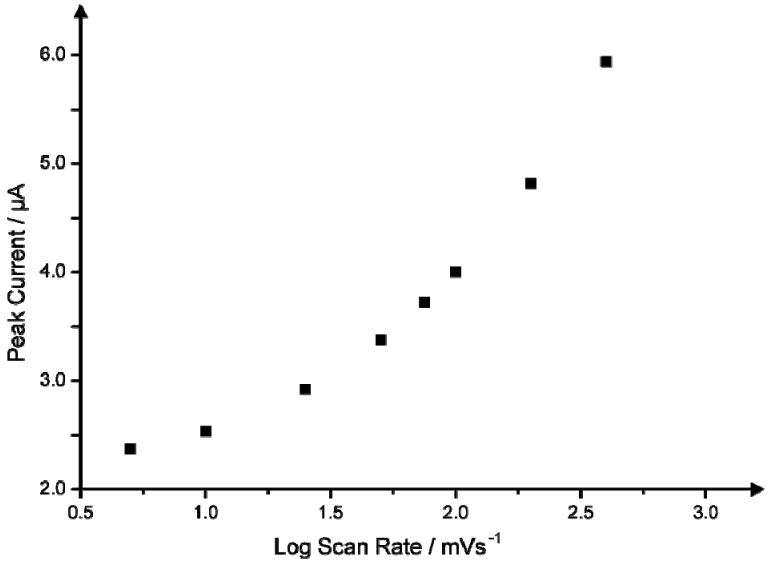
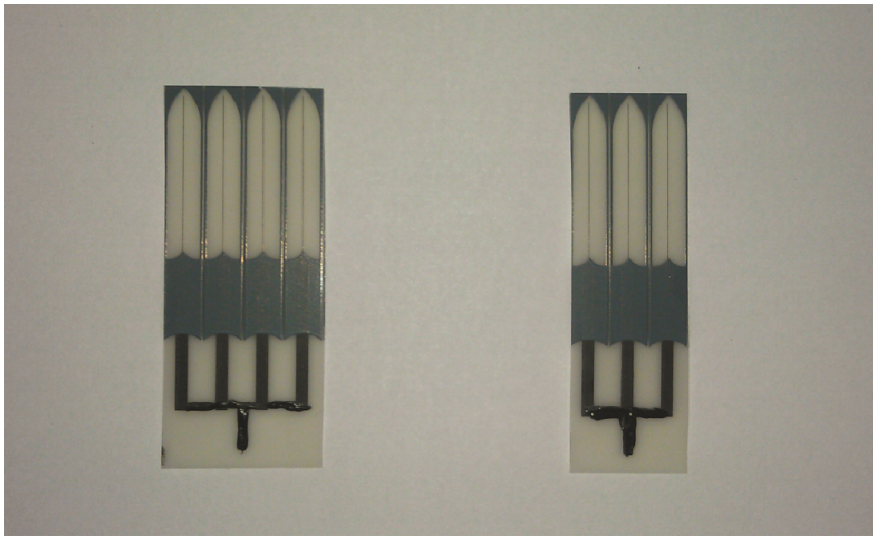
Electronic Supplementary Material (ESI) for Analyst

Electronic Supporting Information (ESI)

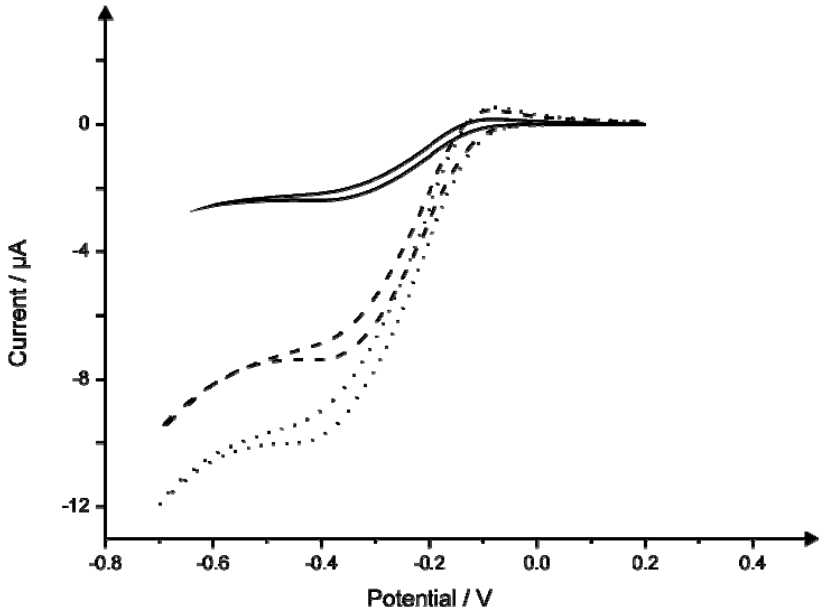
Fabrication of Co-Planar Screen Printed Microband Electrodes; Jonathan P. Metters, Rashid O. Kadara and Craig E. Banks*



