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Abstract

Multisensing Wearable Technology for Sweat Biomonitoring †

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Abstract: This work describes a multisensing wearable platform for monitoring biomarkers in sweat during the practice of exercise. Five electrochemical sensors for pH, potassium, sodium, chloride, and lactate are implemented in a flexible patch approach together with a paper microfluidic component to continuously measured sweat composition. The sensors are fabricated with silicon technologies: Ion Selective field effect transistors (ISFETs) for pH and ionic species and a gold thin-film microelectrode for lactate. The latter includes a polymeric membrane based on an electropolymerized polypyrroled structure where all the biocomponents required for carrying out the lactate analyses are entrapped. The flexible patch is fabricated using hybrid integration technologies that includes printed pads defined on a polyimide (Kapton®) substrate and wire bonding encapsulation of silicon chips. To fix and align the sensors to the flexible substrate, different laminated materials like polymethyl methacrylate (PMMA), polydimethylsiloxane (PDMS) and silicone-based adhesive are used. First results show the good performance of the sensors – ISFETS sensitivity between 54–59 mV dec^{-1} for ion ranges in sweat (from 2 to 100 mM) and lactate sensor' sensitivity of (−135 × 102 μA M^{-1} cm^{-2} for the range of 2–50 mM). The microfluidic platform has been tested in terms of adequate sensor wettability and rapid response during the time span of exercise activity (2h) showing excellent results.

Keywords: wearables; sweat; biomarkers; multisensors, paper microfluidics