

PEDOT-CNT Microelectrode Arrays

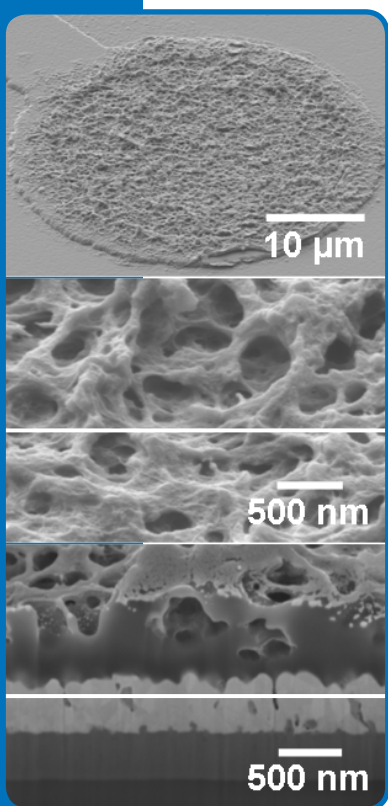
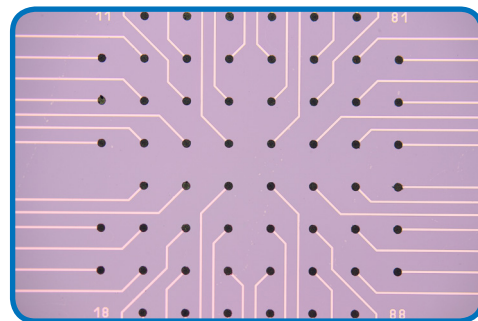
for recording and stimulation

- Reproducible low impedance
- High signal-to-noise ratio
- Excellent biocompatibility and cell adhesion
- Ideal for stimulation

Low impedance microelectrode arrays

The big issue in electrode fabrication is to find a balance between electrode size and impedance. The problem is that a decrease in electrode size results in a higher impedance. However, the goal is to have small-sized electrodes with low impedance. The solution is a composite of carbon nanotubes and PEDOT, which is deposited on the microelectrodes by electropolymerization. Although the electrode area is small (e.g. 30 μm diameter), the surface is increased because of the 3-dimensional structure of the material.

The new PEDOT-CNT microelectrode arrays combine the advantages of both materials: The low impedance, the suitability for stimulation, and the excellent biostability and biocompatibility of PEDOT as well as the mechanical stability and viability and spike activity enhancing properties of carbon nanotubes (CNT).



Gerwig et al. (2012). PEDOT-CNT composite microelectrodes for recording and electrostimulation applications. *Frontiers in Neuroengineering* 5, 1-11.

Advantages of PEDOT-CNT microelectrodes

Reproducible low impedance

As described above, PEDOT-CNT electrodes show lower impedances over the whole frequency range when compared to gold or TiN electrodes ($<20\text{k}\Omega$ @ 1 kHz). Importantly, you can count on the low impedance, as it is reproducible.

Excellent biocompatibility and cell adhesion

Cells cultured on PEDOT-CNT microelectrode arrays showed long viability and functionality as well as high signal amplitudes, indicating very good biocompatibility and cell adhesion.

High signal-to-noise ratio

Because of the low impedance, the noise-level is very low. Together with the very good cell adhesion, the recordings show high signal amplitudes and an excellent signal-to-noise ratio.

Ideal for stimulation

PEDOT-CNT electrodes are very stable and resist even high stimulation pulses. On the other hand, due to high charge injection capacities, you do not need high voltages to stimulate tissue. Moreover, the impedance is not affected by stimulation.

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