

On-Skin Electrodes based on Silk Fibroin for Ambulatory Electrophysiological Monitoring under Sweaty Condition

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Abstract:

The conformal fabrication of on-skin electrodes enhances the perception and interaction of ambulatory electrophysiological signals for early diagnosis of heart disease and neural dynamics. However, current on-skin electrodes have a poor conformal property under sweaty condition, which gives rise to unreliable ambulatory electrophysiological signals upon sweating. Herein, we fabricated highly conformal all-polymer (CAP) electrodes, made of an ionically crosslinked silk fibroin (SF) gel and stretchable conducting polypyrrole (PPy), which accommodate the large deformation of wet skin for ambulatory electrophysiological sensing upon sweating. The interlocking structure between PPy and SF layer endows on-skin electrode with highly conformal property through making rigid PPy film to be stretchable. SF gel provides a relatively low dynamic modulus on wet surface, leading to the highly conformal property of on-skin electrodes under sweaty condition. Our strategy will provide potential opportunities and applications for continuous health-monitoring, intelligent self-diagnostics system of diseases, and smart human-machine interfaces under extreme condition.