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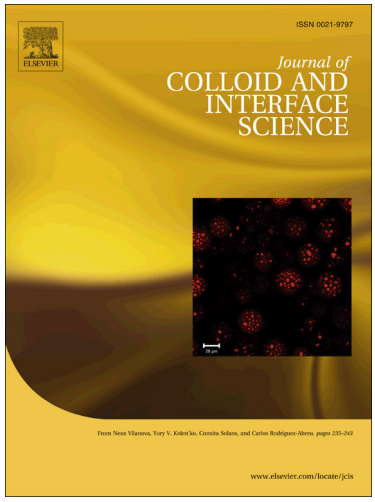

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Significance of an in-situ Generated Boundary Film on Tribocorrosion Behavior of Polymer-Metal Sliding Pair

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Abstract: Polymer composites have a high potential for applications as tribo-materials exposed to sea water owing to their self-lubrication characteristic and high chemical stability. In the present work, tribological behaviors of polyetheretherketone (PEEK) composites rubbing with stainless steel in sea water were explored using a pin-on-disc tribometer integrated with a potentiostat for electrochemical control. It was demonstrated that further adding 5 vol.% hexagonal boron nitride (h-BN) nanoparticles into PEEK reinforced with short carbon fibers (SCF) significantly enhanced the wear resistance. Moreover, the stainless steel exhibited significantly enhanced tribocorrosion resistance when rubbing with the hybrid nanocomposite, in comparison to the sliding against PEEK filled only with SCF. Nanostructures of the boundary films formed on the steel surface were comprehensively investigated. It was manifested that tribo-chemistry products of h-BN, i.e. H_3BO_3 and B_2O_3, were arrayed in a closely packed boundary film. It seems that inclusion of layer-structured H_3BO_3 and B_2O_3 improved the resilience of the boundary film. The continuous boundary film covering the steel surface provided a lubrication effect and strengthened the passivation layer. A new route for enhancing simultaneously tribological and corrosion resistance of polymer-metal pairs by controlling in-situ tribo-chemistry was thus proposed.

Keywords: Boundary film; Tribocorrosion; polyetheretherketone composites; nanoparticles; Stainless steel; Sea water