Abstract

This thesis focuses on testing and improving Ti-6Al-4V ELI biomaterials, which are currently one of the most used titanium alloys in biomedicine (predominantly in orthopaedics and dentistry), in cooperation with research institutions and private companies developing and producing such materials. The metallic samples were previously modified by plasma electrolytic oxidation (PEO) with use of electrolytes of a different composition to induce development of a homogeneous TiO_2 layer on its surface. *In vitro* interactions of human osteoblast-like cell line Saos-2 with the surface of Ti-6Al-4V ELI alloy samples are investigated. Initial cell attachment, spreading, morphology, cell population density, viability, calcium deposition and expression of selected osteogenic markers, e.g. collagen type I, alkaline phosphatase and osteocalcin, were evaluated on cultured cells. The cells behavior were then correlated with physicochemical properties of the material surface, such as its topography, roughness, wettability, surface layer chemical composition *etc.* The results are also compared with those obtained in cells cultured on control samples of untreated alloys as well as microscopic glass coverslips and bottom of standard polystyrene cell culture wells. The aim of this thesis is to select the most promising modified material for use in temporary bone implants.

Keywords: Ti-6Al-4V, bone implants, bone tissue engineering, osteoblast, Saos-2, calcium deposition, collagen type I, osteocalcin, alkaline phosphatase.