Distinct Tribological Mechanisms of Various Oxide Nanoparticles Added in PEEK Composite Reinforced with Carbon Fibers

Lihe Guo, Huimin Qi, Ga Zhang, Tingmei Wang, Qihua Wang

PII: S1359-835X(17)30100-8
DOI: http://dx.doi.org/10.1016/j.compositesa.2017.03.003
Reference: JCOMA 4593

To appear in: *Composites: Part A*

Received Date: 8 December 2016
Revised Date: 22 February 2017
Accepted Date: 2 March 2017

Please cite this article as: Guo, L., Qi, H., Zhang, G., Wang, T., Wang, Q., Distinct Tribological Mechanisms of Various Oxide Nanoparticles Added in PEEK Composite Reinforced with Carbon Fibers, *Composites: Part A* (2017), doi: http://dx.doi.org/10.1016/j.compositesa.2017.03.003

Distinct Tribological Mechanisms of Various Oxide Nanoparticles Added in PEEK Composite Reinforced with Carbon Fibers

Lihe Guo[a,b], Huimin Qi[a,b], Ga Zhang[a,*], Tingmei Wang[a], Qihua Wang[a]

[a] State Key Laboratory of Solid Lubrication, Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences, Lanzhou 730000, China

[b] University of Chinese Academy of Sciences, Beijing 100049, China

* Corresponding author: Prof. Ga Zhang

E-mail: gzhang@licp.cas.cn.

Tel: +86-931-4968041.

Fax: +86 931 4968180

Abstract

The tribological behaviors of various oxide nanoparticles, i.e. Bi_2O_3, CuO, SiO_2 and ZrO_2, added into a carbon fibers reinforced polyether-ether-ketone were comprehensively investigated. It was demonstrated that nanoparticle types played an important role in the tribological performance. When sliding took place at a low FV (load × speed) condition, the addition of CuO and ZrO_2 nanoparticles led to the formation of patch-like tribofilms increasing friction and wear. However, at FV factors ranging from 30 to 300 N·m/s, the hard nanoparticles, i.e. SiO_2 and ZrO_2, resulted in dramatic improvement of the tribological properties. Moreover, nano-ZrO_2 was significantly more effective than nano-SiO_2 for enhancing the tribological performance. Hard nanoparticles released onto the sliding interface removed the tribo-oxidation layer on steel counterface. Hereafter, they were "tribo-sintered" into an oxide-based tribofilm having a high load-carrying capability. However, the soft nanoparticles, i.e. Bi_2O_3 and CuO, did not help to form a robust and lubricating tribofilm.