O34

3D Made Electrochemical Sensors

Justyna Kalisz, Katarzyna Węgrzyn, Krzysztof Maksymiuk, Agata Michalska
Faculty of Chemistry, University of Warsaw, Warsaw, Poland, agatam@chem.uw.edu.pl

Summary

Making electrochemical, potentially disposable, ion-sensors requires application of electronically conducting substrates, e.g. screen printed electrodes. The latter however, is not always optimal choice. The aim of this work was to investigate possibility of making electrochemical sensors using 3D printing or drawing.

Electrochemical sensors require the presence of electronically conducting track, that has to be typically isolated from solution and at some part modified by a receptor layer. A common alternative for glassy carbon supports are screen printed electrodes. The latter were proven successful in many applications, however, they are not best suited for longer (hours) time scale sensor contact with sample due to spontaneous hydrolysis of materials used to printing. This process is leading to change of the properties of the conducting layer, formation of ions which is a problem in case of ion-selective sensors.

The alternative approach can benefit from 3D printing of the conducting track. The hot melt approach used allows application of polymer rich in the presence of a conducting material, e.g. carbon to prepare conducting track. At the same process electrically non-conducting polymer to prepare insulation (from solution) can be used. The problems related to spontaneous changes of support material are mitigated, an additional advantage is lack of constrains with respect to geometry of the sensor. The unique advantage of the proposed approach is, among others, possibility of using properties of the polymer applied to prepare the 3D support to help to assure excellent adhesion of the receptor layer to the conducting substrate, to minimize variation of recorded signals. The sensors obtained using this approach are characterized with high stability of performance in time, analytical parameters well comparable with those of classical sensors, as shown on example of potassium sensors [1]. This can be an attractive alternative for making disposable sensors even at low resources condition.

References

[1] J. Kalisz, K. Węgrzyn, K. Maksymiuk, A. Michalska, 3D-Drawn Supports for Ion-Selective Electrodes, Anal. Chem. 94 (2022) 3436–3440.