

Accepted Manuscript

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PII: S0257-8972(16)31326-3
DOI: doi: [10.1016/j.surfcoat.2016.12.038](https://doi.org/10.1016/j.surfcoat.2016.12.038)
Reference: SCT 21895
To appear in: *Surface & Coatings Technology*
Received date: 26 September 2016
Revised date: 6 December 2016
Accepted date: 13 December 2016

Please cite this article as: M Manjaiah, Rudolph F Laubscher , Effect of anodizing on surface integrity of Grade 4 titanium for biomedical applications. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Sct(2016), doi: [10.1016/j.surfcoat.2016.12.038](https://doi.org/10.1016/j.surfcoat.2016.12.038)

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Effect of anodizing on surface integrity of Grade 4 Titanium for biomedical applications**Manjaiah M* and Rudolph F Laubscher**

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Abstract

Titanium-based alloys are widely used in the biomedical field due to various favourable material properties. These include low density, high corrosion resistance and good mechanical and biocompatible properties. Surface integrity descriptors such as topography, surface chemical composition and aesthetic appearance are important for adequate part performance. Various surface engineering treatments are routinely applied to obtain improved performance. The current investigation examines the effect of anodizing on the oxide layer thickness and composition, surface topography and aesthetic appearance. Anodizing is conducted on especially finished (Sa ± 13 nm) Grade 4 titanium specimen at various voltages in a H₂SO₄ electrolyte. Surface analysis consisted of atomic force microscopy (AFM), scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS), X-ray diffractometry (XRD) and UV spectrophotometry. The results show that highly-ordered oxide structures in partially anatase and rutile TiO₂ substrates are readily achieved. Various interference colours are readily achieved with different anodizing process parameters. An increase in anodizing voltage leads to layer thickness growth, increased roughness and changes in surface phase composition. An increase in oxide layer thickness is coincident with an increase in surface roughness. Reference is made throughout the paper to the effect of the various surface integrity descriptors measured, on the perceived biomedical effect of implant performance of the specific descriptor in question based on published data.

Keywords: Anodization, sulphuric acid; surface roughness; TiO₂; AFM; titanium alloy and Crystal structure.

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