2D nanomaterials for electroanalysis

Sabine Szunerits¹

Published online: 19 November 2020

© Springer-Verlag GmbH Germany, part of Springer Nature 2020

A large variety of in vitro diagnostic tests are currently used for the analysis of clinical samples. To establish a treatment protocol that is appropriate for the patient, these analytical tests should be fast and highly accurate. In addition to the demand for the sensing of new analytes, interest in the development of new clinical tests is also driven by efforts to reduce costs, complexity, and lengthy analysis time of current techniques. Electrochemical- and electrical-based biosensors are eminent players amid the abundance of possibilities available today. These platforms require little and affordable instrumentation, provide low detection limits upon optimization, and are easily miniaturized, thus offering the key characteristics for point-of-care tests.

Due to interest of both patients and clinicians alike in these efficient, fast, and simple to use sensing platforms, the number of biosensors developed in research laboratories, which are now entering the market, is gradually increasing. The importance of cheap, portable, and fast diagnostics as provided by electrochemical sensors is clearly evident from the current health crisis. What started as a temporary issue has morphed into a more permanent and long-lasting global pandemic. One efficient manner to limit COVID-19 spreading and to better manage the COVID-19 outbreak is through unrestrained availability of fast, efficient, accurate, and cost-effective point-of-care testing devices. While it is too early to comment on all the different approaches in this field, it is clear that one challenge concerns the sensitive and selective recording of biological recognition events in complex media such as viral transport medium and human serum and saliva where picomolar (pM) and even lower detection limits for biological analytes are often necessary. The construction of viable

biosensing platforms is a great challenge. The choice of the electrical transducer, the selection of appropriate recognition elements, together with adapted surface-linking strategies need to be considered simultaneously for advanced biosensors.

A wide range of electrical- and electrochemical-based sensors with improved analytical performance have been fabricated thanks to the attractive properties of different 2D-based nanomaterials. These ultrathin nanomaterials differ greatly from their bulk counterparts. Maximal exposure of numerous active sites and short diffusion paths of ultrathin nanosheets facilitate charge transfer.

Moreover, many attachment chemistries are possible for the integration of sensing ligands in these adjustable platforms, making 2D materials ideal for exploration in biosensors.

The ten articles included in this topical collection span the globe and provide some taste and insight into the diverse use of 2D materials for electroanalytical aims. I want to thank warmly all the different researchers who were willing to contribute to this special collection. Their contribution came in a time where COVID-19-related confinements changed our daily work routine and affected our research activities in many ways. Their dedication and enthusiasm to contribute to this interdisciplinary field of 2D materials for electroanalysis, interconnecting chemistry and materials science with physics and biology, helped to make this special edition come true. The interest in using these interfaces for biological sensing of neurodegenerative blood biomarkers, living cells, viral infections as well as small biologically relevant molecules has been nicely demonstrated in this collection. While biological sensing was the focus of this collection, 2D materials are not limited to electrochemical biosensors, and interesting research related to environmental sensing, food quality control, etc., is developing.

Published in the topical collection *2D Nanomaterials for Electroanalysis* with guest editor Sabine Szunerits.

✉ Sabine Szunerits
sabine.szunerits@univ-lille.fr

¹ Institut d'Electronique, de Microélectronique et de Nanotechnologie (IEMN), UMR CNRS 8520, Université de Lille, 59652 Villeneuve d'Ascq, France

Sabine Szunerits is Full Professor of Chemistry at the University of Lille. Her current research interests are in the area of material and analytical science with emphasis on the development of novel nanostructures and approaches for nanomedical applications as well as sensing-related issues. She is co-author of more than 360 research publications, has written 24 book chapters, and has 9 patents. In 2018, she was awarded the Médaille d'argent CNRS for her contribution to sensing and nanomedicine.