Wearable textile platform for selective sensing in healthcare

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Nowadays, the ubiquity of smart technologies and wireless communication networks is stimulating the development of sensing systems able to continuously monitor the human health state and physiological parameters . Local point-of-care medical units or monitoring systems for athletic training performance are two possible examples that would directly profit from such a technology. The crucial bottleneck to establish robust wireless biological sensor networks is the development of new transducer materials. They have to be capable to effectively convert the biological event (for example concentration changes of chemical markers or a bioelectronic current) into the electronic domain. Semiconducting polymers, such as PEDOT:PSS (poly(3,4-ethylenedioxythiophene) poly(styrene sulfonate)) are widely employed in bioelectronical and biosensing applications as they combine two main advantages: (i) they offer electronic as well as ionic conductivity ; (ii) they exhibit excellent bio-compatibility and good mechanical properties.

Here, we report a new fully textile biosensing platform that can be directly integrated into fabric. They can continuosly monitoring the ion chloride concentration [1] and the pH value [2] in biofluids, such as sweat, thus limiting the invasiveness for the wearer. Human sweat contains abundant information about a person's health status and representing an excellent biofluid for portable, non-invasive chemo-sensing. For instance, chloride content is a precious index for hydration status as well as a consolidated hallmark in newborns diagnosis of cystic fibrosis. Moreover, sweat pH is related to hormonal unbalance and lactic acid secretion during physical activity. Our platform consists of PEDOT:PSS-coated threads whose functionalization determines their selective sensing. The sensor is validated in standard electrolytes and in artificial sweat showing high sensitivity and selectivity demonstrating the reliability of our device.

This approach paves the way for a new generation of real-time smart wearable sensors for medical point-of-care, effectively fabricated onto non-conventional substrates, such as textiles or single fibres.

[1] I. Gualandi, M. Tessarolo, F. Mariani, T. Cramer, D. Tonelli, E. Scavetta, B. Fraboni, Sensors and Actuators, B (2018) 834-841.

[2] F. Mariani, I- Gualandi, M. Tessarolo, B. Fraboni, and E. Scavetta, ACS Applied Materials & Interfaces, 2018, 10, 22474-22484.