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RF AND DC MAGNETRON SPUTTERING METHODS for DEPOSITION of BIOINERT and BIOACTIVE COATINGS

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Surface modification of implants is a rapidly developing multidisciplinary field that combines expertise of materials science and healthcare professionals. Improvement of implants in terms of their biocompatibility, hemocompatibility, antibacterial properties, osteointegration and osteoinduction are the main topics of research. These properties are crucial to ensure desirable biological response to the newly implanted material, in the manner that the cells, which are adhered to the surface of such scaffolds can function in a way that is similar to physiological conditions or help to prevent possible complications.

Physical vapor deposition (PVD) of thin films, allowing the deposition of multicomponent coatings, has been available for some years. An emerging method for bioactive coating deposition in the field of PVD is radiofrequency (RF) magnetron sputtering method [1]. Magnetron sputtering is widely used in the formation of coatings for various applications. The continuous interest of scientists for this method is due to the possibility of modifying the coating structure and its physicochemical properties by variation of the deposition parameters. There is a significant interest in radiofrequency (RF) magnetron sputtering of bioactive calcium phosphate thin films. This method allows deposition of CaP coatings with a high level of adhesion to substrate. In the light of demand for antibacterial coatings, hydroxyapatite is frequently substituted by ions of Zn, Cu, and Ag [2]. Zinc ions, for example, are well-known not only for its antibacterial properties, but it also acts as an inhibitor of crystal growth. It is essential trace element for tissue regeneration [3]. An RF magnetron sputtering of Zn- or Cu-substituted hydroxyapatite allow to deposit antibacterial calcium phosphate coatings that not only improve osteointegration, but act as a protecting layer that could alter the degradation rate of the substrate and induce local antibacterial effect.

On the other hand, binary and ternary titanium compounds (oxides and oxynitrides) standalone among other coatings due to their high bio- and hemocompatibility. This is especially true for cardiovascular implants. The titanium oxynitride film, deposited using reactive magnetron sputtering, combines the properties of two components: titanium oxide and nitrogen oxide (NO). Modification of deposition parameters such as substrate bias, working gas, deposition pressure, allow to change the structure and properties of deposited layers.

Moreover, the magnetron sputtering method has been used to modify different scaffolds from bioinert polymers, ceramics and metallic alloys. The magnetron co-sputtering method with using of copper and titanium targets in an argon atmosphere is applied to modify the PCL scaffolds surface for improvement of osseointegration and antibacterial properties.

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