TRIBO AND TRIBOCORROSION STUDIES OF DLC FILMS OVER TI6AL4V

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1. Introduction

Ti-6Al-4V alloy is among the most corrosion-resistant materials used for implants, but the release of titanium, aluminum, and vanadium can cause poisoning and certain diseases, which can be aggravated with implant fretting and subsequent fracture [1,2].

DLC (Diamond-Like Carbon) films have been extensively studied due to their properties that can increase biocompatibility and protect the prosthesis from corrosion. Additionally, DLC coatings can prevent the Ti6Al4V substrate from eluting Ti, Al and V by plastic deformation and corrosion.

2. Experimental

DLC film with around 2 μm thickness were deposited on Ti-6Al-4V plates (2.0×2.0×0.5 cm^3) previously ground and polished to a mirror-like finish surface. A silicon-carbon interlayer using HMDSO (hexamethyldisiloxane) was deposited to enhance the DLC to substrate adhesion. The film depositions were performed for 2 h, with discharge voltage of -400 V and -700V, using methane for DLCH30% and hexane for DLCH40%.

Potentiodynamic curves, performed to assess corrosion resistance by recording anodic and cathodic currents, were carried out using a CETR potentiostat with three-electrode horizontal cell with platinum wire counter electrode with an Ag/AgCl (3M KCl) reference electrode. The potentiodynamic measurement rate was 1mVs−1, and the potential was varied in a range that corrosion was observed on the bare sample, viz. from −2.5VAg/AgCl to 2.5VAg/AgCl.

3. Results and Discussions

DLC films protected the surface of Ti-6Al-4V from corrosion on Ringer's solution. The less hydrogenated film (DLCH30%) performed better on all tests, except on the open circuit potential test, which is an important test but it is not enough to characterize the sample in an electrochemical medium. DLCH30% and DLCH40% presented a protective efficiency of 84 and 80%, respectively.

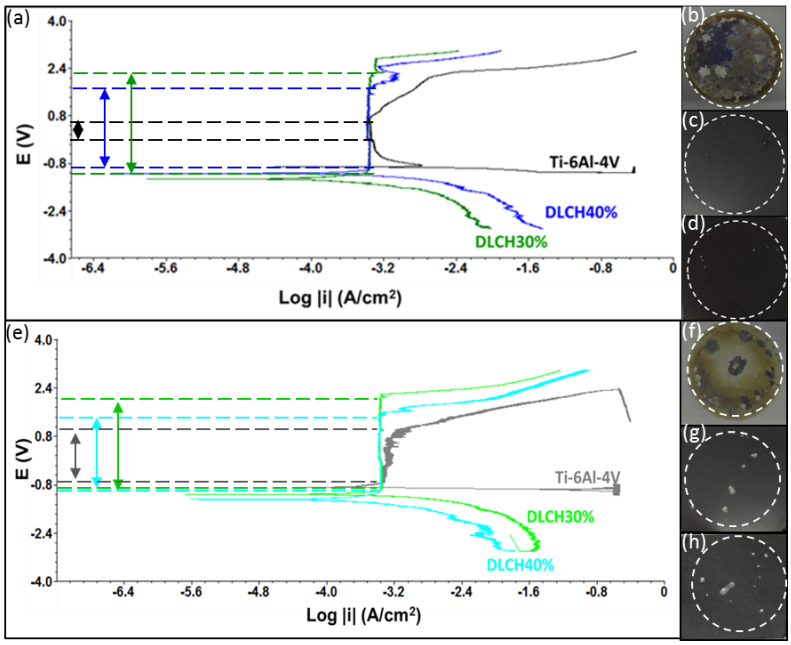

Figure 1 –Potentiodynamic polarization curves of bare Ti-6Al-4V, as well as DLCH30% and DLCH40% covered Ti-6Al-4V samples in Ringer's solutions in (a) static mode and (e) tribocorrosion mode; Condition of sample surfaces after polarization tests (b, f) bare Ti-6Al-4V; and Ti-6Al-4V covered with (c, g) DLCH30% and (d, h) DLCH40%.

4. References

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