

Application of graphene platelet-additivated grease in tribological contacts

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To enhance the lubrication conditions of grease in tribological contacts under oscillating motion, graphene platelets as additive feature outstanding properties. Wear on the asperity contacts on the reversal points of the oscillating motion can be reduced due to the sliding planes of the graphene platelets. To investigate the tribological benefit of graphene as an additive, systematic tests on a linearly oscillating tribometer were conducted. The lab scale tests were compared to results achieved by bench tests. In this case angular contact ball bearings were tested under pivoting motion. On lab scale and in bench tests the addition of graphene platelets to grease featured an improvement in wear and friction.

Keywords: graphene platelets, rolling bearings, grease lubrication, oscillating motion

1. Introduction

In case of bearings performing an oscillating motion, boundary and mixed lubrication on the reversal points has to be taken into account. Under these lubrication conditions the lubricants additivation has a high impact on wear and friction. A possible additive are graphene platelets, which feature outstanding tribological properties. Up to date the tribological performance of graphene is mainly investigated in terms of nano- and micro tribological methods [1]. Liu et al. investigated graphene and other 2D materials as lubricant additives and proved that this type of material has a beneficial mechanism of interfacial and surface friction [2]. In this study we want to investigate the influence of various graphene platelets and graphite nanoparticles on the tribological properties under oscillating tests.

2. Methods

To investigate the influence of graphene as an additive to grease in ball bearings, previous studies were performed, applying a bearing test rig and angular contact ball bearings of type 7208 under pivoting motion. It could be shown that, due to the addition of graphene platelets to grease, the frictional torque of the bearings is reduced drastically [3]. In this study the frictional properties of grease with graphene platelets were examined applying an oscillating milli-tribometer (Fig. 1). In this tribometer a stationary ball with a diameter of 6 mm as a friction counterpart is moved over a grease lubricated 100Cr6 bearing steel sample under a defined load. In our case we choose grease additivated with graphene platelets of varied thickness. The results were compared to grease and grease additivated with graphite nanoparticles. The results were compared to bench tests performed on angular contact ball bearings investigated under pivoting motion.

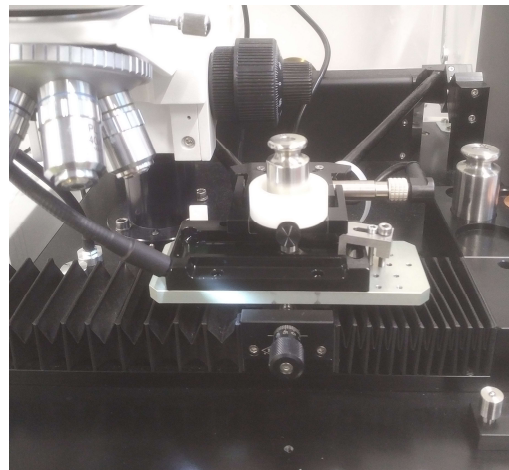


Fig. 1: Oscillating milli-tribometer

3. Results and Discussion

Under boundary and mixed lubrication conditions, the graphene platelets as an additive to grease could reduce friction and wear. The staple thickness of the graphene platelets showed an influence on the friction reduction, there seems to be an optimal staple thickness to cover contacting asperities. The investigation on the tribometer could confirm the studies of the bearing bench tests.

4. References

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