Tribology Online
Japanese Society of Tribologists
http://www.tribology.jp/trol/

Vol. 14, No. 5 (2019) 339-344.
ISSN 1881-2198
DOI 10.2474/trol.14.339

Article

Evaluation of Lubrication Performance of Foil Bearings with New Texturing

Hyuga Kikuchi[1)*], Mohd Danial Ibrahim[2)] and Masayuki Ochiai[3)]

[1)]Graduate School of Engineering, Tokai University, 4-1-1 Kitakaname, Hiratsuka, Kanagawa 259-1292, Japan
[2)]Department of Mechanical and Manufacturing Engineering, University Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
[3)]Department of Mechanical Engineering, Tokai University, 4-1-1 Kitakaname, Hiratsuka, Kanagawa 259-1292, Japan

*Corresponding author: Hyuga Kikuchi (kikuchi-h@fuji.tokai-u.jp)

Manuscript received 29 June 2019; accepted 06 November 2019; published 15 December 2019
Presented at the International Tribology Conference Sendai 2019, 17-21 September, 2019

Abstract

Foil bearings have excellent characteristics such as a high damping performance and acceptable dimensional changes caused by installation errors and thermal expansion. However, the problem of large friction losses also occurs at the top foil under the high rotational speed required to support a shaft without any contact. In this paper, a new type of foil bearing with a surface texture on the top foil is proposed. The effects of the texture were verified by the rotational motion experimental analysis under a high circumferential speed and dry lubrication. For a bearing with dimples on the contact area, the effect of friction reduction could be observed under boundary lubrication. Moreover, it was also confirmed that the dimples adversely affected the air film formation with the sliding speed increase. For a newly designed F-grooved model, the phenomenon of an early transition from boundary lubrication to fluid lubrication can be seen. However, the friction coefficient increases at the boundary lubrication. In this study, it was also the highest friction reduction effect was confirmed at the maximum sliding speed. Furthermore, an additional friction reduction effect and a small temperature rise were obtained by combining the above textures.

Keywords

texturing, foil bearing, fibonacci groove, dimple, dry lubrication, high sliding speed, fluid lubrication, mixed lubrication, boundary lubrication