In vitro biocompatibility evaluation of nanostructured polymers

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Implantable Multi-Electrode cortical arrays are key neuronal interfacing systems in neurophysiological and clinical research to better understand healthy and pathological brain dynamics. One of the major challenge is to propose a biocompatible device that remains stable over a long period of time and therefore that minimizes undesirable brain tissue reactions. Several studies indicate that surface structuration can promote neuron adhesion to the implant surface while it could limit glial cell proliferation (Piret et al. [1-4], Cesca et al. [5]). As the major part of the implant in direct contact with the surface of the neural tissue is the insulating material, a method to nanostructure the polymeric surface of the implant was needed. Using plasma etching procedures, it was possible to get reproducible nanostructure topologies of SU-8, polyimide and parylene polymers. The biocompatibility of these different nanostructured polymers was then studied on rat primary cortical cells cultures.

[1] Piret et al "Neurite outgrowth and synaptophysin expression of postnatal CNS neurons on GaP nanowire arrays in long-term retinal cell culture", Biomaterials 34(4), pp. 875-887(2013).
[2] Piret, G and Prinz, CN "Could the use of nanowire structures overcome Some of the current limitations of brain electrode implants?" Nanomedicine11 (7), 745-747(2016)
[3] Piret et al "Support of neuronal growth over glial growth and guidance of optic nerve axons by vertical nanowire arrays" ACS applied materials & interfaces7(34), 18944-18948(2015)
[4] Piret et al "3D-nanostructured boron-doped diamond for microelectrode array neural interfacing" Biomaterials53, 173-183(2015)
[5] Cesca et al "Fabrication of biocompatible free-standing nanopatterned films for primary neuronal cultures" RSC Advances, 4, 45696-45702(2014)