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Trans-Reflection SR-FTIR technique applied to biomedical coatings study

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Keywords: synchrotron radiation, biomedical coatings, FTIR

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It is known that coating titanium and related films with ceramics such as hydroxyapatite has been studied for use as body implants. Chemical bonding between the implant and host tissue takes place through the phosphate layer, which is created on the bioactive materials surface when in contact with the body fluids environment.

Synchrotron Radiation Fourier Transform Infrared (SR-FTIR) spectroscopy can yield micro-structural information on the segment level complementary to the morphological information acquired from X-ray scattering and optical as well as electron microscopy.

SR-FTIR method is applied to thin films study on the different substrates. Moreover SR-FTIR microscopy allows to obtain surface and cross section maps in reflection and transmission mode. This leads to visualization of chemical imaging between substrates and films.

More than a few modification have been engaged to coat metal including electrodeposits system (EPD). In our work the films with different addition of nano-hydroxyapatite and nano-silicate were deposited by EPD method on titanium and/or steel.

Analysis of received biomaterials were determined by FTIR trans-reflection technique based on focal plane array (FPA) detection system at Dafne beam line in Frascati. SR-FTIR spectra were collected using Bruker spectrometer with microscope (Hyperion-3000) equipped with MCT and FPA (64x64 pixel) detectors.

The spectra were recorded in the mid IR-range by averaging 256 scans with 4cm^{-1} of resolution. The aperture of 25 x 25 μm was used with MCT detector experiments and in the case of FPA detector the area 170 μm x 170 μm was measured. The spectral data were baseline corrected and calculations the area of the Si-O as well as P-O bands and in the region from 1200 cm^{-1} to 900 cm^{-1} were done which allow us to show chemical imaging of the samples.

Furthermore a scanning electron microscopy (SEM) with X-ray microanalysis was applied to determine morphology and structure of the samples.

Acknowledgments: "The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n.°226716."

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