Influence of Hydrogen Charging on the Formation of Nanostructural Titania by Anodizing with Cathodic Pretreatment

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Abstract

The purpose of the present study was to evaluate the influences of titanium hydride on the formation of nanostructural titanium oxide by electrochemical treatment. The physico-chemical surface properties were investigated by scanning electron microscopy, cross-sectional transmission electron microscopy, thin film X-ray diffractometry, and X-ray photoelectron spectroscopy. Nanoporous structures were formed after anodization with cathodic pretreatments. The titanium hydride is formed by cathodic pretreatments. Titanium hydride was a sacrificial layer on titanium following anodization. The sacrificial layer has a -TiH2 phase. The -TiH2 is a tetragonal nanostructure and its lattice constant is a=3.12 nm. Furthermore, it was formed within titanium matrices during cathodization. The nanostructural -TiH2 decomposes after anodization. Furthermore, the nanoporous Ti formed by dissolution of TiH2 was changed to nanoporous TiO2. The TiH2 plays an important role in forming nanoporous TiO2. The triangle-like -TiH2 was observed on the Ti matrix and grain boundary. In the -Ti matrix, an -Ti -TiH2 transition occurred during cathodization. The anodization with cathodic pretreatment not only produces titanium hydride layer, but also results in formation of nanostructural titanium oxide. Nanoporous titania can be enhanced osseointegration of implant such as orthopedic and dental implants