Transfer Film Fluctuation and Multi-Interface Wear Behavior of PTFE Alumina

Keywords: surfaces and interfaces; transfer film; wear; PTFE

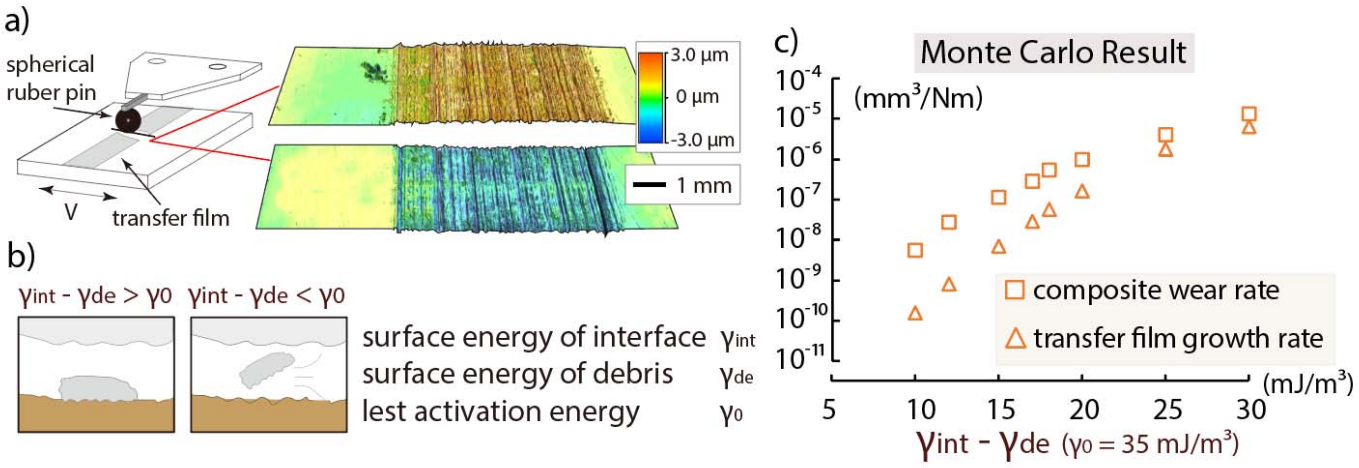
Wei Sun, Jiaxin Ye*, Xiaojun Liu, Kun Liu
(School of Mechanical Engineering, Hefei University of Technology, Hefei, Anhui, China 230009)

Introduction

Polymeric solid lubricants, like Polytetrafluoroethylene (PTFE), lay down their own wear debris onto hard metallic counterfaces to form a protective transfer film which reduces friction and wear effectively without lubrication. Previous studies showed an ultra-low wear (k~10^{-7} mm^3/Nm) alumina-PTFE solid lubricant forms an extremely adherent and complete transfer film and strong chemical bonds between wear debris. [1, 2]

Abstract

In this study, we measured the evolution of the film-substrate interface throughout the course of a standard wear test using contact and non-contact profilometry methods. The result unexpectedly showed continuous wear of the counterface even after a persistent transfer film was formed on top of it. Counterface wear rate decreased monotonically as similar trend of transfer film deposition and there is also correlation between the transfer film thickness and surface energy of the interface according to measurements which strongly suggest a balancing mechanism at the solid lubrication interface keeping the apparent transfer film thickness unchanged. An interface fluctuation prediction model of transfer film was proposed which corelates the surface energy of interface, delamination wear of substrates and transfer film. The model shed some light on the basic understanding of transfer film fluctuation at the interface and its relationship with promoting low wear.



a) Removing pre-developed transfer films by sliding rubber ball; **b)** Relation between debris behavior and interface surface energy; **c)** Monte Carlo Result of interface fluctuation prediction model.

Acknowledgements

The research work presented is supported by the National Natural Science Foundation of China (51875153).

References

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