

Accepted Manuscript

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PII: S0925-8388(18)32433-2

DOI: [10.1016/j.jallcom.2018.06.312](https://doi.org/10.1016/j.jallcom.2018.06.312)

Reference: JALCOM 46648

To appear in: *Journal of Alloys and Compounds*

Received Date: 15 April 2018

Revised Date: 22 June 2018

Accepted Date: 25 June 2018

Please cite this article as: A. Ebrahimi, H. Esfahani, A. Fattah-alhosseini, O. Imantalab, In-vitro electrochemical study of TiB/TiB₂ composite coating on titanium in Ringer's solution, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.06.312.

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In-vitro Electrochemical Study of TiB/TiB₂ Composite Coating on Titanium in Ringer's Solution

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Abstract

In this work, different electrochemical analyses in Ringer's solution at 37 °C were implemented to understand the electrochemical response of diversity of titanium boride coatings developed on the commercially pure titanium (CP-Ti) via pack cementation method. X-ray diffraction (XRD) patterns and scanning electron microscopy (SEM) images indicated that the boriding creates the TiB whiskers and TiB whiskers/TiB₂ dense layer on the top of the surface of CP-Ti in respect to the heat-treatment at 900 and 1000 °C for 3 h. Potentiodynamic polarization curves cleared the passive behavior of the borided samples. Electrochemical impedance spectroscopy (EIS) assays revealed the satisfactory corrosion resistance of the borided samples in Ringer's solution. Mott-Schottky (M-S) assessments represented that the passive films formed on CP-Ti and the borided samples behaved as doped n-type semiconductor properties. Furthermore, M-S assessments indicated that the donor concentration of the passive films decreased with increasing the time. Finally, the borided sample at 900 °C in comparison with the borided sample at 1000 °C illustrated to be the more suitable selection for bioimplant applications, mainly due to better surface conditions to form a less defective and more protective passive film.

Keywords: Diffusion; Mott-Schottky; Passive film; Ringer Buffer Solution; Titanium boride

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