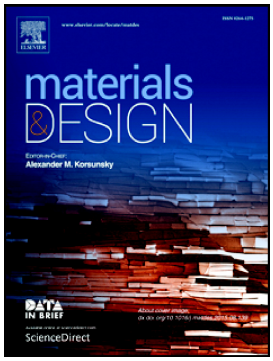

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Formation mechanisms and functionality of boundary films derived from water lubricated polyoxymethylene/hexagonal boron nitride nanocomposites

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Abstract: Development of high-performance polymer composites exposed to water lubrication conditions is of increasing interests for numerous applications, where high durability and reliability are demanded. However, formation of a protective boundary reaction layer on the rubbing surfaces can be problematic with the presence of water. The roles of hexagonal boron nitride (*h*-BN) nanoparticles on the tribological performance of polyoxymethylene (POM) and POM composite reinforced with short carbon fibers were investigated. It is identified that the addition of low loading *h*-BN greatly improves the tribological performance, e.g. wear resistance of POM is enhanced by one order of magnitude. Moreover, *h*-BN and carbon fibers play a synergetic role in enhancing the wear resistance. Tribo-chemistry and nanostructures of the boundary film were comprehensively investigated. It is revealed that H_3BO_3 and B_2O_3 generated as products of tribo-chemical reactions are arrayed in a closely packed outmost layer of the boundary film and exert an important influence on the tribological performance. Our work gives the evidence that the basal planes of H_3BO_3 and B_2O_3 are aligned parallel to the sliding direction, leading to low friction and wear.

Keywords: POM, water lubrication, tribo-chemical reaction, *h*-BN nanoparticles, boundary film

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