Electroactive Oxide Coatings as Substrates for Neural growth

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New tissue engineering technologies will increasingly rely on interactive biomaterials that can both physically support tissue growth and stimulate specific cell functions. It will be necessary that these materials for neuronal growth applications are able to avoid cytotoxicity as well as having a low inflammation response and good tolerance by using them in implants. In the other hand, it is known that electroactive materials are better electrodes for electrostimulation [1].

In this context, different oxides and hybrids materials have been tested, in the form of thin coatings, i. e. Titanium oxide (TiO_2) and Iridium oxide (IrO_x). Materials have been synthesized and characterized as substrates for cell growth, in the final idea that tunning their surface potential, viability and survival and growth may be favored.

In this work we have grown TiO_2 and IrO_x thin films by sol-gel or electrodeposition techniques respectively [2,3]. Titanium oxide thin films (80 nm thick) were obtained from the partial hydrolysis of titanium isopropoxide and have been deposited by spin coating on soda-lime-glass covered with ITO (mono and three layer depositions). Finally, these samples have been annealed at different temperatures (250, 350 and 450ºC) in order to study the dependence between sample surfaces and cell survival. Also layers of IrOx have been obtained on platinum coated soda-lime-glass substrates by electrochemical deposition from $IrCl_3$-xH_2O aged solutions [4,5], and their electrochemical behavior and suitability as substrates have been investigated.

Material surfaces and biomaterial interfaces are characterized using state-of-the-art technologies including AFM, XPS, Raman spectroscopy, grazing angle XRD, reflectometry-XRD, SEM-EDX and contact angle measurements [6,7]. Neural responses in primary neuron cultures are quantified by using fluorescent tracers and optical microscopy. Studies of neuronal cultures show that the cellular survival depends on the type of surface in samples of TiO_2 and display promising results in the case of films of IrO_x, in a large variety of surfaces. In the case of TiO_2 thin films, the nano-structured surface does not offer a correlation between roughness and cell viability but rather it shows that the surface composition and chemical properties are the most important aspects, directly or involving surface charge changes. Contact angle measurements and therefore hydrophobicity, show no correlation with cell survival.

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