MME SEE CONGRESS 2023

5th Metallurgical & Materials Engineering Congress of South-East Europe
Trebinje, Bosnia and Herzegovina
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BOOK OF ABSTRACTS

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NANOSCALE METAL OXIDES AS MATERIALS USED FOR MODIFICATION OF CRBORN-BASED ELECTRODES IN ELECTROCHEMICAL SENSORS

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Nanostructured metal oxides used as modifiers of various carbon-based working electrodes serve as the basis for designing sensitive electrochemical sensors to detect desired analytes. The sensors we develop are distinguished by low detection limit (*LOD*), high analyte selectivity, sensitivity, and versatile real-world sample use case. In this work we present the design of two based on metal oxides as modifiers of carbon paste working electrode (CPE) and their applications in the electrochemical determination of levodopa and adrenaline. The physicochemical properties of designed materials were analyzed by complementary experimental technics (XRPD, TEM, SEM, EDS, electrochemical measurements) to determine their (micro)structural properties and correlate them with electroanalytical performance. Europium has been considered a significant lanthanide element with higher redox reaction behavior. We conducted a hydrothermal synthesis of Eu_2O_3@Cr_2O_3 and used them for CPE modification. The proposed Eu_2O_3@Cr_2O_3/CPE electrode was used to develop an analytical procedure quantifying L-Dopa in a wide micromolar linear range (1-100 μM), high sensitivity of 1.38 μA μM^{-1} cm^{-2} and a low detection limit (*LOD* = 0.72 μM). On the other side, we investigated the physicochemical properties of the gallium/bismuth mixed oxides and studied the influence of different Ga_2O_3:Bi_2O_3 ratios on the electrochemical detection of adrenaline. Square wave voltammetry was optimized, and the best electrode showed a wide linear working range of 7-100 μM, under optimized conditions. The *LOD* for the proposed sensor was calculated to be 1.9 μM, with a low limit of quantification (*LOQ* = 5.8 μM). The total performance of the sensors, particularly their performance on real-world samples and their potential for commercialization, had to be carefully evaluated during the sensor construction. Our team is devoted to developing highly selective electrochemical sensors based on nanomaterials to be potentially used as the basis for the fabrication of high-performance miniature devices with exceptional sensitivity to specific analytes, like adrenaline and L-Dopa, in this research.

Keywords Europium/chromium oxide, gallium/bismuth oxide, electrochemistry, levodopa, epinephrine