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BIOCOMPATIBLE PEO COATINGS FUNCTIONALIZED WITH POLYSACCHARIDE PHOSPHONATES

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Plasma electrolytic oxidation (PEO) is a promising method for production of biocompatible coatings on titanium implants. High voltages promoting plasma microdischarges in the surface layer generate unique coating morphology exhibiting porous and rough structure contributing to the cell adhesion and further osseointegration. The surface layer provided by the PEO technology shows good mechanical compatibility with the human bone, because it forms a gradual descent of the elasticity modulus from the metal of the implant to the material of the bone. Moreover, the PEO process opens the possibility to incorporate Ca- and P- containing phases into the oxide coating; this supplies tricalciumphosphate, hydroxyapatite and other bioactive phases for the osteosynthesis. However, this approach provides physical and chemical compatibility, but the biological processes are left out of the scope. Therefore, the idea of this research is to functionalize the PEO coating with organic compounds acting in the extracellular matrix in order to improve osseointegration.

An experimental study of the PEO process on Cp-titanium was conducted in pulsed bipolar mode at different frequencies. It was shown that increasing the frequency from 20 to 10000 Hz does not affect dramatically the coating thickness and morphology, but it increases the bio-crystalline and amorphous Ca-, P- phase content. The PEO coatings were functionalized with phosphonates of polysaccharides (hyaluronic acid, carboxymethyl cellulose), which showed good adhesion to the modified metal surface and increase the corrosion resistance compared to bare Ti surface. It is assumed that the introduction of phosphorylated polysaccharides prevents non-specific protein layer formation, enhances the biomineralization process and, therefore, osseointegration compared to simple PEO coated and uncoated Cp-Ti.

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