APPLICATION of GLANCING ANGLE DEPOSITION for MANIPULATION of THIN CALCIUM PHOSPHAPTE COATINGS MORPHOLOGY [1]

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Calcium phosphate (CaP) coatings are a widely researched topic which, over the years, resulted in lots of applications in the field of bone regeneration. It is due to the fact that conventional metallic implants become encapsulated by fibrous tissue, which in turn not only prolongs the healing time, but also leads to implant loosening and eventually premature failure of implantation. Not to mention bear Ti corrosion rate in the physiological fluids which might cause metallosis.

The modern approaches to healthcare are aiming to produce implants with biomimetic properties. 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. From that point of view, the formation of a coatings that consists of different types of surface gradient structures and with variation in the level of roughness in submicro- and nanoscale could be of significant interest for biomimetic purposes. Thus, a possibility to manipulate nanotopography attracts much attention in the recent years.

Physical vapor deposition (PVD) of thin films, allowing the deposition of porous and/or columnar-like structured coatings, has been available for some years. In turn, the use of an oblique angle geometrical configuration, or as it is also referred as glancing angle deposition (GLAD) method, is frequently exploited for formation of three-dimensional columnar micro- or nanostructured surfaces. It is generally accepted that the mechanistic factor controlling the nanostructural evolution of the films is a ‘‘shadowing effect”, which prevents the deposition of particles in regions situated behind initially formed nuclei (i.e., shadowed regions) [1].

An emerging method for bioactive coating deposition in the field of PVD is radiofrequency (RF) magnetron sputtering method [2]. 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 CaP thin films. This method allows deposition of CaP coatings with a high level of adhesion to substrate.

In our work we show the influence of GLAD geometry on the morphology and structure of thin calcium phosphate films deposited by RF magnetron sputtering method. The method allowed us to manipulate the coating roughness on the submicron and nanoscale levels. A significant change in the coating morphology was revealed when the substrate tilt angle was set to 80º. It was shown that an increase in the coating crystallinity for samples deposited at a tilt angle of 80º corresponds to formation of crystallites in the bulk structure of the thin film. Cross section SEM revealed inner structure of deposited coatings and predominant growth towards the particle flux was easily detectable. The GLAD of complex calcium phosphate material can lead to the growth of thin films with significantly changed morphological features and can be utilized to create self-organized nanostructures on various types of surfaces [3].

REFERENCES

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