

Technical University of Denmark



Ultrasensitive 3D Carbon Microelectrodes for Electrochemical Biosensing Application

Hemanth, Suhith; Halder, Arnab; Caviglia, Claudia; Chi, Qijin; Keller, Stephan Sylvest

Publication date:
2017

Document Version
Peer reviewed version

[Link back to DTU Orbit](#)

Citation (APA):

Hemanth, S., Halder, A., Caviglia, C., Chi, Q., & Keller, S. S. (2017). Ultrasensitive 3D Carbon Microelectrodes for Electrochemical Biosensing Application. Abstract from 8th International Conference on Advanced Materials and Nanotechnology, Queenstown, New Zealand.

DTU Library

Technical Information Center of Denmark

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Ultrasensitive 3D Carbon Microelectrodes for Electrochemical Biosensing Application

S. Hemanth^{1*}, A. Halder², C. Caviglia¹, Q. Chi² and S.S. Keller¹

¹DTU Nanotech, ²DTU Chemistry,
Technical University of Denmark, 2800 Kongens Lyngby, Denmark
suhem@nanotech.dtu.dk

This work represents the fabrication and electrochemical characterization of 2D and multi-layered three-dimensional (3D) pyrolytic carbon microelectrodes and their further application in electrochemical biosensing.

Carbon materials have several attractive properties such as wide electrochemical potential window, biocompatibility and ease of functionalization, makes it an ideal material for microelectrodes used as biosensor, scaffolds or energy storage devices [1, 2]. However, device sensitivity and biological signals from 2D electrodes are limited due to the low surface area from 2D nature of the electrode. Towards this a 3D carbon microelectrode is fabricated and transferred on the working electrode of an electrochemical cell using UV photolithography technique followed by pyrolysis [3]. The feature size as small as 5 μ m is fabricated which is comparable to cell dimensions. The 3D electrodes had higher sensitivity (2 folds higher) than 2D electrodes in standard 10mM ferri/ferrocyanide redox probe. For a proof of concept study, we have tried to combine this electrode with some based material and further used for electrochemical biosensing application. Electrochemical biosensing response showed that these kinds of electrodes can be used for the development of ultrasensitive low cost biosensors.

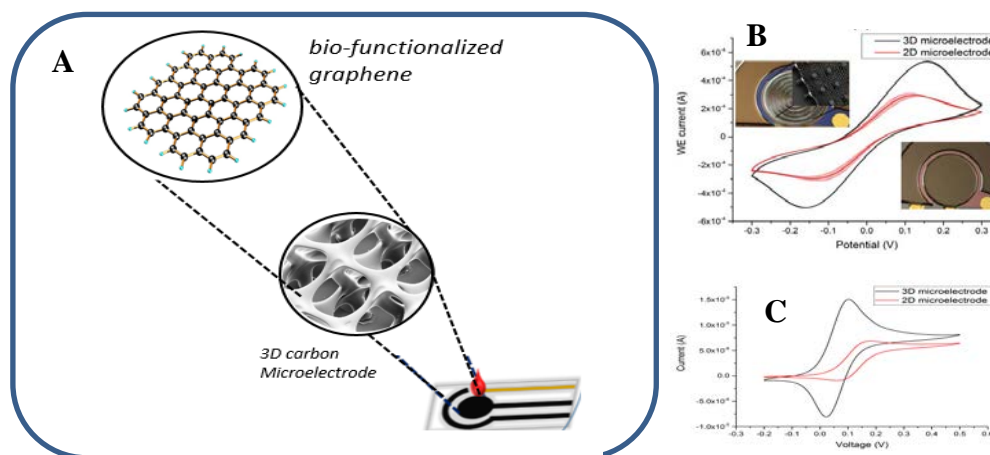


Figure 1: A. Schematic diagram of 3D carbon electrochemical bio-sensing device. B and C shows the higher sensitivity of 3D microelectrode in 10mM ferri/ferrocyanide and 1mM Glucose respectively.

References

- [1] McCreery RL. Chem Rev.108(7):2646–87 (2008).
- [2] Amato L, et al. Adv Funct Mater. 24(44):7042–52 (2014).
- [3] Lim Y, Heo J-I, Shin H. Sensors Actuators B Chem.192(2014):796–803