements.

Aluminium alloys

Aluminium, alloyed with small quantities of tin, silicon, cadmium, nickel or copper is also used as bearing metal. Aluminium alloy containing about 20 to 30% of tin and up to 3% of copper is capable of substituting bronze bearings for certain industrial applications.

It is best suited for hard journals. It is necessary to give extra clearance between the bearing and the journal to overcome the effects of high thermal expansion.

Aluminium alloys for bearings are available with special properties needed for higher load carrying, strength and thermal conductivity.

Cast iron

Cast iron is used as bearing metal for light loading and low speed applications.

Sintered alloys

Bearing metals such as plain or lead bronze, iron, stainless steel are also made by the sintering process providing porosity in the metal. The structure of the bearings made by the sintering process is spongy, and can absorb and hold considerable quantity of oil. These bearings in actual use will be of a self-lubricating type. These bearings are used in situations where lubrication is difficult.

Plastics

Plastics of different types are used as bearings because of the following reasons.

- Good resistance to corrosion.
- Silent operation.
- Ability to be moulded in different shapes easily
- Elimination of the need for lubrication.

The most commonly used types of plastic materials are

- laminated phenolics
- nylon
- teflon.

Laminated phenolics

This consists of cotton fabric, asbestos, or other materials bounded with phenolic resin. This material has high strength and shock-resisting properties. The thermal conductivity of this material is low. There should be adequate facilities for cooling the bearings made out of these materials.

Nylon

This is widely used for light loading applications. Nylon bearing needs no lubrication as it has self-lubricating properties.

Teflon

This material has self-lubricating properties, resistance to attack of chemicals, a low co-efficient of friction, and can withstand a wide temperature range. The cost of this material is high and the load-carrying capacity is low.

With the movement of two mating parts of the machine, heat is generated. If it is not controlled the temperature may rise resulting in total damage of the mating parts. Therefore a film of cooling medium with high viscosity is applied between the mating parts which is known as a 'lubricant'.

A 'lubricant' is a substance having an oily property available in the form of fluid, semi-fluid, or solid state. It is the lifeblood of the machine, keeping the vital parts in perfect condition and prolonging the life of the machine. It saves the machine and its parts from corrosion, wear and tear, and it minimises friction.

Purposes of using lubricants

- Reduces friction.
- Prevents wear.
- Prevents adhesion.
- Aids in distributing the load.
- Cools the moving elements.
- Prevents corrosion.
- Improves machine efficiency.