THE INFLUENCE OF THE BINDER ON THE MORPHOLOGICAL AND TOPOGRAPHICAL CHARACTERISTICS OF THE MODIFIED ELECTRODE SURFACE

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Abstract

Modified carbon electrodes with TiO_2 nanoparticles exhibit several advantages over other electrode materials. The electrochemical characteristics of the electrode material depend on various factors, including the type and size of carbon particles, the size of modifier particles, the choice of binder, the preparation method, and the surface morphology and topology. In this paper, the influence of the type of binder on the morphological and topographical characteristics of the surface of modified carbon paste with TiO_2 nanoparticles was investigated. Paraffin oil (PO), tricresol phosphate (TCP), and a mixture of paraffin oil and tricresol phosphate (POTCP) in a 1:1 ratio were used. The surface was characterized using scanning electron microscopy (SEM-EDS) and atomic force microscopy (AFM). The composition of the examined electrode pastes was analyzed using Fourier transform infrared spectroscopy (FTIR). The electrochemical characteristics of the modified electrode paste were analyzed using cyclic voltammetry. The results indicate that the binders used do not have a significant effect on the morphological characteristics of the surface of the modified carbon paste. Changes in surface roughness were observed, with increased roughness leading to a larger electroactive surface area of the electrode. The change in the topographic characteristics of the surface of the electrode paste is caused by the formation of agglomerates of TiO_2 nanoparticles whose size and shape partly depend on the adhesion forces between the binder and the TiO_2 nanoparticles. FTIR spectra for all tested electrode materials did not show additional peaks that would indicate the creation of chemical bonds between individual components of the electrode material. The test results point to the importance of the influence of the topographic characteristics of the surface of carbon electrodes modified with TiO_2 nanoparticles on the electrochemical characteristics of the electrode itself.

Keywords: *Modified carbon electrode, TiO_2 nanoparticles, roughness, paraffin oil, tricresol phosphate.*