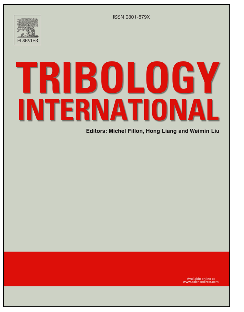

Viscosity wedge effect of dimpled surfaces considering cavitation effect

Xiangkai Meng, M.M. khonsari

PII: S0301-679X(18)30088-4
DOI: 10.1016/j.triboint.2018.02.011
Reference: JTRI 5110

To appear in: *Tribology International*

Received Date: 13 October 2017
Revised Date: 6 February 2018
Accepted Date: 8 February 2018

Viscosity Wedge Effect of Dimpled Surfaces Considering Cavitation Effect

Xiangkai Meng[1] and M.M. khonsari[2*]

[1]Department of Mechanical Engineering, Zhejiang University of Technology, China.

[2]Department of Mechanical and Industrial Engineering, Louisiana State University, USA

[*]Corresponding author (khonsari@lsu.edu) 225.578.9192

Abstract

A thermohydrodynamic model is developed to study the viscosity wedge effect associated with dimpled surfaces considering the cavitation effects. The Streamline-Upwind/Petrov-Galerkin (SUPG) finite element method was applied to solve the energy and Reynolds equations combined with the Jakobsson–Floberg–Olsson (JFO) cavitation boundary conditions. The performance of a slider surface with an array of dimples are studied and the geometrical parameters of the dimples are optimized for enhancing the load-carrying capacity (LCC) and coefficient of friction (COF). The film pressure and temperature distribution at different conditions are analyzed. The simulation results show that the viscosity wedge effect has a more pronounced influence on the LCC and COF than the cavitation effect. The dimples with dimensionless depth h_g/h_0*=0.6 and no more than 25% dimple area ratio are recommended.*

Keywords: Viscosity wedge effect; dimpled surface; cavitation effect; load-carrying capacity; thermohydrodynamic analysis

Nomenclature

a	Dimple distance
c	Oil film specific heat
f	Friction coefficient
F_o	Dimensionless load-carrying capacity
h, H	Film thickness, $H=h/h_0$
h_0	The gap between slider and pad
h_g, H_g	Dimple depth, $H_g=h_g/h_0$
k, K	Oil film thermal conductivity, $K=\theta+(1-\theta)k_g/k_l$
L	The slider length
p, P	Film pressure $P=(p-p_c)/(p_a-p_c)$
p_0	Inlet and outlet pressure
p_c	Cavitation pressure of oil film
q_p	Local heat flow into the pad
R	Dimple radius