INVESTIGATION OF USING MICROBUBBLES TO REDUCE FRICTION IN JOURNAL BEARING

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KEYWORDS

Friction; Fluid lubrication; Green tribology, Journal Bearing, Lubrication model, Visualization experiment

ABSTRACT

In recent years, mechanical elements including journal bearings, which are the subject of this research, are required to reduce the friction generated during operation in order to solve environmental and energy problems. This study focuses on microbubbles as a new reduction method for journal bearings. Known to have a microbubble fluid drag reduction effect [1]. In an experiment applying microbubbles to journal bearings, the friction torque in journal bearings was measured, demonstrating that microbubbles are effective in reducing friction [2]. However, the mechanism by which the behavior of microbubbles in the journal bearing clearance affects friction reduction is still unknown. In this study, to elucidate the friction reduction mechanism of microbubbles in journal bearings, the clearance was varied by changing the shaft diameter and the frictional torque was measured.

Table 1. experimental conditions

Oil	**VG32**
Bearing Clearance [μm]	**67.5** **92.5** **117.5**
Number of rotations [rpm]	**1,000** **2,000** **3,000**

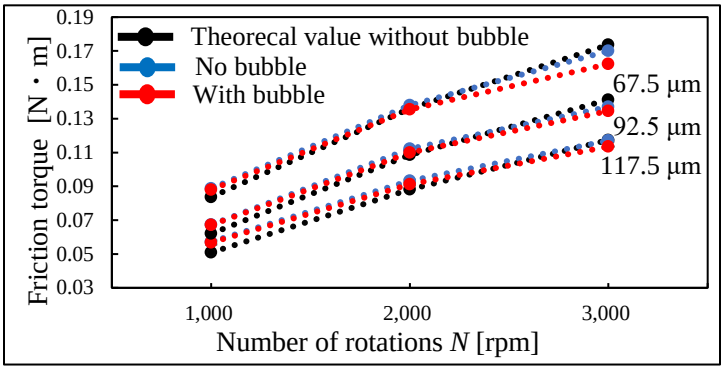

Table 1 shows the experimental conditions and Figure 1 shows Relationship between frictional torque and rotation speed. The figure shows that the highest friction reduction effect was observed at a clearance of 67.5 μm, with a maximum friction torque reduction of 4.6% at 3,000 rpm. In this experiment, microbubbles with a diameter of about 60 μm were frequently generated, suggesting that there is a relationship between the friction reduction of journal bearings clearance and the bubble diameter.

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REFERENCES

[1] Yan-Yan Feng, "Microbubble effect on friction drag reduction in a turbulent boundary layer," Ocean Engineering, Volume 211, 2020.

[2] Shinpei Kotani, Yuki Tashiro , Yuki Kawamoto, Shun Takahashi, Masayuki Ochai, Effect of Micro Bubbles in Lubricating Oil on Friction Characteristics of Journal Bearing, Tribology Conference Proceedings, G16, (2020).