OR0301

High performance antibacterial thin films for titanium biomedical components

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Titanium and Ti alloys are extensively used in biomedical market due to their excellent biocompatibility and high corrosion resistance in the human body fluids. However, they exhibit poor mechanical properties and inadequate antibacterial properties. Currently, one of the main concerns in biomedical market, is the microbial infection of the components which leads to their failure after long time exposure due to bacterial colonization. Particularly, microorganisms are abundant in the oral environment where dental implant failure can be a direct consequence of serious microbial attack and hence, new Ti based biomaterials with the desirable antibacterial properties are essential for high quality implant performance.
In this study, high durability coatings with antibacterial properties are investigated to be applied of Ti dental implants. Tantalum nitride thin films deposited by High Power Pulsed Magnetron Sputtering (HPPMS) technique incorporating antibacterial agents are developed. TaN is well known as high corrosion and wear resistance thin film in biological environment. To provide to the TaN thin film the antibacterial property, silver (Ag) is incorporated into the matrix by co-sputtering of Ta and Ag in N_2/Ar reactive atmosphere. Although the benefits of Ag to attack bacterial colonization are well documented, the Ag dose needs to be accurately controlled to avoid Ag from becoming cytotoxic.
Different composition and microstructure TaN _Ag films are grown in this work. Tribocorrosion performance of TaN_Ag films with different Ag atomic contents in oral environment was investigated to evaluate the durability of these surface treatments. Cytotoxicity (cell viability) tests and antibacterial tests against different bacteria were performed on TaN_Ag films with different Ag contents.

Keywords
Implants
TaN
Silver
Antibacterial