Physical vapor deposited titanium thin films for biomedical applications: Reproducibility of nanoscale surface roughness and microbial adhesion properties.

Lüdecke C, Bossert J, Roth M, Jandt KD (2013) Physical vapor deposited titanium thin films for biomedical applications: Reproducibility of nanoscale surface roughness and microbial adhesion properties. *Applied Surface Science* 280, 578-589.

Details

Abstract

The surface topography is of great importance for the biological performance of titanium based implants since it may influence the initial adsorption of proteins, cell response, as well as microbial adhesion. A recently described technique for the preparation of titanium thin films with an adjustable surface roughness on the nanometer scale is the physical vapor deposition (PVD). The aims of this study were to statistically evaluate the reproducibility of nanorough titanium thin films prepared by PVD using an atomic force microscopy (AFM) based approach, to test the microbial adhesion in dependence of the nanoscale surface roughness and to critically discuss the parameters used for the characterization of the titanium surfaces with respect to AFM microscope settings. No statistically significant differences were found between the surface nanoroughnesses of the PVD prepared titanium thin films. With increasing surface nanoroughness, the coverage by *Escherichia coli* decreased and the microbial cells were increasingly patchy distributed. The calculated roughness values significantly increased with increasing AFM scan size, while image resolution and pixel density had no influence on this effect. Our study shows that PVD is a suitable

tool to reproducibly prepare titanium thin films with a well-defined surface topography on the nanometer scale. These surfaces are, thus, a suitable 2D model system for studies addressing the interaction between surface nanoroughness and the biological system. First results show that surface roughness even on the very low nanometer scale has an influence on bacterial adhesion behavior. These findings give new momentum to biomaterials research and will support the development of biomaterials surfaces with anti-infectious surface properties.

Involved units

Bio Pilot Plant Miriam Agler-Rosenbaum Read more

Leibniz-HKI-Authors

Claudia Lüdecke-Beyer

Details

Martin Roth

Details

Identifier

doi: 10.1016/j.apsusc.2013.05.030