BEARING CHARACTERISTICS OF JOURNAL BEARING APPLIED BIOMIMETICS

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ABSTRACT
There will be times when we were walking on a rainy day and we slipped and fell down. Very small friction is realized while supporting a load by merely slight fluid intervening between shoes and the ground. This phenomenon is called fluid lubrication. Those using fluid lubrication are journal bearings used in engines and turbochargers. Journal bearings maintain extremely low friction even under high surface pressure or high-speed rotation because of fluid lubrication. This bearing has evolved for development of high-quality machineries. Especially, friction of bearings used in automobiles is concerned with fuel consumption, so friction reduction is strongly required. In response to that request, various methods have been developed, such as applying a groove-like texture to the engine bearings[1]. However, innovative friction reduction technology is necessary in order to meet the demands of the world. Therefore, author focused on biomimetics. Biomimetics is science and technology that helps new technological development by imitating the excellent functions and structures of organism. However, no research applied to journal bearing has been found.

The organism that the author attracted attention is a dragonfly. Dragonfly has excellent flight ability. In particular, long-distance flight of 7,100 km is possible by using gliding[2]. One of the factors that realizes this flight is micro spikes with a height of about 100 μm present on the wing surface as shown in Fig. 1. It has been clarified that this spike has a resistance reducing effect[3]. From the viewpoint of size effect, the residential environment of the dragonfly is governed by the viscosity like the fluid under fluid lubrication. Therefore, author considered whether it can be applied to friction reduction of fluid lubrication.

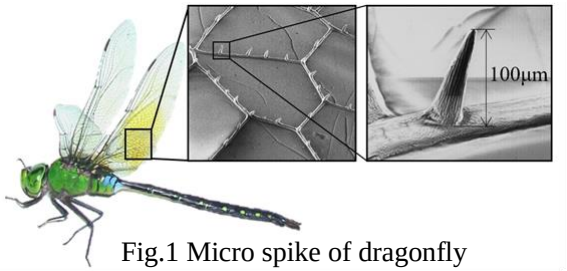

Fig.1 Micro spike of dragonfly

In this study, the structure simulating the micro spike of the dragonfly as shown in Fig. 2 was provided on the sliding surface of the journal bearing, and the effect by spike was considered by measuring the friction torque. As a result, as shown in Fig. 3, the friction torque decreased when the micro spike was positioned on the entire surface and the edge side of the lower half part of the bearing at 4000 rpm and 5000 rpm. Also, when the axial locus was measured, the runout of the shaft was suppressed at the rotational speed which the friction torque was reduced.

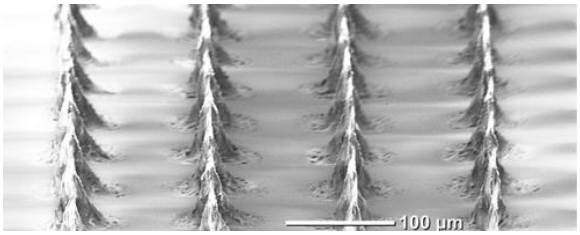

Fig.2 Micro spike of test apparatus

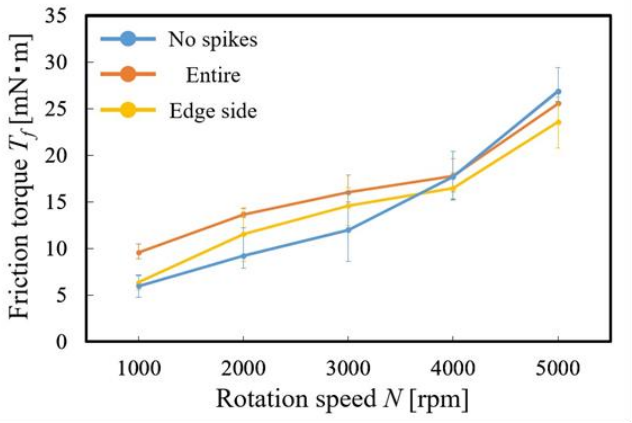

Fig.3 Experimental result

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