Success Story COMET

FFG

CEST competence center

CEST
Centre of Electrochemical Surface Technology
Programm: COMET – Competence Centers for Excellent Technologies
Programmlinie: K1-Zentrum
COMET-Einzelprojekt, Laufzeit und Projekttyp:
[Sea-on-a-Chip], [12/2013 – 05/2017], FP-7 funded
[Potentiometric Sensors], [09/2013 – 09/2016], Lower Austria funded

Biosensors for clinical and environmental applications

The field of sensors and biosensors is a rapid growing and emerging field in research and our daily life. Based on their small size they offer a vast number of possibilities without the need for a fully equipped laboratory. Based on two research projects several types of (bio-) sensors were developed for the detection of cancer biomarkers and toxic contaminants in a range of mg to „µg/L. Based on these results, they are in the final test stage and miniaturization process in order to lower the detection limit, to reach the market and to be used in further contamination studies.

Analytical Chemistry & Sensors

The requirements and possibilities concerning modern analytical chemistry are very challenging. Usually a large amount of samples should be analyzed within the shortest possible period, leading to exact and reliable results. Although the field of chromatography is fulfilling most of these needs, the main drawback is the necessity of a well-equipped and cost intensive laboratory.

A perfect and fast growing alternative to this is the use of (bio-) sensors. Depending on the needs and the application, optimized sensors can provide results within seconds without the need of expensive equipment.

Based on these advantages, CEST has its research focus on the development and improvement of sensors and biosensors for analytical applications.

At the moment we have already developed several prototypes which were successfully used in the detection of biomarkers and contaminants in clinical and water samples.

In order to optimize and miniaturize these prototypes several investigations with partner universities and companies are in progress. This should finally lead to cheap, small and reliable devices which satisfy the required needs in modern analytical chemistry. Since this field is still very new and emerging, several projects are already planned for the future in order to reach new applications fields.

Development, Optimization and Miniaturization

Based in two funded research projects (EU & Lower Austria), we planned to develop sensors for the application in seawater and in the clinical diagnostic. The main challenges therefore were the selectivity towards the target molecules as well as the problem of aggressive media (salt water).

In order to reach our aims we focused on the development of prototypes of a potentiometric and an amperometric sensor. The successful design of a prototype was followed by a material

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optimization in order to lower the detection limit under 1 mg/L. Although this is already a very sensitive device, we are still working on the optimization in order to push the detection limit further down.

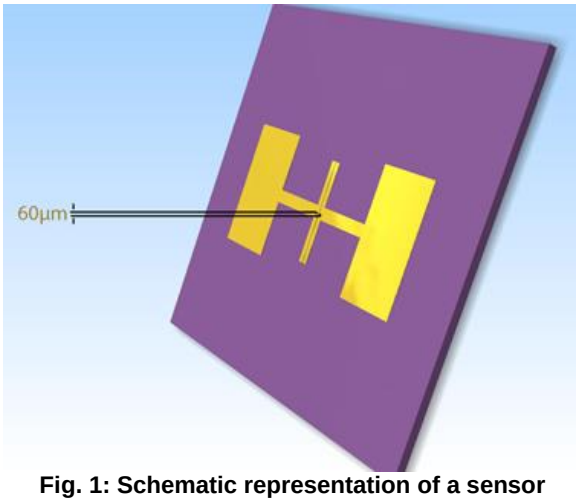

Fig. 1: Schematic representation of a sensor prototype based on a FET. (© CEST)

A crucial role within the development and optimization plays graphene, a material with the thickness of one atom layer and very good electric properties. Concerning its very high conductivity, the selective coating with this material can lead to sensors which are able to detect less than a sugar cube in a sport swimming pool.

At the moment different real sample measurements are in progress in order to push the detection limit even lower and to make the last step towards the market.

Impact and Effects

The potential applications and possibilities for these small and economic sensors are extremely widespread. This is mainly because a working sensor can be easily adapted towards different applications. Considering their possibilities and the cheap production costs, electrochemical sensors are supposed to play a crucial role in the future. This is once again mainly because of their small size, reliability and accuracy without the need for a fully equipped laboratory. For this reason they can be used in the determination of the quality and the contaminations within food and feed or in the detection of all kind of contaminants ranging from toxins and drugs till microbes.

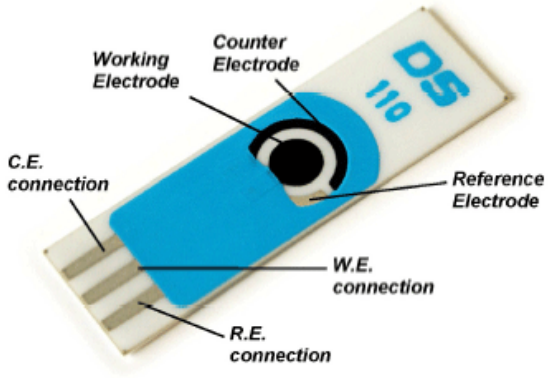

Fig. 2: Commercial electrodes can be easily adopted towards specific needs. (© DropSens)

Within our competence center we are still strengthening our focus in the field of (bio-) sensors in order to provide taylor-made solutions for our partners and customers in research and the industry. Currently several projects are in the planning and starting phase which clearly demonstrates capability and economic importance of this field.

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