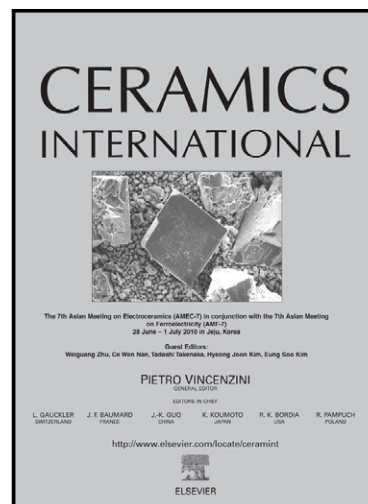


Author's Accepted Manuscript

Thermal Stability of Electrochemical-Hydrothermal Hydroxyapatite Coatings

Keith Savino, Matthew Z. Yates



www.elsevier.com/locate/ceramint

PII: S0272-8842(15)00470-8
DOI: <http://dx.doi.org/10.1016/j.ceramint.2015.03.065>
Reference: CERI10144

To appear in: *Ceramics International*

Received date: 23 February 2015
Revised date: 10 March 2015
Accepted date: 12 March 2015

Cite this article as: Keith Savino, Matthew Z. Yates, Thermal Stability of Electrochemical-Hydrothermal Hydroxyapatite Coatings, *Ceramics International*, <http://dx.doi.org/10.1016/j.ceramint.2015.03.065>

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 galley proof before it is published in its final citable 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.

Thermal Stability of Electrochemical-Hydrothermal Hydroxyapatite Coatings

Keith Savino, Matthew Z. Yates*

Department of Chemical Engineering and Laboratory for Laser Energetics, University of Rochester, Rochester, NY, 14627, United States.

Abstract

Dense, uniform hydroxyapatite (HA) coatings were synthesized by hydrothermal crystal growth onto titanium substrates that were electrochemically seeded with HA nanocrystals. The HA was also doped with yttrium and/or fluoride during the hydrothermal reaction. The resulting HA coatings have a unique morphology consisting of crystal domains aligned with the crystallographic *c*-axis oriented normal to the surface of the coating. At elevated temperatures, the HA coatings were found to slowly decompose via dehydroxylation to β -tricalcium phosphate (β -TCP). Thermal decomposition negatively impacts the mechanical stability of the coating and can negatively impact performance *in vivo* due to the higher solubility of β -TCP relative to HA. It is shown that thermal decomposition of HA membranes can be avoided by adding water vapor to suppress dehydroxylation during thermal processing, or by doping the membrane with fluoride during hydrothermal synthesis. Thermal decomposition of HA coatings to β -TCP was characterized by X-ray diffraction and scanning electron microscopy. Coatings of HA or yttrium-doped HA were found to be unstable in dry air above 600 °C, but stable in a steam atmosphere at 900 °C. Coatings doped with fluoride or co-doped with yttrium and fluoride were also thermally stable in dry air at 900 °C. Therefore, the unique HA coating morphology and composition can be maintained during post-synthesis thermal processing or high temperature applications.

Keywords:

Hydroxyapatite, Hydrothermal, Thermal stability, Fluoride

*Corresponding author

Email address: myates@che.rochester.edu (Matthew Z. Yates)

Download English Version:

<https://daneshyari.com/en/article/10624577>

Download Persian Version:

<https://daneshyari.com/article/10624577>

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