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Tribological behaviors of fluid-lubricated DLC films under sliding and fretting conditions

Hanmin Fu^{a,§}, Xiaoqiang Fan^{a,§*}, Wen Li^a, Hao Li^a, Zhenbing Cai^b, Minhao Zhu^{a,b}

^a Key Laboratory of Advanced Technologies of Materials (Ministry of Education),
School of Materials Science and Engineering, Southwest Jiaotong University,
Chengdu 610031, China

^b Tribology Research Institute, State Key Laboratory of Traction Power, Southwest
Jiaotong University, Chengdu 610031, China

Abstract

To meet the ever-increasing performance requirements of mechanical equipment under various working conditions, lubrication schemes have been transformed from onefold to synergistic lubrication. Here we introduced the synergistic lubrication systems consisting of DLC film as anti-wear supporting layer and two high-performance fluids (ionic liquids (ILs) and multiply-alkylated cyclopentanes (MACs)) as lubricating layer, and their tribological properties were conducted under sliding and fretting conditions. Results show that ILs and MACs can improve the friction reduction and wear resistance of DLC film under sliding condition because a boundary lubrication film was formed by physical adsorption film and tribo-transfer film, which could minimize the shear and adhesion. Under fretting condition, the lubrication function of ILs and MACs is not superior to that under sliding condition partly because intact fluid-film has difficulty in formation on the fretting regime, and also partly because fretting conditions induce the transformation of fretting running regime from partial slip to gross slip.

* Corresponding author: Xiaoqiang Fan.

E-mail: fxq@home.swjtu.edu.cn (X. Q. Fan).

§ These authors contributed equally to this work.

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