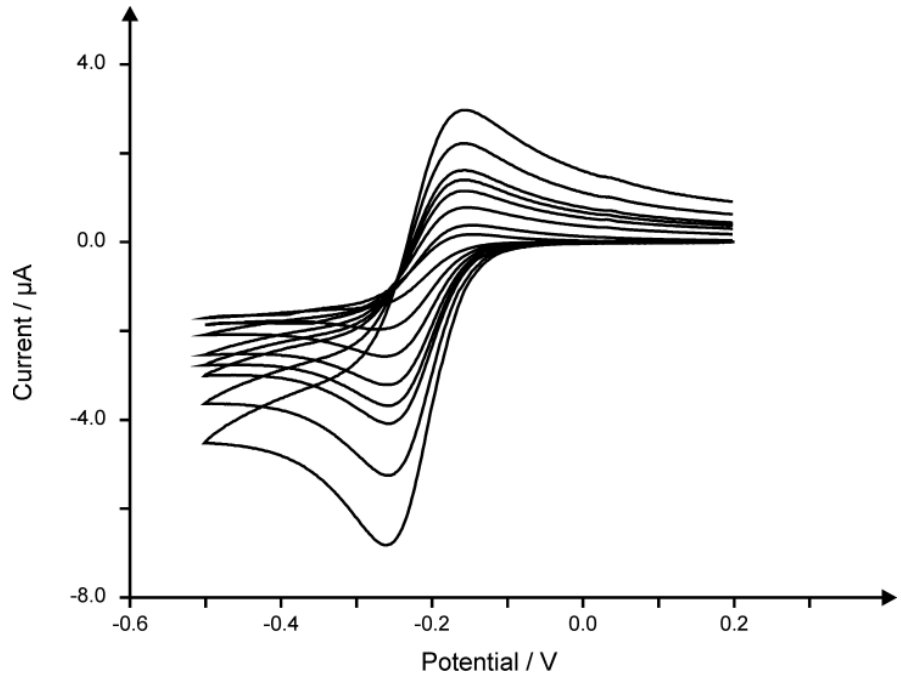
ESI Fig 1. Dependence of the peak current on the voltammetric scan rate obtained in 1 mM hexaammine-ruthenium (III) chloride / 0.1 M KCl using the graphite-bSPE.



ESI Fig. 2 Image of the graphite-bSPE arrays, left $N = 3$ and right $N = 4$.



ESI Fig. 3 Typical cyclic voltammetric traces obtained in 1 mM hexaammine-ruthenium (III) chloride / 0.1 M KCl) using the graphite-bSPE (solid line) and at arrays of graphite-bSPE; $N = 3$ (dashed line) and $N = 4$ (dotted line). Scan rate: 5 mVs^{-1}



ESI Fig. 4 Typical cyclic voltammetric responses observed through scan rate studies (5 – 200 mVs^{-1}) using the gold-bSPE at 1 mM hexaammine-ruthenium (III) chloride in 0.1 M KCl.

Calculation of diffusion interaction between neighbouring microband electrode comprising the array presented in ESI figure 2:

It is inferred that the diffusion layer is given (in 3D) by:

$$\delta = \sqrt{6D\left(\frac{\Delta E}{\nu}\right)} \quad (1)$$

If we consider the graphite-bSPE arrays shown in ESI figure 2, there should be no diffusion layer interaction between neighbouring microbands such that the diffusion layer, δ, must be less than $f_{greater}$, as given by:

$$f_{greater} = \left(\frac{d_{centre}}{2}\right) - \left(\frac{d_{electrode}}{2}\right) \quad (2)$$

where d_{centre} is the centre-to-centre separation between the electrodes and $d_{electrode}$ is the diameter D is the diffusion coefficient, υ the voltammetric scan rate employed and ΔE is the potential range over which electrolysis has occurred. When a single array comprising three graphite-bSPE is utilised, $N = 3$ while when four graphite-bSPE is used, $N = 4$, the diffusion layer, δ, can be estimated over the range of experimentally utilised scan rates which spans between 112.7 and 567.5 µm for the fastest (200 mVs^{-1}) and slowest (5 mVs^{-1}) applied voltammetric scan rates respectively for the three electrode graphite-bSPE array and between 120.2 and 622.6 µm for the four electrode graphite-bSPE array. Using equation (2) $f_{greater}$ was deduced for our graphite-bSPE to equate to 2475 µm. Thus given that the diffusion layer will reach a maximum of 509.1 µm at the slowest applied voltammetric scan rate (for $N = 4$), the graphite-bSPE has no diffusional interaction/overlapping diffusion layers between the electrodes comprising the array.