3D PRINTED ELECTRODES FOR APPLICATIONS IN ELECTROCHEMICAL SENSING

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Applications of electrochemistry vary from sensors to energy storage, from electrolysis to fuel cells. One of the important fields of electroanalysis is biosensing. Biosensors act as a transducer converting a biological response into a detectable electrical signal [1], a biosensor can be used for several applications depending on its type. There are different types of biosensors ranging from enzyme based, tissue based, immunosensors, DNA biosensors, to thermal and piezoelectric ones [2]. The fast and efficient applicability of electrochemical based biosensors can be noticed form the recent COVID-19 crisis as a group of researchers made an electrochemical biosensor based on RNA detection for a rapid detection of the COVID-19 virus [3]. The electrochemical electrodes can be redesigned or functionalized to act as certain biosensors, e.g., the electrochemical measurement system can be embedded within a needle for glucose level measurement which can be an excellent solution for diabetics [4]. Carbon ceramic electrodes modified with single walled carbon nanotubes can be used for detection of codeine and caffeine [5].

3D printing is a crucial factor in additive manufacture as it allows the printing of customized and innovated designs [6]. Conductive filaments and polymers are usually used to print electrodes that can be used in electrochemical analysis and sensing applications. 3D electrodes are not yet widely used, but more and more researchers try to employ them in electrochemistry. Several examples of their fabrication techniques can be found in the literature, for example a group used 3D printed electrodes to monitor the brain activity [7], another group used a metal plated 3D printed electrode for the carbohydrates sensing [8].

The aim of this study is to design, print and characterize customized 3D electrodes that can be further used in sensing application. The study can be extended to make customized filaments using different conductive polymers and nanomaterial allowing to study and define the effect of the selected polymers and nanomaterials on the sensor response and sensitivity.

References

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