SURFACE ANALYSIS OF TITANIUM ALLOY Ti-6Al-4V ELI WITH OCTADECYLPHOSPHONIC ACID (ODPA) AND HYDROXYAPATITE (HA) LAYERS

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Titanium alloy Ti6Al4V ELI, made in accordance with ASTM F 136/1472 standards [1] is recommended for surgical applications [2], including for the construction of endoprostheses. It has very good mechanical properties such as low density and corrosion resistance. Unfortunately, due to doping with toxic elements - Al, V [3], modification of its surface is very important [4]. The aim of the project is to optimize the surface modification process of Ti6Al4V ELI with phosphonic compounds. It has already been proven that octadecylphosphonic acid (ODPA) (fig. 1.) shows sorption with hydroxyapatite (HA) (fig. 2.) – bone building material [5]. Titanium alloy and phosphonium compounds are very common in medicine [6]. There are many publications on their properties or specific applications [7]. However, no research could be found that would accurately describe the manner in which the monolayers would arrange on the surface of the titanium alloy as well as the subsequent interaction with hydroxyapatite.

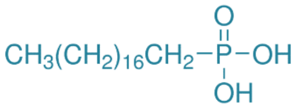

Fig. 1. the ODPA

$Ca_5(OH)(PO_4)_3$

Fig. 2. the hydroxyapatite

Ti-6Al-4V ELI titanium alloy plates measuring 30 mm x 15 mm x 11 mm (from Wolften) were used for the tests, (percentage alloy composition: Fe – 0.12; V – 3.85; Al - 6.15; C - 0.008; O – 0.13; N – 0.004; Y - <0.0004; Ti - 89.74). Current research has focused on creating an ODPA layer on the surface of the titanium alloy plate and then creating the HA layer through the crystallization process. The application of the ODPA layer consisted of complete evaporation of the solvent – THF. Figures 3 and 4 show the difference before and after ODPA application on the plate surface.

For analysis of Ti-6Al-4V ELI surface modified with ODPA and HA, inVia confocal Raman microscope (Renishaw) was used, with a 785 nm beam laser and 50x and 100x magnification lenses. To confirm the correctness of the results, measurements using Fourier-transform infrared spectroscopy (FTIR) were carried out for the same samples. In addition, to check the wettability of the surface, contact angle measurements were realized. The obtained results confirm the presence of ODPA together with HA on the surface of the titanium alloy plate.

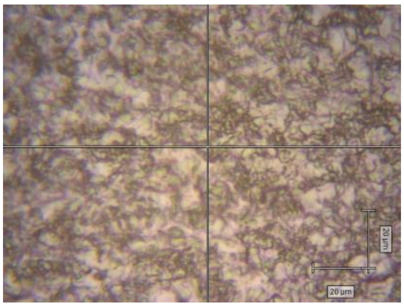

Fig. 3. Ti-6Al-4V ELI surface at 50x magnification, before applying the ODPA layer

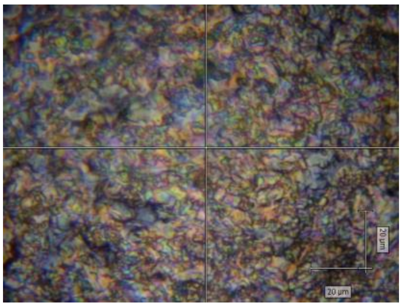

Fig. 4. Ti-6Al-4V ELI surface at 50x magnification, after applying the ODPA layer

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