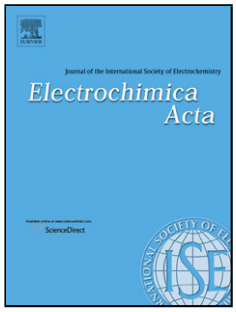

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Electrodeposited Iridium Oxide on Platinum Nanocones for Improving Neural Stimulation Microelectrodes

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Abstract: Microelectrodes for electrical neural stimulation play an important role in various medical and brain science applications, however, the shrinking size of microelectrodes leads to high electrode/tissue interfacial impedance and low charge injection capacity (CIC). In order to achieve safe, efficient and durable electrode performances, we proposed a layer-by-layer electrodeposition method to modify the bare platinum (Pt) microelectrodes. Combining the advantages of platinum gray (Pt gray) with iridium oxide (IrO_x), herein a low impedance and high charge injection IrO_x/Pt gray microelectrode was fabricated with nanoscale roughness. Morphological tests showed that nanocone-shaped Pt gray provided large effective surface area and hence good adhesion for dense IrO_x deposition, which was beneficial for long-term mechanical stability of the composite coating. A typical microelectrode sample with the nanostructured IrO_x/Pt gray coating had a low impedance down to 2.45 $k\Omega \cdot cm^2$ at 1 kHz, and a cathodic charge storage capacity (CSC_c) up to 22.29 $mC \cdot cm^{-2}$, which was about 6, 2.8 and 2.7 times higher than CSC_c of those samples coated with bare Pt, Pt gray and IrO_x, respectively.

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