Electrochemical biosensor for glucose detection using zinc oxide nanotetrapods

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Abstract: Wurtzite structural zinc oxide (ZnO) nanotetrapods were synthesised by a thermal evaporation method. These ZnO nanotetrapods were used for the construction of an electrochemical biosensor for detecting glucose. In the biosensor, the ZnO nanotetrapods acted as supporting materials for glucose oxidase (GO_x) enzyme loading because of the large surface area to volume ratio. The results indicated that the biosensor with the structure of [polystyrene mixed with ZnO powder/GO_x/ZnO nanotetrapod powder/Au electrode] exhibited the lowest glucose detection limit (?0.5 mM). These results demonstrate that zinc oxide nanostructures have potential applications in biosensors. Copyright ?? 2011 Inderscience Enterprises Ltd.

Author Keywords: Biosensor; Glucose; Nanotetrapods; Zinc oxide

Year: 2011

Source title: International Journal of Nanotechnology

Volume: 8

Issue: 5-Mar

Page : 300-311

Link: Scorpus Link

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ISSN: 14757435

DOI: 10.1504/IJNT.2011.038207

Language of Original Document: English

Abbreviated Source Title: International Journal of Nanotechnology

Document Type: Article

Source: Scopus

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References:

1. Thevenot, D.R., Toth, K., Durst, R.A., Wilson, G.S., Electrochemical biosensors: Recommended definitions and classification (1999) Pure Appl. Chem., 71, pp. 2333-2348
2. Yoshimura, K., Hozumi, K., Response characteristics of a glucose electrode with a sensing membrane prepared by plasma polymerization (1996) Microchem. J., 53 (4), pp. 404-412
3. Keay, R.W., McNeil, C.J., Separation-free electrochemical immunosensor for rapid determination of atrazine (1998) Biosen. Bioelectron., 13 (9), pp. 963-970
4. Battaglini, F., Bartlett, P.N., Wang, J.H., Covalent attachment of osmium complexes to glucose oxidase and the application of resulting modified enzyme in an enzyme switch responsive to glucose (2000) Anal. Chem., 72 (3), pp. 502-509
5. Burmeister, J.J., Gerhardt, G.A., Self-referencing ceramic-based multisite microelectrodes for the detection and elimination of interferences from the measurement of L-glutamate and other analytes (2001) Anal. Chem., 73 (5), pp. 1037-1042
6. Kulys, J.L., Tetianec, L., Schneider, P., Recombinant microdochium nivale carbohydrate oxidase and its application in an amperometric glucose sensor (2001) Biosen. Bioelectron., 16 (4-5), pp. 319-324
7. Murthy, A.S.N., Sharma, J., Glucose oxidase bound to self-assembled monolayers of bis(4-pyridyl) disulfide at a gold electrode
8. Amperometric determination of glucose (1998) Anal. Chim. Acta, 363 (2-3), pp. 215-220
9. Glezer, V., Lev, O., Sol-gel vanadium pentaoxide glucose biosensor (1993) J. Am. Chem. Soc., 115 (6), pp. 2533-2534
10. Zhang, F.F., Wang, X.L., Ai, S.Y., Immobilization of uricase on ZnO nanorods for a reagentless uric acid biosensor (2004) Anal. Chim. Acta, 519 (2), pp. 155-160
11. Teng, X.M., Fan, H.T., Pan, S.S., Ye, C., Li, G.H., Photoluminescence of ZnO thin films on Si substrate with and without ITO buffer layer (2006) J. Phys. D: Appl. Phys., 39, pp. 471-476
12. Xia, Y., Yang, P., Sun, Y., Wu, Y., Mayers, B., Gates, B., Yin, Y., Yan, H., One-dimensional nanostructures: Synthesis, characterization and application (2003) Adv. Mater., 15 (5), pp. 353-389
13. Wang, Z.L., Zinc oxide nanostructures: Growth, properties and applications (2004) J. Phys.: Condens. Matter, 16, pp. R829-R858
14. Yi, G.-C., Wang, C., Park, W.I., ZnO nanorods: Synthesis, characterization and applications (2005) Semicond. Sci. Technol., 20, pp. S22-S34
15. Kosmulski, M., (2001) Chemical Properties of Material Surfaces, , Marcel Dekker, New York, Basel
16. Liu, Z.M., Liu, Y.L., Yang, H.F., Yang, Y., Shen, G.L., Yu, R.Q., A mediator-free tyrosinase biosensor based on ZnO sol-gel matrix (2005) Electroanalysis, 17 (12), pp. 1065-1070
17. Wang, J.X., Sun, X.W., Wei, A., Lei, Y., Cai, X.P., Li, C.M., Dong, Z.L., Zinc oxide nanocomb biosensor for glucose detection (2006) Appl. Phys. Lett., 88, p. 233106
18. Sun, X.W., Wang, J.X., Wei, A., Zinc oxide nanostructured biosensor for glucose detection (2008) J. Mater. Sci. Technol., 24 (4), pp. 649-656