

FORMATION OF THE NANORODS STRUCTURES OF POLYANILYLINE ON THE UNPREPARED Al-ELECTRODE BY POTENTIODYNAMIC METHOD

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The use of metallic electrodes both from noble (Au, Pt, Pd) and active metals (Fe, Ni, Cu, Al etc.) as platforms for the electrochemical synthesis of nanostructured polyaniline (PAn) is an actual problem for nanochemistry of electrically conductive polymers [1]. Such nanostructured with nanofibrilic morphology polyanilines serve as platforms for the chemical or electrochemical reduction of the metals from their salts solutions and as the electrically conductive matrix-carriers of the formed metal nanoparticles, that determines their use as electrocatalytic systems. The synthesis of nanorods PAn structures is much more complex and requires the use of different types of templates, for example specially grown aluminum oxide layer on the Al surface. However, such method of the synthesis of nanostructured PAn is multistage, too time consuming, and highly costly. Therefore, the use of unprepared aluminum electrode (coated with a natural oxide layer) can be very interest and perspective alternative method of the production of PAn nanorods.

The deposition of PAn on the Al-electrode has been realized in potentiodynamic mode (under the potential scanning rates from 20 to 75 mV/s in the (-200)–(+1200) mV potential range) from the 0.25 M aniline aqueous solution in 0.5 or 1.0 M H₂SO₄ within for the different number of the cycles of potential scanning. The morphology and composition of PAn films deposited on the Al-electrode was studied by scanning electron microscopy, X-ray phase analysis and Fourier-transform infrared spectroscopy methods. The optimal conditions for the formation of PAn films, which are constructed from nanostructured structures, were established as a result of the research (see Fig.).

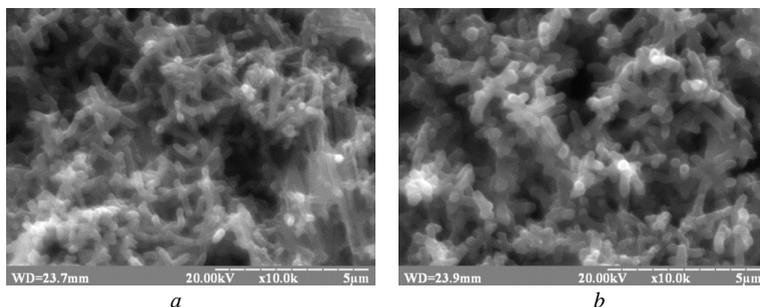


Fig. SEM images of nanostructured PAn deposited on Al-electrode surface from the 0.25 M aniline aqueous solution under the 0.5 (a) and 1.0 M (b) H₂SO₄ concentration (magnification 10,000x)

Thus, the use of Al-electrodes without pre-treatment of their surface allows to produce in potentiodynamic mode the nanostructured polyaniline with nanorods morphology and extremely large surface area.

[1] Kuntiyi O., Yatsyshyn M., Zozulya G., Dobrovets'ka O., Reshetnyak O. Electrochemical synthesis of metallic nanoparticles and nanocomposite. Lviv: Publishing House of Lviv Polytechnic National University, 2019. 288 p. (in Ukrainian).