

## Accepted Manuscript

Title: Theoretical and experimental study of the incorporation of tobramycin and strontium- ions into hydroxyapatite by means of co-precipitation

Author: Baochang Wang Mirjam Lilja Taoran Ma Jan Sørensen Hartwig Steckel Rajeev Ahuja Maria Strømme



PII: S0169-4332(14)01514-1  
DOI: <http://dx.doi.org/doi:10.1016/j.apsusc.2014.06.193>  
Reference: APSUSC 28245

To appear in: *APSUSC*

Received date: 26-5-2014  
Revised date: 30-6-2014  
Accepted date: 30-6-2014

Please cite this article as: B. Wang, M. Lilja, T. Ma, J. Sørensen, H. Steckel, R. Ahuja, M. Stromme, Theoretical and experimental study of the incorporation of tobramycin and strontium- ions into hydroxyapatite by means of co-precipitation, *Applied Surface Science* (2014), <http://dx.doi.org/10.1016/j.apsusc.2014.06.193>

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.

## Theoretical and experimental study of the incorporation of tobramycin and strontium- ions into hydroxyapatite by means of co-precipitation

Baochang Wang<sup>1</sup>, Mirjam Lilja<sup>2,3</sup>, Taoran Ma<sup>1</sup>, Jan Sørensen<sup>4</sup>, Hartwig Steckel<sup>4</sup>, Rajeev Ahuja<sup>1</sup>, Maria Strømme<sup>2\*</sup>

<sup>1</sup> *Applied Materials Physics, Department of Materials and Engineering, Royal Institute of Technology (KTH), S 100 44 Stockholm, Sweden*

<sup>2</sup> *Division for Nanotechnology and Functional Materials, The Ångström Laboratory, Uppsala University, 751 21 Uppsala, Sweden*

<sup>3</sup> *Sandvik Coromant Sverige AB, 12680 Stockholm, Sweden*

<sup>4</sup> *Department of Pharmaceutics and Biopharmaceutics, Christian Albrecht University Kiel, Kiel, Germany*

\*corresponding author: [maria.stromme@angstrom.uu.se](mailto:maria.stromme@angstrom.uu.se)

### Abstract:

Antibiotic incorporation into hydroxyapatite (HA) coatings by co-precipitation and the impact of bone relevant doping elements on the adsorption kinetics are investigated from both theoretical and experimental points of view.

Tobramycin interactions with bioactive TiO<sub>2</sub> and HA surfaces are analyzed using density functional theory. According to the calculations, the drug molecule has larger adsorption energy than the Ca<sup>+</sup> ion on both surfaces under study in Phosphate Buffered Saline (PBS). The results support the experimental observations that HA nucleation and growth are strongly limited on TiO<sub>2</sub> surfaces in the presence of clinically relevant antibiotic concentrations in PBS. The drug molecule is more likely to adopt parallel arrangement onto the HA surface, as the adsorption energy of such arrangement is higher compared to a perpendicular one. Strontium substitution of the HA surface is found to result in a weaker drug-surface interaction, and leads also to a decrease in coating thickness. However, the presence of strontium gives rise to a coating morphology with enhanced drug incorporation capacity and slower antibiotic release compared to non-substituted, co-precipitated counterparts. Our theoretical calculation results were found to be in excellent agreement with experimental data and provide a powerful tool to understand the interaction mechanism between drug and different surface chemistries necessary for development of future versatile orthopedic and dental implant surfaces.

Download English Version:

<https://daneshyari.com/en/article/5358372>

Download Persian Version:

<https://daneshyari.com/article/5358372>

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