

## ADSORPTION AND REDOX PROCESSES AT CARBON NANOFIBER ELECTRODES GROWN ONTO A CERAMIC FIBER BACKBONE

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The adsorption of aromatic compounds onto activated carbons and carbon nanofibers is of considerable technical importance and beneficial in electroanalytical procedures. Here, effects due to the strong adsorption of hydroquinone, benzoquinone, and phenol onto carbon nanofiber electrodes [1] immersed in aqueous media are reported [2].

Carbon nanofiber materials (fiber diameter approximately 100 nm) are grown onto ceramic fiber substrates by employing an ambient pressure chemical vapour deposition process. The resulting composite electrode material is sufficiently electrically conducting due to the high carbon content and mechanically robust due to the ceramic backbone. It is shown that the voltammetric signal obtained for the one electron reduction of  $\text{Ru}(\text{NH}_3)_6^{3+}$  is dominated by solution trapped in the three dimensional electrode structure. In contrast, for the hydroquinone/benzoquinone redox system in aqueous phosphate buffer (pH 7) strong adsorption onto the carbon nanofiber material is observed. Finally, in the presence of high concentrations of phenol in the aqueous solution phase the formation of multi-electron oxidation products related to benzoquinone is observed. The change in pathway for the oxidation process is attributed to (i) the high surface area of the carbon nanofiber electrode and (ii) the adsorption of intermediates.

### References

- [1] F. Marken, M.L. Gerrard, I.M. Mellor, R.J. Mortimer, C. Madden, S. Fletcher, K. Holt, J.S. Foord, R.H. Dahm, F. Page, *Electrochem. Commun.* 3 (2001) 177.
- [2] M.A. Murphy, G.D. Wilcox, R.H. Dahm, F. Marken, *Electrochem Commun.* in print.

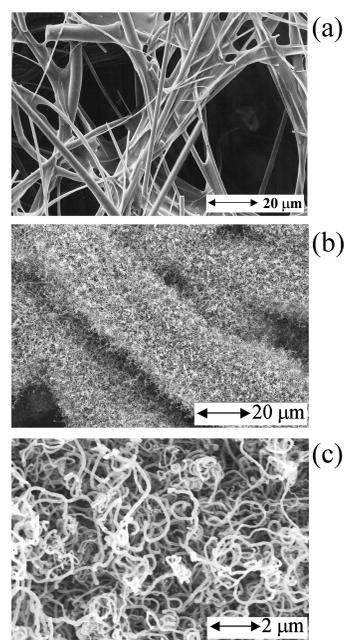


Fig. 1. FEGSEM images of (a) a ceramic paper substrate, (b) carbon nanofibers, and (c) carbon nanofibers at higher magnification.

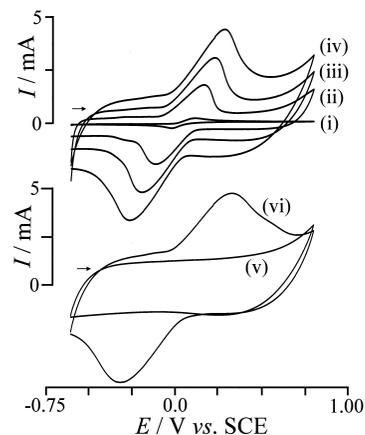


Fig. 2. Cyclic voltammograms for the oxidation of 5 mM hydroquinone in 1.0 M phosphate buffer (pH 7) obtained (i) at a 3 mm diameter glassy carbon electrode and (ii-iv) at a 7 mm diameter carbon nanofiber electrode (different scan rates) and cyclic voltammograms for the background current obtained in 1.0 M phosphate buffer (pH 7) (v) before and (vi) after immersion in a solution containing 5 mM hydroquinone and 1.0 M phosphate buffer (pH 7).