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Enhancement of tribofilm formation from water lubricated PEEK composites by copper nanowires

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Abstract: A high-performance tribofilm is crucial to enhance the tribological performance of tribomaterials. In order to promote tribofilm formation under water lubrication conditions, copper nanowires as a functional nanomaterial were filled into neat polyetheretherketone (PEEK) and PEEK10SCF8Gr (i.e., PEEK filled with 10 vol.% short carbon fibers and 8 vol.% graphite flakes). The results show that the addition of copper nanowires and a greater applied load can enhance materials transfer and tribofilm formation during sliding process. Moreover, copper nanowires can share a part of applied load, and retard the fatigue effect to some extent. In addition, copper nanowires, carbon fibers and graphite can synergistically improve the tribological performance and the tribofilm formation under water lubrication and severe working conditions. In particular, only 0.5 vol.% copper nanowires can form a high-performance tribofilm, which endows superior lubricating property and wear resistance capacity of the PEEK10SCF8Gr. Furthermore, the surface analysis indicates that the tribofilm contains some transferred materials and the products from tribochemical reactions as well.

Keywords: Tribological performance; Copper nanowires; Water lubrication conditions; Tribofilm; Tribo-chemical reactions

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