A wearable sensor platform for sweat analysis

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Abstract

The increasing popularity of sports practice is rising the demand of smart wearable devices to track athlete performance and conditions during training and competition. In case of professionals, real time data concerning sweat composition and muscle fatigue may help coaches to take decisions based on facts rather than guess work and sport clubs to predict outcomes and minimize risks of injury. In addition, wearable sensors represent a possible solution for an enormous number of sports enthusiasts practicing in unsupervised self-training sessions who may be interested to monitor performances with minimal invasiveness and impediment. Here we show a voltammetric sensor platform exploiting laser induced graphene (LIG) electrodes fabricated on a Kapton® foil combined with a paper-based sampler for sweat analysis. LIG electrodes were fabricated using a CO_2 laser on a Kapton foil, and the conductive tracks were protected by an additional kapton layer. The device was used for the analysis for pH, resistance, uric acid, and tyrosine. While tyrosine and uric acid are naturally electroactive, sensor sensitivity to pH was obtained by drop-casting 1 µL of an aqueous solution containing an indoaniline derivative (4-((4-aminophenyl)imino)-2,6-dimethoxycyclohexa-2,5dien-1-one) [1]. A silver/silver chloride reference electrode was integrated in the device by electrodepositing silver on LIG from a silver nitrate solution thanks to the application of a negative voltage (-2 V) and a subsequent treatment with sodium hypochlorite. The reference electrode was finally coated with a Nafion® layer to prevent degradation. The device was calibrated using square wave voltammetry as transduction technique. The reported fabrication technique could be used to develop cheap and conformable pH sensors and may represent an improvement towards wearable sensor systems for personalized healthcare.

References

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