Electrochemical and biological characterization of hydroxyapatite-coated TiO_2-DLC films

Juliana Milani[1], Natália Marassi Martinelli[1], Maria Julia Galera Ribeiro[1], Ritchelli Ricci[1], Vladimir Jesus Trava-Airoldi[2], Anderson Oliveira Lobo[1], Fernanda Roberta Marciano[1]

[1]Universidade do Vale do Paraíba, [2]Instituto Nacional de Pesquisas Espaciais

e-mail: juliana_mila@hotmail.com

In recent years, with an increase in life expectancy, the prosthesis placement surgeries has increased. In

the search for a complete material, the coating of metal materials by diamond-like carbon films (DLC)

has received considerable attention. Because of its low friction coefficient, chemical inertness, corrosion

resistance and biocompatibility, the incorporation of TiO2 nanoparticles in DLC films aims to improve its

mechanical and chemical properties. This new composite material can be coated with phosphates and

carbonates, which exhibit osseointegration properties and biocompatibility with biological tissue. This

work shows the electrochemical corrosion resistance and biological characterization of hydroxyapatite-

coated DLC and TiO2-DLC films. The films were deposited using plasma enhanced chemical vapor

deposition technique. Titanium dioxide nanoparticles were incorporated into DLC at different

concentrations during the deposition process. Scanning electron microscopy, energy dispersive X-ray, X-

ray diffraction and Raman scattering spectroscopy characterized the samples.

Emphasis was placed on the

investigation of the electrochemical corrosion behavior, which was tested by potentiodynamic method.

This study also characterizes the composites through in vitro assays with L929 cells (fibroblasts) using

MTT and LDH release colorimetric assays and fluorescence microscopy. The electrochemical analysis

indicated hydroxyapatite-coated TiO2-DLC films present superior impedance and polarization resistance

as compared to DLC, which indicate they are promising material against corrosion and ion release and

thereby improve their biocompatibility.