Roaa Sait, J Nanomed Nanotechnol 2017, 8:5 (Suppl)
DOI: 10.4172/2157-7439-C1-052

Synthesis and characterization of TiN NWs towards neural electrode application

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In neurophysiological measurements, a neural electrode interface material plays a critical role in eliciting action potentials without damaging the tissue of interest. However, the need to minimize electrode dimensions and reduce invasiveness and the activation of glial cells has rendered the choice of a suitable interface material. Platinum, iridium oxide and gold are currently the most utilized microelectrode material due to their apposite electrical and mechanical properties, however their performance becomes limited when electrode dimensions are reduced; as the total surface area decreases, limitations are placed on the successful transfer of charge or charge injection into the tissue for stimulation. Research on nanostructured surfaces has shown a great potential for improving the electrochemical and mechanical properties. Thin films of titanium nitride (TiN) have been implemented in neural electrode applications previously due to its useful properties e.g., TiN has a higher charge injection (2.2-3.5 mC/cm^2) as compared to that of Pt (0.02-0.15 mC/cm^2). Moreover TiN nanowires (NWs) have not been synthesized previously towards for neural interface application, which is the aim of the work described here. The synthesis involves the low temperature and cost effective hydrothermal growth of Titanium Oxide NWs (TiO_2-NWs) grown, for the first time, from a TiN sputtered layer optimized elsewhere. The growth is followed by a novel nitridation process. The effects of the hydrothermal growth parameters (e.g. seeding layer thickness, time and temperature) on the properties of the TiO_2 nanowires were investigated using Scanning Electron Microscopy (SEM), X-Ray Diffraction (XRD) and Cyclic voltammetry (CV) for morphological, structural and electrochemical studies respectively. Aspect ratio as well as crystalline structure, electrical resistivity and capacitance will be presented and distilled here. The ease and convenience to tune the nanowires properties bring this approach great potential for building an optimum neural electrode interface material.

Recent Publications

1. Sait R and Cross R (2017) Synthesis and characterization of sputtered titanium nitride as a nucleation layer for novel neural electrode coatings. *Applied Surface Science:* 1-19.

References

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Biography

Roaa Sait is currently a PhD student at De Montfort University in the UK. She has been active in the area of material science and nanotechnology. Recently she has published a paper on synthesis and characterization of sputtered TiN as a nucleation layer. Her current research involves the study of neural electrode interface materials for improving recording and stimulation of neurons in the brain. She focuses on controlling the properties titanium nitride nanostructures.

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