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ZnO-based nanostructured electrodes for biosensors: Corrosion behavior in Ringer's physiological solution

Katarina Aleksić[1], Ana Stanković[1], Ivana Stojković Simatović[2], Smilja Marković[1]

[1] Institute of Technical Sciences of SASA, Belgrade, Serbia, [2] University of Belgrade, Faculty of Physical Chemistry, Belgrade, Serbia

Over the last decade, due to its numerous unique features that can achieve single biomolecule detection, zinc oxide have been examined as potential electrochemical biosensor for medical diagnosis. Previous studies proved success of ZnO-based materials in determining various biomolecules such as glucose, cholesterol, uric acid, etc. The materials being used as biosensors require special characteristics including high corrosion resistance.

The main goal of this study was to examine biocorrosion characteristics of ZnO materials in Ringer's physiological solution as a function of immersion time. Six different ZnO nanostructured powders were synthesized by microwave processing with an aid of citric acid and CTAB in different weight amount (5, 10, and 20 wt.%). To comprehend the influence of physicochemical characteristics of ZnO samples on biocorrosion, decisive features such as the crystal structure, morphology, textural properties, and surface chemistry were systematically investigated and correlated with biocorrosion activity. The biocorrosion activity of the samples was measured by potentiodynamic polarization technique. The measurements were performed on a potentiostat using a conventional three-electrode cell and a Ringer's solution as the electrolyte. Platinum foil and a standard calomel electrode (SCE) were used as the counter and the reference electrode, respectively, while FTO glass was used as the working electrode. The working electrode was coated with a thin film of ZnO ink prepared by mixing of a ZnO powder as an active material and Nafion solution as a binder. Prepared specimens were immersed in 100 ml of Ringer's solution for different immersion times ranging from 30 min to 7 days. The immersed specimens were then characterized by potentiodynamic polarization techniques in the potential range from −0.2 to +0.3 V vs SCE, at the scan rate of 0.1 mVs^{-1}. We found that all examined ZnO samples has low biocorrosion activity. Slight differences in biocorrosion activity between the samples are determined by particles morphology, textural properties and surface chemistry influenced by used surfactants.