Modification of titanium surfaces by micro-arc oxidation and apatite coating

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Apatite-based coatings and others that contain calcium play an important role in implant-bone integration. This binding capacity is attributed to the release of calcium that induces a specific biological response to the living tissue, establishing a stable chemical bond between the formed bone and the implants. The efficiency of implant anchorage also depends on the structure and morphology of the surface. In this work, the surface of commercially pure titanium (c.p.-Ti, F67, G2) was modified by micro-arc oxidation (MAO) process to produce a porous surface with calcium-containing titanium oxide on which apatite was deposited by the sol-gel/dip coating technique followed by the heat treatment. The surfaces were characterized by X-ray diffractometry (XRD), Scanning Electron Microscopy (SEM), coating thickness and wettability measurements. The modified surface consists of rutile TiO_2(PDF 71-650), calcium titanate (PDF 26-333) and apatite (PDF 89-4405) layers. SEM analysis revealed high porous surface after micro-arc oxidation and that the sol-gel method provided adequate apatite coverage. The thickness of porous and apatite layers is approximately 5um and 12-17um, respectively. The wettability increases as the contact angle between water droplet and surface decreases from 91.3º±4.8 for c.p.-Ti to 84.1º±11.6 for oxidized surface and to 22.8º±7.6 for apatite coated surfaces. The results show that the carried out modifications provided features to improve the aforementioned integration.