Design and Fabrication of Electrochemical Sensors for Brain-Computer Interfaces and Sweat Analysis

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Flexible and wearable sensors have recently found wide applications in health monitoring and human-machine interaction. Desirable features in wearable sensors are high sensitivity and multi-targets detection capability in non-invasive manners. The sensitivity and multi-analyte detection capabilities are a function of the sensing material and sensor structures. Herein, we utilize a single-layer microgels structure integrated into a wearable capacitive sensor to realize both high sensitivity and multi-targets detections. We established a responsive sensing chain of analytes-the conformational changes of polymer chains-the morphology changes of the single-layer microgels structure-device capacitive signals. The conformational changes of microgel polymer chains due to physiological signals and metabolites in body fluids induce measurable capacitive signals generated by the sensors. This work provides mechanistic insight into a stimuli-responsive chain of analytes induced molecular conformation and thus morphology changes that induce the capacitive signal in the wearable sensors. This multipurpose sensor platform demonstrates the ability to detect bacteria such as E. coli and B. subitilis, metabolites such as uric acid in sweat, and physiological signals such as sound recognition, respiration, and pulse beat.

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