Effect of Microstructure on Corrosion Resistance of Anodic Oxidation Coatings on TA2 Commercially Pure Titanium in Sodium-Tartrate Solution

Xiao Wang, Ju Rong*, Yuhao Yao, Jing Feng, Yunnan Zhang, Xiaohua Yu*, Zhaolin Zhan

Faculty of Materials Science and Engineering, Kunming University of Science and Technology, Kunming, 650093, China

*E-mail: JRong_kmust@163.com; xiaohua_y@163.com

doi: 10.20964/2018.10.27

Received: 25 May 2018 / Accepted: 17 July 2018 / Published: 1 September 2018

Titanium anodic oxide films were prepared using a constant-potential method in a sodium-tartrate environmentally friendly electrolyte at different concentrations (1, 5, 15, 30 and 50 g L⁻¹). The microstructure, elemental composition, and microscopic three-dimensional morphology of the film were analyzed by scanning electron microscopy, energy-dispersive spectrometry, and atomic force microscopy. The polarization curve and electrochemical impedance spectroscopy of the sample at a low potential in 3.5% NaCl solution were studied by using an electrochemical workstation. The effect of the microscopic three-dimensional morphology on the corrosion resistance was discussed. The surface morphology of the oxide film indicates that a uniform and complete oxide film with a lower roughness can be obtained in the 15 g L⁻¹ sodium-tartrate solution concentrations. As the sodium-tartrate electrolyte concentrations increases, the depths of the cracks deepen and the size of the raised bulges increases. The resulting oxide film has a wide passivation region of 0 to 4 V, a maximum polarization resistance, a small passivation-induced current value, and a low corrosion current value of 3.730×10^{-5} A·cm⁻², and thus, it exhibits an excellent corrosion resistance, and a wide range of potential applications, such as in biological technologies. This work provides a new approach to prepare environmentally friendly, non-polluting titanium anodic oxide films and proposes a novel design to adjust the corrosion resistance performance of the anodized film.

Keywords: TA2 pure titanium; anodic oxidation; corrosion resistance; atomic force microscopy

[FULL TEXT](#)

© 2018 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).