

## **DEVELOPMENT OF NEW POROUS COATINGS OBTAINED ON TITANIUM BY PLASMA ELECTROLYTIC OXIDATION IN ELECTROLYTES CONTAINING PHOSPHORIC ACID WITH THE ADDITION OF CALCIUM, COPPER, MAGNESIUM AND ZINC NITRATES**

Due to the populations aging of the European Union, operations and re-operations of knee or hip are increasingly performed. Therefore, patients have to be hospitalized and the knee or hip prostheses, which are made mostly of titanium, have to be inserted into their body. Because the biocompatibility of these implants depend on porosity as well as chemical and phase composition of coatings, the Plasma Electrolytic Oxidation (PEO) may be used for these coatings' preparation. The PEO processing allows for doping of the coatings by the desirable elements, such as phosphorus, calcium, magnesium, copper and zinc, to build up a structure similar to hydroxyapatite, which is the main building material of bones, with additional bactericidal properties.

The main goal of the project is to understand the growth mechanism of new porous coatings on titanium obtained by Plasma Electrolytic Oxidation (PEO) at DC and AC voltages, in concentrated phosphoric acid containing nitrates of calcium, magnesium, and bactericidal elements such as copper, zinc, as well as to elaborate innovative new models of these coatings. The influence of electrolyte composition, DC or AC voltages, and treatment time will be studied as well. New growth models will also contain information about the state of oxidation of all studied elements and surface porosity, and 3D roughness parameters and corrosion resistance. Moreover, the mathematical models/formulae will be found, which will describe the amount of phosphorus, calcium, copper, magnesium, and zinc in the porous PEO coatings grown on titanium in electrolytes containing calcium, copper, magnesium and zinc.

All porous coatings will be obtained on titanium (CP Titanium Grade 2) samples by Plasma Electrolytic Oxidation (PEO) process using the high potential power supplies: PWR 1600H, Multi Range DC Power Supply 1600W, 0-650V/0-8A and PCR12000W2, AC 1-300 V, 1-500 Hz, combined with oscilloscope to monitor the shapes of voltage and current. As the electrolyte, a mixture consisting of concentrated phosphoric acid with nitrates of calcium, magnesium, copper and zinc will be used. Obtained porous coatings will be studied by: SEM, EDS, XPS, XRD, GDOES, confocal microscope, potentiostat.

In the future, an introduction of selected drugs to coatings is also planned thanks to the porosity of the coatings obtained by Plasma Electrolytic Oxidation. Another application of the project results, besides the modification possibilities of metallic biomaterials, may be the production of porous catalysts, which may be required in the automotive industry, as well as in the energy sector, and their porosity and chemical and phase composition have a significant impact on their performance. Both biomaterials as well as catalysts are currently used more and more often, and have a significant impact on the civilization development of Polish society, and in general, on all European Union countries.