Sensors and Materials, Vol. 20, No. 6 (2008) 289–298
MYU Tokyo

S & M 0726

Optimization of Carbon Nanotube Layer Formation on Plasma-Polymerized Thin Film for Enzyme Biosensor

Yasunori Matsui, Masahiro Yoshizawa,
Tatsuya Hoshino and Hitoshi Muguruma*

Department of Electronic Engineering, Shibaura Institute of Technology,
3-7-5 Toyosu, Koto-ku, Tokyo 135-8548, Japan

(Received April 7, 2008; accepted September 5, 2008)

Key words: amperometric biosensor, glucose oxidase, plasma-polymerized film, carbon nanotube

An electrochemical biosensor based on a carbon nanotube (CNT) layer with glucose oxidase (GO*x*) enzyme sandwiched between 6-nm-thick acetonitrile plasma-polymerized films (PPFs) was fabricated. The lower PPF was deposited onto a sputtered gold electrode. The optimization of the casting formation of the CNT layer onto the lower PPF is addressed. As a result, the best candidate for the casting solution was a 1:1 mixture of phosphate buffer and ethanol, and the optimized CNT concentration was 7.5 mg ml^{-1}. The optimized glucose biosensor characteristics exhibited ultrasensitivity (a sensitivity of 11 μA mM^{-1} cm^{-2} (4.9–19 mM), a detection limit of 6.2 μM at S/N = 3, +0.8 V vs Ag/AgCl), and a rapid response (< 4 s to reach 95% of maximum response). This high performance is attributed to the excellent electrocatalytic activity and enhancement of electron transfer that CNTs provide, and because the PPF and/or plasma process for CNTs are an enzyme-friendly platform.

*Corresponding author: e-mail: muguruma@sic.shibaura-it.ac.jp