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Optimized SU-8 pyrolysis for fabrication of pyrolytic carbon microelectrodes

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This work focuses on the fabrication of two dimensional (2D) pyrolytic carbon microelectrodes obtained from a lithographic process using the negative epoxy photosensitive SU-8. The pyrolysis process at high temperature (1100°C) in N\(_2\) atmosphere has been optimized in order to decrease the resistivity of the resulting carbon material and improve the performance in cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS).

Pyrolytic carbon is obtained by heat treatment of organic polymers in inert atmosphere and has a microstructure which is similar to glassy carbon, composed of both graphitic and amorphous regions. The carbon microelectromechanical systems (C-MEMS) technique is a simple and high-yield process which typically consists in the heat treatment of a patterned photoresist at 900°C in inert atmosphere [1]. This process enables the reproducible fabrication of 2D and 3D pyrolytic carbon microelectrodes with tailored designs and sensitivities for specific applications such as heavy metal detection, biosensing or cell fate monitoring [2-4]. Changing the pyrolysis conditions modifies the graphitic content of the carbon material and leads to different material properties which determine the electrical and electrochemical behaviour of the final carbon microelectrode [2]. It has been reported that the electrical and electrochemical properties of pyrolytic carbon improve with increasing final pyrolysis temperature [1, 2].

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References: