

4th International Conference and Business Expo on

Wireless, Telecommunication & IoT

July 19-20, 2018 | London, UK

High performance chemical and biological sensing in wearable formats

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Existing and emerging applications of wearable sensors – for personal health and wellness, healthcare, sports, fitness, and others – demand reliable, unobtrusive, and affordable sensors for diverse physical, chemical and biological parameters. At present, the range of reliably measured parameters is fairly limited and users demand the performance of wearable sensors to be comparable with established sensors or even laboratory and hospital equipment. We are developing new generation of wearable sensors that bridge the gap between the existing and required capabilities of wearable sensors. This talk will provide a critical overview of our developments of a new generation of chemical and biological sensors to meet these modern demanding sensing requirements. Our sensors are based on multivariable measurement principles and provide several independent responses from a single device to allow quantitation of several individual components in mixtures, rejection of interferences, and correction for environmental instabilities. We will discuss the design criteria of these sensors and the key roles of sensing materials and data analytics to achieve desired sensor performance. These developed multivariable sensors are attractive when selectivity advantages of classic off-line analytical instruments are cancelled by requirements for no consumables, low power, low cost, and unobtrusive form factors. We will conclude with a perspective for future needs in fundamental and applied aspects of chemical and biological sensing and with the 2025 roadmaps for ubiquitous monitoring.

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