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Nanostructured platinum grass enables superior impedance reduction for neural microelectrodes

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Abstract

Micro-sized electrodes are essential for highly sensitive communication at the neural interface with superior spatial resolution. However, such small electrodes inevitably suffer from high electrical impedance and thus high levels of thermal noise deteriorating the signal to noise ratio. In order to overcome this problem, a nanostructured Pt-coating was introduced as add-on functionalization for impedance reduction of small electrodes. In comparison to platinum black deposition, all used chemicals in the deposition process are free from cytotoxic components. The grass-like nanostructure was found to reduce the impedance by almost two orders of magnitude compared to untreated samples which was lower than what could be achieved with conventional electrode coatings like IrOx or PEDOT. The realization of the Pt-grass coating is performed via a simple electrochemical process which can be applied to virtually any possible electrode type and accordingly shows potential as a universal impedance reduction strategy. Elution tests revealed non-toxicity of the Pt-grass and the coating was found to exhibit strong adhesion to the metallized substrate.

Keywords:

- Nanostructure
- Electrode
- Platinum
- Neural Prosthesis
- Electrical stimulation
- Interface

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