Corrosion

Summary

- Corrosion is the result of a chemical reaction
- Corrosion occurs, for example, due to a damp environment, insufficient packaging or inadequate corrosion protection
- There are two types: Corrosion due to moisture and fretting corrosion
- Corrosion due to moisture means rust and can lead to peeling (“spalling”) in the late stage
- According to DIN 50900, fretting corrosion is the “localised corrosion of metal surfaces caused by friction without external heat”
- Fretting corrosion can in turn be divided into fretting and false brinelling

Have you ever heard of corrosion? Corrosion is basically divided into two main forms according to ISO 15243: Corrosion by moisture and fretting corrosion. Fretting corrosion can in turn be divided into fretting corrosion and false brinelling.

The most common type is probably corrosion caused by moisture. This occurs as a result of a chemical reaction on a metallic surface and due to the presence of moisture and/or aggressive media (e.g. acids). Possible causes can be, for example, poor, damp storage, insufficient packaging or inadequate corrosion protection. Rolling bearing manufacturers such as NTN therefore provide recommendations in their catalogues for the correct storage of rolling bearings. Furthermore, handling without hand protection can lead to corrosion (recognisable, for example, by fingerprints on the outer ring).

Corrosion due to moisture

Corrosion

Corrosion due to moisture occurs most frequently and arises after contact of the rolling bearing with moisture or aggressive (chemical) elements such as acids. This type of corrosion can occur, for example, due to excessive humidity. In some instances, a rolling bearing that has been running without problems can suddenly make noise after a long static period, for example. In this case, the lubricant may have absorbed water, resulting in corrosion damage due to the inactivity.

The ring of a deep groove ball bearing is affected by corrosion in the form of rust – caused by the penetration of corrosive media such as water into the rolling bearing.

Fretting corrosion

Fretting corrosion, also called tribo-corrosion or tribo-oxidation, can be divided into two subtypes: Fretting and false brinelling. These two types are discussed below.

1. Fretting

Various translations of “fretting corrosion” can be found, such as “contact erosion”, “frictional corrosion”, “fretting” and also “wear oxidation”. Following ISO 15243 and in order to simplify readability, the word “fretting” is used below.

The picture shows the inner ring of a deep grove ball bearing. The black-brown trace is

called fretting. The cause was micro-sliding movements between the shaft and the inner ring. These micro-sliding movements are caused by vibrations or loads acting on the bearing, which resulted in slippage between the shaft and the inner ring. In combination with oxygen, the detached particles oxidise. The result can be bearing damage.

This inner ring is affected by fretting corrosion.

Of course, fretting can be found not only on the inner ring of a rolling bearing, but also on the outer ring and on other mechanical elements (for example shaft-hub connections, etc). In the case of rolling bearings, it must be checked whether factors such as the surface finish, fit quality and the geometric and position tolerances of the rolling bearing seats meet the quality specifications of the rolling bearing manufacturer. If these are insufficient, they can promote the formation of fretting.

2. False Brinelling (standstill markings)

For the second type of fretting corrosion, so-called “false brinelling”, one can also find several translation variants, for example “standstill markings”, “ripple formation” or also “trough formation”. To simplify matters, only one term is used in the following,

namely “false brinelling”.

False brinelling occurs at the rolling contacts of bearings. These are caused by micromovements under cyclic vibrations. Depending on the intensity of the vibrations, loads and lubrication conditions, indentations form on the raceways. Furthermore, these micromovements cause the lubricant film to be displaced from the contact area. The unprotected surface can now corrode. Consequently, the resulting particles from the corroded areas can lead to abrasive wear.

The example of this bearing ring shows false brinelling. These were caused by vibrations while the bearing was static.

Corrosion prevention

Corrosion can be reduced/prevented by various adjustments. A few points are listed below:

Design

- Improvement of the sealing properties
- Use of a suitable lubricant (with corrosion protection additives)
- Rolling bearing seat
    - Correct surface finish
    - Fit quality and the geometric and position tolerances in accordance with the recommendations of the rolling bearing manufacturer

Delivery/storage conditions

- VCI Paper/Foil
- Control of temperature and humidity levels (see bearing manufacturer’s storage

instructions)

Assembly

- Wearing gloves
- Removal of the rolling bearing from the packaging shortly before mounting
- Clean assembly environment

Delivery

- Elimination of vibration sources
- Preload the bearing to prevent false brinelling

In operation

- Elimination of vibration sources or no standstill of the machine
- Regular testing of the lubricant
- Compliance with relubrication intervals
- If necessary, change the lubricant

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