Wear

Summary

- The term wear includes worn components of the rolling bearing such as raceway surfaces or rolling elements
- Reasons for wear are lubrication faults, inadequate operating conditions and fitting errors
- Abrasive wear is largely caused by hard particles that are trapped in the rolling bearing
- Adhesive wear occurs under frictional heat, which is caused by insufficient lubrication
- Prevention of wear can be achieved through an adequate lubrication method and improved seal efficiency

Rolling bearings, like other mechanical components, encounter problems such as wear. Wear describes the progressive removal of material from surfaces and is caused by two contact surfaces acting on each other during operation.

In rolling bearings, “wear“ can refer to various components such as worn raceway surfaces, cages, guide lips, rolling elements and seals. A worn surface, for example, is usually characterised by scratches and increased roughness. One often hears that the bearing in the respective machines can become increasingly noisy over time and that vibrations become stronger. A possible cause could be a worn roller bearing. To determine these causes, vibration measuring devices are used, among other things, to identify specific frequencies of rolling or static damage on the bearing.

Wear

Reasons for the development of wear

Similar to the formation of cracks and fractures, it can be stated that the occurrence of wear can be traced back to various triggers. Possible reasons can be lubrication errors (for example, insufficient or excessive lubricant, or an incorrectly selected viscosity). One consequence of insufficient lubrication is mixed friction. The increase in friction leads to an increased temperature in the rolling bearing, an increased noise level and an increase in vibrations. Other causes of a worn bearing can be, for example, the operating conditions (overloading, external vibrations, excessive load changes) or assembly errors (jamming, inadequate fastening, incorrect choice of tolerance and fit).

You can see wear on the ring raceway of this rolling bearing as an example.

Abrasive wear

This example shows abrasive material on

Wear can be differentiated into two types, abrasive and adhesive wear. Abrasive wear occurs with the presence of hard particles. In this case, the particles rub against another surface. In the process, material is removed from the surface, causing it to become increasingly damaged. It must be noted that this surface appears increasingly matte when exposed to larger particles, but tends to appear polished when exposed to fine

the raceway surface.

particles. In abrasive wear, the number of particles in the rolling bearing usually increases progressively before bearing failure finally occurs.

Adhesive wear

Adhesive wear is characterised by the transfer of material from one surface to another. It is important to note that the energy for this process is generated by the slip between the moving parts. Investigations on the surface of a worn bearing show that the surface burnishes or new hardening zones form. Both lead to local stress concentrations and mean an increased risk of cracking or chipping occuring in the contact area. In books, this is typically referred to as “smearing” or “seizure”. Both words describe the same failure mechanism. They can only be distinguished on the basis of the failure pattern or – in other words – smearing *becomes* a seizure.

Adhesive wear can very often be observed in large cylindrical and spherical roller bearings that are only lightly loaded. When entering the load zone, as the rolling elements are accelerated to the kinematic speed, the separating lubricating film can break off and a brief welding of the surfaces can occur. However, this connection is separated again in the next moment. After a certain running time, this can result in bearing damage.

Furthermore, relative movements between inner ring and shaft or outer ring and housing can lead to adhesive wear. The reason for this is the “creeping” of the rings, for example due to the slightly different diameters of the respective components or also if the bearing rings are too loosely fitted.

Wear prevention

Wear

There are several ways to prevent potential wear of rolling bearings:

- Correct lubrication (lubricant quantity, method and quality)
- Suitable operating conditions (alignment, vibration, checking the load)
- Checking the assembly (installation, fastening of the bearing, choice of fit)

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