IR Mapping of Bio-Ceramic Layers on Titanium Substrate

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Modern medicine requires high quality implant materials. Bio-ceramics have revolutionized orthopedic and dental repair of damaged parts of the bone system. Some of biomaterials due to their biocompatibility allow manipulation and adaptation to the shape and dimensions of bone defects.

Titanium and its alloys are widely used in bio-implant applications. The nature of their surfaces can directly influence cellular response, ultimately affecting the rate and quality of new tissue formation. In order to improve titanium implants properties, they are usually covered with various kinds of layers. The bio-inert ceramic materials have attractive properties, such as strength and fracture for medical applications. For example ceramics containing zirconia (ZrO_2) are attractive materials because of chemical durability and ionic conductivity. Consequently, ZrO_2 has various applications in engineering and as biomaterial.

Vibrational spectroscopy has been extensively used for in vitro and in vivo investigations of degradation mechanism and kinetics of different biomedical devices as well as it has been used to characterize the crystalline and amorphous domains in bio-mineralization process. Infrared and Raman spectroscopy methods are valuable tools in the biomaterials engineering allowing the study of the processes occurring during their preparation.

In vitro tests, where the materials immersed in simulated body fluids and/or artificial saliva, have been used to evaluate the biocompatibility of biomaterials. This kind of tests are a wide range of repeatable and reproducible methods, which are regulated by international standards for commercial use and scientific development of new materials and products.

The aim of this work has been to examine zirconia silicate coatings obtained by sol-gel method on titanium and its alloys. The bioactivity of the composite films was studied by immersing the coatings in synthetic body fluids (SBF).

The changes in phase composition of biomaterials were determined by FTIR reflection technique based on focal plane array (FPA) detection system. Raman micro-spectroscopy was used as the complementary measurements. The study of the interaction of components of artificial body fluids with biomaterials being subjected to different environmental conditions by FTIR imaging is shown.

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