

Accepted Manuscript

Crystal growth mechanism of calcium phosphate coatings on titanium by electrochemical deposition



T. Mokabber, L.Q. Lu, P. van Rijn, A.I. Vakis, Y.T. Pei

PII: S0257-8972(17)31228-8
DOI: [doi:10.1016/j.surfcoat.2017.12.011](https://doi.org/10.1016/j.surfcoat.2017.12.011)
Reference: SCT 22929
To appear in: *Surface & Coatings Technology*
Received date: 22 September 2017
Revised date: 2 December 2017
Accepted date: 4 December 2017

Please cite this article as: T. Mokabber, L.Q. Lu, P. van Rijn, A.I. Vakis, Y.T. Pei , Crystal growth mechanism of calcium phosphate coatings on titanium by electrochemical deposition. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Sct(2017), doi:[10.1016/j.surfcoat.2017.12.011](https://doi.org/10.1016/j.surfcoat.2017.12.011)

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Crystal growth mechanism of calcium phosphate coatings on titanium by electrochemical deposition

T. Mokabber¹, L.Q. Lu¹, P. van Rijn², A.I. Vakis¹, Y.T. Pei^{1*}

¹ Department of Advanced Production Engineering, Engineering and Technology Institute Groningen, Faculty of Science and Engineering, University of Groningen, Nijenborgh 4, 9747 AG Groningen, the Netherlands

² Department of BioMedical Engineering, University of Groningen, University Medical Center Groningen, Ant. Deusinglaan 1, 9713 AV Groningen, the Netherlands

Abstract

The pulsed current electrochemical deposition of calcium phosphate (Ca-P) coatings on a titanium substrate was investigated in this study. The effects of applied voltage and H₂O₂ concentration in the electrolyte solution on the phase composition and coating morphology were studied using X-ray diffraction and scanning electron microscopy. At lower concentrations of H₂O₂, the coating consists of mixed phases of dicalcium phosphate dehydrate, octa-calcium phosphate, and hydroxyapatite, whereas increased H₂O₂ concentrations results in a dual phase of octa-calcium phosphate and hydroxyapatite being deposited. Furthermore, with increasing H₂O₂ concentration, the voltage must be reduced in order to avoid H₂ evolution. The best conditions for Ca-P deposition were achieved at -1.4 V and 1.5 wt.% H₂O₂. The morphological changes at different deposition times as well as the crystallographic orientation of deposited crystals were studied using scanning electron microscopy and transmission electron microscopy. It was found that the crystal growth of Ca-P coatings is a time-dependent process. During the first stage of deposition (t = 1 min), the electrolyte is supersaturated and randomly oriented polycrystals of Ca-P nucleate and form nanoplates. During the second stage (t = 3 min), crystals grow slightly in a more oriented fashion and form micro-sized plates. During the third stage (t > 10 min), the deposited crystals grow in a highly directional manner and the morphology of the coating consists of elongated ribbon-like single crystals.

Keywords: Calcium phosphate; Coating; Electrochemical deposition; Nucleation and growth; Morphology.

* Corresponding author. Email: y.pei@rug.nl

Download English Version:

<https://daneshyari.com/en/article/8024702>

Download Persian Version:

<https://daneshyari.com/article/8024702>

[Daneshyari.com](https://daneshyari.com)