

Towards wearable pH sensors for the analysis of biofluids

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Abstract

The design of wearable chemical sensors plays a key role towards the development of Internet of Things technologies and personalised medicine, where real-time and non-invasive monitoring of biological parameters could dramatically impact on the quality of life. At the same time, essential sensor requirements such as conformability, robustness and simple architecture [1] are also shading light on the limited applicability of conventional electrochemical sensors. On one hand, alternative sensing architectures based on organic electrochemical transistors (OECTs) have been showed to interface the biological domain providing intrinsic signal amplification, ease of miniaturisation and sensing capabilities without the need of a freestanding reference electrode. On the other hand, the design of novel electrochemical transducers allows to develop selective sensing devices and to realise innovative architectures that well adapt to flexible substrates and textiles. In this contribution, we report a material-based approach for the development of wearable pH sensors based on the organic semiconductor poly(3,4-ethylenedioxythiophene) (PEDOT) doped with the pH dye Bromothymol Blue (BTB). Upon functionalisation of the gate electrode of the transistor with PEDOT:BTB, a flexible OECT-based pH sensor was realised on a plastic foil for the non-invasive monitoring of sweat pH [2]. Furthermore, a simpler, electrochemically gated device was designed with a chemiresistor-like geometry, leading to facile integration into clothes or other real-life objects. The versatility and robustness of the two-terminal pH sensor architecture were demonstrated with the realisation of pH sensing textile yarns [3] and smart bioceramic fabrics [4] for real-time monitoring of body fluids.

Biography:

Federica Mariani earned her PhD in Chemistry in 2020 (University of Bologna) and she is currently a post-doctoral research fellow at the Department of Industrial Chemistry, University of Bologna (Italy). In 2016 she spent a research stay at the Department of Bioelectronics (Ecole Nationale Supérieure des Mines de Saint-Etienne - France) in the group of Prof. R. M. Owens and in 2018 she worked as visiting researcher in the group of Analytical Chemistry - Electroanalysis and Sensors of Prof. W. Schuhmann (Ruhr-Universität-Bochum - Germany). Her main research interests concern the development of electrochemical interfaces for bioelectronic applications and wearable devices.

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