THE EFFECT OF FIBER MATERIAL ON FRICTIONAL BEHAVIOR OF LOOPED FIBER BRUSH

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ABSTRACT

Looped Carbon Fiber Brush (LCFB) has been developed as low stick:slip material for stabilizing friction of bearing. Generally, when the ratio between static and kinetic friction \((\mu_s/\mu_k)\) is low, stick:slip phenomenon is suppressed. It was reported that the value of \(\mu_s/\mu_k\) was almost 1.0 whereas the value of Al pin was almost 2.0. This report reveals frictional properties of Looped Fiber Brush (LFB) made from other fiber material because different environment requires other material to be used. Carbon nylon and spring steel are used as fiber material in this report. LFB made from carbon nylon shows low kinetic friction, \(\mu=0.033\), whereas \(\mu_s/\mu_k\) was 2.6. On the other hand, spring steel fiber shows low \(\mu_s/\mu_k\), which is 1.1.

Keywords: Looped Fiber Brush (LFB), friction reduction, stick-slip, Looped Carbon Fiber Brush (LCFB).

INTRODUCTION

Many engineers have tried to restrain stick-slip phenomenon which prevent smooth sliding because the phenomenon causes noise and prevents precision machining. New sliding material, Carbon Fiber Brush (CFB), has been developed as low stick-slip material. It was reported that the ratio between static and kinetic friction coefficient \((\mu_s/\mu_k)\) was almost 1.0 whereas the value of Al pin was almost 2.0 (Otsuka, 2012). Isogai introduced new concept that fiber brush should be looped shape which allow fiber to contact with its side part. His report showed that Looped Carbon Fiber Brush (LCFB) also had low \(\mu_s/\mu_k\) and low wear ratio compared to CFB (Isogai, 2013). LCFB is considered to be used under sliding bearing components because of its unique properties. However, the unique properties of Looped Fiber Brush (LFB) is only investigated with carbon fiber.

Each operating environment requires engineers to design components with proper materials. Therefore, it is demanded that whether other fiber material shows the unique properties as carbon fiber has. Tribological properties of LFB made from carbon nylon or spring steel are revealed in this research.

RESULTS AND CONCLUSIONS

The results from friction tests with three types of LFB, carbon nylon fiber which loop radius \(R\) is 5 mm, carbon nylon fiber with radius \(R=8\) mm and spring steel fiber with radius \(R=5\) mm, are shown in Fig. 1. Figure 2 (a, b) shows static friction coefficient, average of kinetic friction
coefficient and $\mu_s/\mu_k$ of each LCB. LFB made from carbon nylon shows low kinetic friction, $\mu=0.033$, whereas $\mu_s/\mu_k$ is 2.6. On the other hand, spring steel fiber shows low $\mu_s/\mu_k$, which has a value of 1.1.

Fig. 1 - Friction coefficient of several looped fiber brush. The top right figure shows schematic of LFB.

This study shows that material selection and design of loop can control frictional properties even all LFB is made of looped fiber. The results indicate that LFB has possibility to be used under many operating conditions. Further tests and analysis should be performed in order to clarify the effect of loop design and material properties, hardness and Young’s modulus, on frictional properties of LCB to achieve optimum controlling.

REFERENCES
