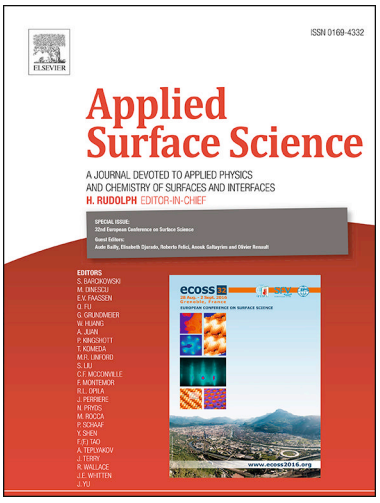

Full Length Article

Electrochemical deposition and characterization of ZrO_2 ceramic nanocoatings on superelastic NiTi alloy

Natalia Isabel de Azevedo Lopes, Nelson Henrique Jardim Freire, Pedro Damas Resende, Leandro de Arruda Santos, Vicente Tadeu Lopes Buono

PII: S0169-4332(18)31116-4
DOI: https://doi.org/10.1016/j.apsusc.2018.04.154
Reference: APSUSC 39153

To appear in: *Applied Surface Science*

Received Date: 17 November 2017
Revised Date: 3 April 2018
Accepted Date: 16 April 2018

Please cite this article as: N.I. de Azevedo Lopes, N. Henrique Jardim Freire, P. Damas Resende, L. de Arruda Santos, V. Tadeu Lopes Buono, Electrochemical deposition and characterization of ZrO_2 ceramic nanocoatings on superelastic NiTi alloy, *Applied Surface Science* (2018), doi: https://doi.org/10.1016/j.apsusc.2018.04.154

Electrochemical deposition and characterization of ZrO_2 ceramic nanocoatings on superelastic NiTi alloy

Natalia Isabel de Azevedo Lopes*, Nelson Henrique Jardim Freire, Pedro Damas Resende, Leandro de Arruda Santos and Vicente Tadeu Lopes Buono

Department of Metallurgical and Materials Engineering, Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, MG, Brazil

*Corresponding author: nlopes@ufmg.br

Abstract

This study aimed to develop an appropriate nano-sized coating to prevent premature failures of NiTi components and nickel release to the human body. Two zirconyl salts, $ZrOCl_2$ and $ZrO(NO_3)_2$, were evaluated for electrodeposition as well as the effects of methanol and polyDADMAC addition. The surface morphology and chemical composition of the coated samples were evaluated using scanning electron microscopy with energy dispersive X-ray spectrometry, X-ray diffraction, and atomic force microscopy. The corrosion resistance was evaluated using potentiodynamic polarization tests in Hank's simulated physiological solution at 37 °C. The results showed that deposition using both $ZrOCl_2$ and $ZrO(NO_3)_2$ aqueous solutions reduces the surface roughness and improves the corrosion resistance of superelastic NiTi wires. When a $ZrOCl_2$ methanolic electrolyte was used, the deposition was heterogeneous and cracks were observed in the film. The addition of PolyDADMAC to aqueous and methanolic electrolytes resulted in more uniform coating surface and higher corrosion resistance in Hank's solution. The deposition of ZrO_2 improved the corrosion resistance of NiTi wires even when no previous electrolytic polishing was applied.

Keywords: *nickel-titanium; corrosion; electrodeposition; nanocoating; zirconia; biomaterials.*