PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A MATHEMATICAL, PHYSICAL & ENGINEERING SCIENCES

# The Use of Redox Mediator Modified Glucose Oxidase in Amperometric Enzyme Electrodes

P. N. Bartlett and V. Q. Bradford

*Phil. Trans. R. Soc. Lond. A* 1990 **333**, 165
doi: 10.1098/rsta.1990.0152

## The use of redox mediator modified glucose oxidase in amperometric enzyme electrodes

By P. N. Bartlett and V. Q. Bradford
*Department of Chemistry, University of Warwick, Coventry CV4 7AL, U.K.*

Glucose oxidase, modified by the covalent attachment of ferrocenyl groups, has been shown to undergo direct oxidation at clean metal electrodes (Degani & Heller 1987, 1988; Bartlett *et al.* 1987). Since modified enzymes of this type do not require a freely diffusing mediator and can be oxidized at modest overpotentials they are attractive for application in biosensors and in bioelectronics.

The use of ferrocene monocarboxylic acid and ferrocene acetic acid modified glucose oxidase has been studied in membrane enzyme electrodes for glucose. It was found that the lifetime of these devices is limited by the stability of the oxidized form of the ferrocenyl substituent attached to the enzyme. In buffered aqueous solution this is of the order of minutes for the ferrocene monocarboxylic acid modified enzyme and of the order of hours for the ferrocene acetic acid modified material.

We have also studied the modification of glucose oxidase using tetrathiafulvalene (TTF) and tetracyanoquinodimethane (TCNQ). It is known that electrodes made from TTF.TCNQ carry out the oxidation of unmodified flavoproteins (Albery *et al.* 1987*a*); however, the mechanism remains controversial (Albery *et al.* 1987*b*; Kulys 1986). We reasoned that planar hydrophobic molecules, such as TTF and TCNQ, might be incorporated into the hydrophobic regions of the protein. Our results suggest that this is indeed the case, and we have shown that glucose oxidase, modified with TTF or TCNQ, undergoes oxidation at metallic electrodes.

### References

Albery, W. J., Bartlett, P. N., Bycroft, M., Craston, D. H. & Driscoll, B. J. 1987*a* *J. Electroanal. Chem.* **218**, 119.

Albery, W. J., Bartlett, P. N. & Cass, A. E. G. 1987*b* *Phil. Trans. R. Soc. Lond.* B**316**, 107.

Bartlett, P. N., Whitaker, R. G., Green, M. J. & Frew, J. 1987 *J. chem. Soc. chem. Commun.* 1603.

Degani, Y. & Heller, A. 1987 *J. Phys. Chem.* **91**, 1285.

Degani, Y. & Heller, A. 1988 *J. Am. chem. Soc.* **110** 2615.

Kulys, J. J. 1986 *Biosensors* **2**, 3.

## Thermal lens spectrometry

By R. D. Snook
*DIAS, UMIST, PO Box 88, Manchester M60 1QD, U.K.*

Thermal lens spectrometry is a laser-based technique that can be used for extremely sensitive spectrophotometric analysis in nanolitre volumes of solutions.

In thermal lens spectrometry (Jun Shen & Snook 1989*a*) a laser is used to excite chromophores in solution. Non-radiative decay routes of the excited chromophore