INTERACTIONS BETWEEN SURFACE-ACTIVE ADDITIVES AND EFFECTS ON THE WEAR PROTECTION OF ROLLING BEARINGS

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ABSTRACT
In rolling element bearings, lubricants such as oils and greases are used to reduce friction and wear. In addition, these lubricants also fulfill other tasks, such as preventing corrosion on the metal surfaces of the bearings. As these requirements cannot be adequately fulfilled by base oils alone, additives are added, which specifically improve the lubricant properties. In order to achieve the desired properties, various additives are used simultaneously in one lubricant. The simultaneous use of various surface-active additives might cause interactions between those additives while forming a tribological boundary layer. Synergistic as well as antagonistic effects of interactions can occur. This would influence the performance of the additives. For this reason, the mechanisms of the surface-active additives must be investigated in combination with each other.

In the application a simultaneous use of anti-wear (AW) and corrosion inhibitor additives (CI) are common. However, the interactions of AW and CI in rolling element bearings have not been investigated yet. Since both additive types are surface-active there is a risk that no homogeneous, tribological boundary layer is formed. For the additives to work properly, a homogeneous layer is necessary [1]. To ensure a safe operation while using both AW and CI the interactions need to be understood.

Therefore, the aim of this contribution is to show the method to analyze the interactions of anti-wear additives and corrosion inhibitors in oil lubricated rolling bearings. The influence of the CI on the wear protection of the AW when using AW and CI simultaneously is examined in this project. Furthermore, the influence of base oil, operating conditions as well as additive concentration and ratio on the wear protection is analyzed. The time dependence of boundary layer formation is studies as well as the influence of an initial boundary layer. For this, thrust bearing tests (FE8 tests) are carried out. To investigate corrosion protection properties of the boundary layer standardized tests such as the Stahlfinger-test and FE8 tests are modified accordingly. The efficiency of tribological boundary layers of the individual tests is studied by analyzing the thickness and chemical composition using electron-microscopic techniques, like electron probe microanalysis (EPMA). Based on these results, both synergistic and antagonistic interactions can be identified for the combined use of AW and CI additives.

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