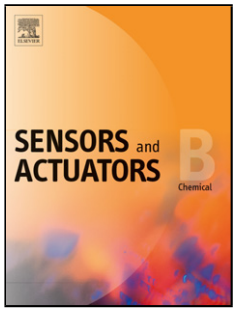

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Alkaline Phosphatase Detection using Electrochemical Impedance of Anti-Alkaline Phosphatase Antibody (Ab354) Functionalized Silicon-Nanowire-Forest in Phosphate Buffer Solution

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Highlights:

- This study presents an electrochemical method for Alkaline Phosphatase (ALP) detection based on anti-ALP functionalized Si nanowire (NW) platform
- The ability to sense between different concentrations of ALP has been demonstrated
- To the best of our knowledge, detection limit of 1nM is one of the lowest demonstrated by electrochemical methods and the lowest one demonstrated by electrochemical impedance spectroscopy.
- Control and specificity measurements proves that blocking is exist, and excellent specificity was achieved
- Highly reproducibility of the system was achieved

Abstract

This article presents an electrochemical impedance study on the detection of Alkaline Phosphatase (ALP) in phosphate buffer saline (PBS) solution by using anti-ALP functionalized Si nanowires (SiNWs). Electrochemical impedance was measured using a three-electrode cell where the working electrode was a very dense and highly disordered array of Si NWs, e.g. SiNW-forest. This array was grown using plasma enhanced chemical vapor deposition (PECVD) at 350°C. The NW surface was modified by immobilizing the anti-ALP. A very efficient detection of very low ALP concentrations in PBS solution, ranging from 0.03 U/L to 0.3 U/L (1nM – 10nM respectively), as well as a high selectivity due to the antibody/antigen interaction were demonstrated. The remarkable sensitivity and selectivity achieved through the combination of SiNW-forest combined electrochemical impedance spectroscopy suggest an effective strategy for real time and quantitative sensing of ALP.