Effect of Lubrication Environments on Wear Performance of Ball Bearing Materials

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1. INTRODUCTION

Nowadays, there are a great variety of advanced lubrication technologies includes thin film coatings [1], nanolubricants [2] and gas lubricants [3]. However, gas lubrication is the most cost effective and has several advantages, such as small friction loss and attractive for high-temperature applications.

From the past researches, wear of materials are effectively reduced by different gas lubrications. However, researches on this topic are not much explored. Thus, in this study, the wear performance of a ball bearing material sliding in air with O_2- or N_2-gas blows were investigated using a systematic approach, which is Taguchi method.

2. EXPERIMENTAL METHOD

The materials used in this study were carbon-chrome steel (SKF bearing) for a ball and EN-31 steel for a disc. By selecting L_9 Taguchi's orthogonal arrays, nine sliding tests were carried out using a modified ball-on-disc tribometer in accordance with ASTM standard G99-95a. All tests were performed under air, N_2- and O_2-gas environments.

3. RESULTS AND DISCUSSION

From Figure 1, a specific wear rate is constant throughout the tests under gas lubricated conditions. On the other hand, the specific wear rate decreases significantly with increasing applied load, sliding speed and sliding distance under air lubrication. With further increase in load, speed and distance; frictional heating may occur under air lubrication due to the interaction of the asperities of two contact surfaces and in this case the wear process may consist of formation and removal of oxide on the surface, resulting in reduction of wear rate. Furthermore, N_2-gas lubrication could play well as anti-wear effect in the frictional pairs because a significant reduction of wear scar diameter, as compared with air and O_2-gas lubrications.

4. CONCLUSIONS

As a conclusion, wear rate of a material is constant under gas lubricated conditions, as compared with air lubrication. In addition, an inert gas, which is N_2, is one of the emerging lubricants that can effectively reduce wear of ball bearing materials.

5. ACKNOWLEDGEMENT

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6. REFERENCES

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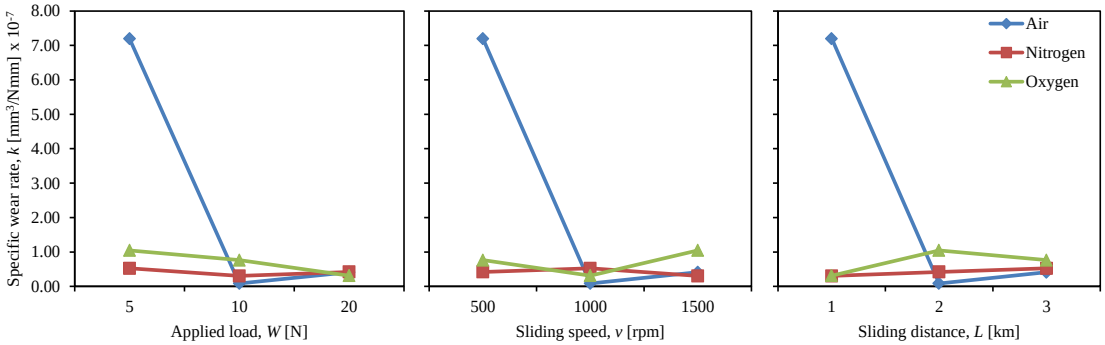

Figure 1 Interaction plot for specific wear rate.