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Formation of functional coatings on titanium

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Biomaterials are typically formed from various metallic alloys usually by titanium and its alloys. Surface treatment of titanium surface allows to increase their functionality. Formation of porous oxide layer with various shape and size of pores influences on the osseointegration process. During the anodization process some of the chemical compounds, including ceramic particles, can be incorporated into the coatings from the bath. One of the advantages of the PEO process is the possibility to anodize real-shaped bone implants.

Ti implants can exhibit antibacterial properties, due to the incorporation, for example, Ag particles. However, the attainable concentration of the ceramic particles is limited. Thus, the post-treatment of the oxide layer is carried out to increase their functionality. A PEO layer might also be covered with the ceramic particles using electrochemical techniques or sol-gel. Sensitive chemical compounds like antibiotics might be blended with a fast-degradable polymer and deposited on the previously anodized Ti alloy. Amoxicillin, vancomycin, clindamycin, cefazolin are easily blended and can be released from a thin polymeric layer such as poly(D,L-lactide-co-glycolide) PLGA (50/50), poly(sebacic anhydrite) or poly(adipic anhydrite). Depends on type of polymer, layer degrades in simulated body fluids after 30 minutes, several hours or around 5 weeks. Drug release allow to design implants with antibiotics in the concentration range only of 50-80 µg/cm2. Nanostructured (ceramic or polymer) layers strongly influence on the osteoblast cells behavior. Thus, plasma electrolytic oxidation coupled with the dip coating technique are favorable for osseointegration process, as well as to prevent septic inflammation. These hybrid coatings may find application in medicine as well as in veterinary.

Biography

Alicja Kazek-Kęsik is working at the position of adjunct in the department of inorganic chemistry, analytical chemistry and electrochemistry at silesian university of technology in Poland. She received her diploma and PhD in chemical technology at silesian university of technology. Her research interests range from biomaterials to bone tissue reconstruction, biological investigations, as well as various electrochemical surface treatments. She has laboratory experience with biological characterization of biomaterials, especially with regard to their cytocompatibility and anti-bacterial properties. She is focused on plasma electrolytic oxidation of various metallic materials and the post-treatment methods. She has improved her knowledge of X-ray techniques at Institute for Nanoscience and Cryogenics in France. She is an author of over 35 scientific articles (H -index=12) as well as several patents about anodization processes and formation of hybrid coatings. Her research is supported by polish national science centre and she was awarded by polish electroplating society.

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