Surface Behaviour of the Ultrafine Grained Biomedical Titanium

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Abstract Text:

Commercially pure titanium (CP-Ti) offers vulnerable combination of the biocompatibility, corrosion resistance in the body fluids and relatively low stiffness, which justified the wide use of this material in the implantology. However, mechanical strength of the standard CP-Ti is not sufficient for its application in the highly-loaded implants. Large plastic deformation techniques provide the solution to this problem by offering the possibility to strengthen CP-Ti by refining its grains to the submicron range. Submicron structure in CP-Ti substrates could be developed e.g. by techniques based on extrusion (hydrostatic extrusion: HE) and multiple-pass cold rolling. HE technique allows to produce ultra-fine grained products in the form of rods, which can be subsequently exploited to fabricate narrow dental implants that transferring higher loads compared to the implants with standard dimensions. In order to fabricate ultra-fine grained CP-Ti products in the form of plates, techniques based on rolling procedures such as multiple-pass cold rolling or accumulative roll bonding (ARB) could be used. Changes introduced during large plastic techniques such as refining grains to the submicron range as well as development of particular crystallographic textures, could affect the properties of the protective oxide layers that are spontaneously formed on CP-Ti surface due to its contact with air. This study offers the analysis of how particular microstructural features affect corrosion resistance of CP-Ti in the simulated body fluid. Improvement of CP-Ti corrosion resistance, obtained by tailoring its microstructure, was compared with the enhancement possible to gain by the electrodeposition of the chitosan-based coatings.

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