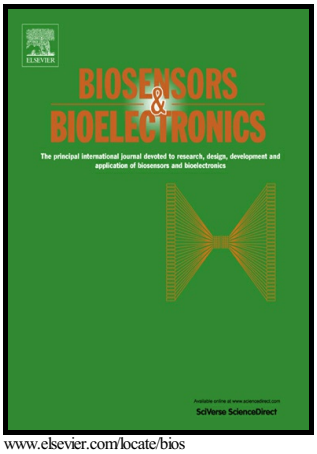

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3D Interdigitated Electrode Array in the Microchannel Free of Reference and Counter Electrodes

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Abstract

We demonstrate the three-dimensional (3D) interdigitated array (IDA) chip that operates without reference and counter electrodes, which are necessary components to apply enough potential to trigger the intended redox process, but used unwieldy for chip-based electrochemical detection. Using the electrode configuration, we propose a unique electrochemical system that is capable of controlling applied potential to a pair of working electrodes despite absence of reference and counter electrodes by fixing the electron transfer mediator on the electrodes in a microchannel. The electrochemical potential of the 2-electrode (2E) system is defined by the potential of the electron transfer mediator, poly(methylene green) (PMG), immobilized with poly(dopamine) (PDA) on the ITO surface by electropolymerization. The 3D IDA chip in the 2E system successfully acts as an electrochemical immunosensing platform. Creatine Kinase-MB in human serum was measured down to ~ pg / mL level. Therefore, the 3D IDA in the 2E system constitutes a simple and scalable platform that needs only nL level of sample volume for sensitive electrochemical detection in miniaturized multiplex immunoassay field.

Keywords: Electrochemical immunoassay, Reference electrode-free system, Two-electrode system, 3D IDA, Microfluidics, Redox cycling

1. Introduction

Electrochemical signal tranceducing methods for biosensors are a suitable option due to cost-effective analysis using miniaturized devices among other methods such as fluorescence, luminescenece, surface plasmon resonance or mass spectrometry which require large and/or