Abstract

Although increasing efforts have been devoted to the development of non-invasive wearable or stretchable electrochemical sweat sensors for monitoring physiological and metabolic information, most of them still suffer from poor stability and specificity over time and fluctuating temperatures. This study reports the design and fabrication of a long-term stable and highly sensitive flexible electrochemical sensor based on nanocomposite-modified porous graphene by simple and facile laser treatment for detecting biomarkers such as glucose in sweat. The laser-reduced and patterned stable conductive nanocomposite on the porous graphene electrode provides the resulting glucose sensor with an excellent sensitivity of 1317.69 $\mu AmM^{-1}cm^{-2}$ with an ultra-low limit of detection (LOD) of 0.079 μm. The sensor can also detect pH and exhibit extraordinary stability to maintain more than 91% sensitivity over 21 days in ambient conditions. Taken together with a temperature sensor based on the same material system, the dual glucose and pH sensor integrated with a flexible microfluidic sweat sampling network further results in accurate continuous on-body glucose detection calibrated by the simultaneously measured pH and temperature. The low-cost, highly sensitive, and long-term stable platform could facilitate and pave the way for the early identification and continuous monitoring of different biomarkers for non-invasive disease diagnosis and treatment evaluation.