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Ion-selective electrode biochip for applications in a liquid environment

(Conference Paper)

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Abstract

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Physiological sensing conducted in a liquid environment requires electrodes with long lifetime. The development of a robust ion-selective electrode-based biochip in a lab-on-a-chip platform is described. To compare electrode lifetime, which is driven by the transducer layer, electrochemical measurements were performed in a custom-made flow-cell chamber. The results of potentiometric measurement of cationic analytes demonstrate the electrodes to have a near-Nernstian slope profile even after they are stored for almost a month in liquid medium. The electrodes also achieved H₂O₂ amperometric sensitivity (1.25 and 3.32 $\mu\text{A}\text{mM}^{-1}\text{cm}^{-2}$ for PEDOT:PSS and PEDOT:CaSO₄ respectively) and lower detection limit (2.21 μM , 8.4 μM , 3.44 μM , for H⁺, NH₄⁺, Ca²⁺ respectively) comparable to that of wire-type electrodes. Furthermore, the lifetime is dependent on the electrodeposition method of the conductive polymer, and the transducer layer must be modified to fit the analyte types. These results indicate that extended lifetime of microfabricated ion-selective electrodes in a multiplex format can be realized by optimizing the microfabricated electrode surface functionalization. © International Federation for Medical and Biological Engineering 2016.

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