Tribocorrosion Behavior of Several Corrosion-resistant Alloys Sliding Against CF-PEEK: Application for Hydraulic Valve in Seawater

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doi: 10.20964/2019.05.66

Received: 22 October 2018 / Accepted: 22 December 2018 / Published: 10 April 2019

To select appropriate combinations of antifriction and wear-resistant materials for key tribopairs in seawater hydraulic valves, the tribocorrosion behavior of six kinds of corrosion-resistant alloys sliding against a carbon fiber/polytetrafluoroethylene/graphite (CF/PTFE/graphite)-filled polyetheretherketone (CF-PEEK) composite under artificial seawater lubrication was comparatively investigated by using a pin-on-disk friction tester and electrochemical workstation. The results show that AISI 316, AISI 630 and chromium-plated Ti6Al4V exhibit better tribological behavior than Ti6Al4V and nitrided Ti6Al4V under dry friction, distilled water and artificial seawater conditions. Besides, Ti6Al4V exhibits better corrosion resistance than other corrosion-resistant alloys in both static corrosion and tribocorrosion conditions, and the chromium plating process significantly accelerates the Ti6Al4V corrosion rate in seawater. Moreover, the corrosion-induced wear is higher than the wear-induced corrosion. In addition, the contribution of corrosion-induced wear to synergetic weight loss is more than 85% for all the alloys under tribocorrosion in seawater. Consequently, material combinations of AISI 630/CF-PEEK and AISI 316/CF-PEEK could preferentially be used in seawater hydraulic valves.

Keywords: corrosion-resistant alloys, CF-PEEK, friction and wear, seawater hydraulic valves, tribocorrosion

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