IMMUNOCHEMICAL CAPACITANCE SENSORS BASED ON NANOCOMPOSITE STRUCTURES

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The medical market demands of highly sensitive and selective immunochemical sensors, which are able to detect and identify in a fast and cheap way the infection exciters, is practically inexhaustible.

The characteristics of such sensors can be radically improved by the utilization of nanocomposite structures.

Nanoporous Anodic Aluminum Oxide (AAO) is a proper candidate to create such nanocomposite structures. Being formed at the surface of Al it prolongs the ICS life cycle protecting it from corrosion, excludes degradation of ICS active layers protecting their interaction with the metallic Al surface, improves adhesion of active layers and can significantly improve sensors sensitivity and selectivity enlarging the effective sensors area due to the pores.

The aim of the present work is to create and investigate the characteristics of the influenza viruses detection immunochemical capacitance sensors (ICS) containing nanocomposite structures on the basis of nanoporous AAO.

The arrays of Al thin film ICS were formed on the pyroceramics substrates. The topology of ICS represents the equidistant Archimedes spiral what excludes the interference of ICS in the arrays in the process of simultaneous measurements of their characteristics.

The layer of AAO of 0, 4 μm thick and 40-50 нм pores diameter was formed by the electrochemical anodization of ICS Al layer excluding the sites of the electrical contacts previously plated by Ni.

The surface of the sensitive area of ICS, covered by AAO, was activated by the compound layer of 3-(trimethoxysilyl) propyl aldehyde (United Chemical Technologies, PA), to which the covalent immobilization of the polyvalent antibodies sensitive to A(H1N1) and B types of the influenza viruses was realized. The antibodies density was regulated by the time of their reaction with the aldehyde groups. The aldehyde groups which did not react with the antibodies were inhibited by the reaction with ethanolamine.

The specific immunochemical reactions antibody - influenza viruses antigen were investigated by the method of the electrical forced polarization of the sensors structures by the linearly swinging voltage in the range of ±300 mV with the rate of 1 mV/sec. The dimensionless coefficients characterizing the ratio of the charges accumulated in the ICS structures during the polarization process served as the information parameters.

The results of the carried out investigations showed, that ICS produced on the basis of the nanocomposite structures containing the layers of nano structured AAO,

functionalized by 3-(trimethoxysilyl) propyl aldehyde; the polyvalent antibodies sensitive to A(H1N1) and B types of the influenza viruses and ethanolamine, statistically identify A(H1N1) and B types of viruses with the reliability of 80%. These ICS structures demonstrated very high resistance to corrosion and significantly improved adhesion of active layers to Al/AAO surface. Further optimization of the developed ICS structures is under way.