Fabrication of cleanroom free, low-cost nanoband electrodes with low zM limits of detection

Vernalyn Abarintos [1]
Gabriel Maroli [1,2], Andrew Piper, [1✉] and Arben Merkoçi. [1✉]
[1]Catalan Institute of Nanoscience and Nanotechnology (ICN2), UAB Campus, 08193 Bellaterra, Barcelona, Spain.
[2]UIDI-CONICET Universidad Tecnológica Nacional - Buenos Aires, Argentina.
Co-corresponding author's emails: arben.merkoci@icn2.cat; andrew.piper@icn2.cat

Nanoscale electrodes have been a topic of intense research for many decades. Their enhanced sensitivities, born out of an improved signal to noise ratio as electrode dimension's decrease, means that they are ideal for the development of low concentration analyte sensors. [1,2] However, to date, nanoelectrode fabrication has typically required expensive equipment and exhaustive, time consuming fabrication methods that has rendered them unsuitable for widespread use and commercialization.[3,4] Herein we report a method of nanoband electrode fabrication using low cost materials and equipment commonly found in research laboratories around the world. The materials cost to produce each nanoband are less than €0.01 and fabrication of a batch takes less than 1 hour. The devices can be made on flexible plastics and their designs can be quickly and easily iterated. Facile methods of combining these nanobands into powerful devices, such as complete 3 electrode systems, have also been displayed. As a proof of concept, the electrodes were functionalized for the detection of a DNA sequence specific to SARS-cov-2019 and found to display low zM limits of detection.

References

[1] Piper, A., Corrigan, D. K. & Mount, A. R. Electrochem. Sci. Adv. n/a, e2100077 (2021).
[2] Silvestrini, M., Fruk, L. & Ugo, P. Biosens. Bioelectron. 40, 265–270 (2013).
[3] Kleps, I., Angelescu, A., Vasilco, R. & Dascalu, D. Biomed. Microdevices 3, 29–33 (2001).
[4] Dickinson, E. J. F. & Compton, R. G. *J. Electroanal. Chem.* 661, 198–212 (2011).

Figures

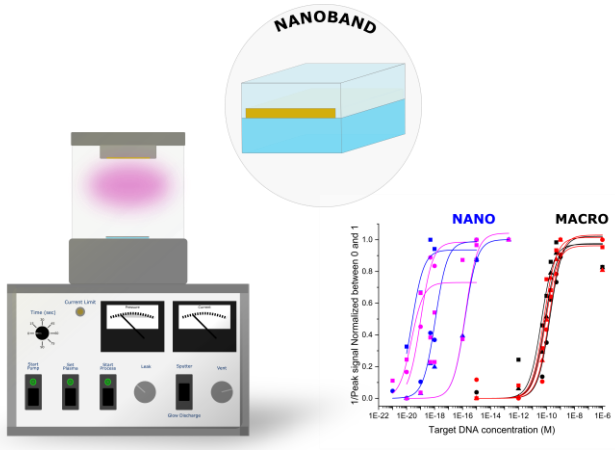

Figure 1: Schematic illustration of a nanoband electrode and calibration curves from the macro and nano electrode for DNA sensing