**Boron-doped Diamond As The Electrode Material For High-performance Electrochemical Sensors Based On Prussian Blue**

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Boron-doped diamond (BDD) is a p-type semiconductor and seems to be a promising electrode material, possessing a number of advantages compared to most used carbon electrodes: low background currents, a wide range of operating potentials, stability and corrosion resistance [1]. In addition, such BDD films are used to create optically transparent electrodes used in spectroelectrochemical studies.

In this work, electrode coatings based on silicon substrates modified with BDD with various surface functional groups were studied: H-terminated, N-terminated, O-terminated. The study of the kinetics of electrode processes was carried out in the mode of cyclic voltammetry (CVA). The CVA of the corresponding electrodes was recorded in the K3[Fe(CN)6] solution in the background electrolyte. For the system Fe(CN)63-/4-, it was shown that the most rapid kinetics of the electrode oxidation-reduction process of potassium hexacyanoferrate is inherent in H-terminated BDD electrodes: CVA with fairly sharp peaks separated on potential scale of 0.075 V was recorded for such electrodes, which is close to the Nernst dependence, whereas for the O-terminated and N-terminated electrodes, the potential difference turned out to be higher than 0.2 V. Moreover, the voltammogram for the H-terminated electrode is stable for more than 100 potential scan cycles.

A comparative study of the kinetics of electrode processes at the surface of the H-terminated electrode and the widely used glass-carbon electrode was carried out. The rate constants (k0) were determined, which amounted to 2.9∙10-3 cm∙s-1 and 5.0∙10-3 cm∙s-1 (pH 1.2), respectively. The rate constant for the H-terminated electrode, determined by electrochemical impedance spectroscopy, was 2.5∙10-3 cm∙s-1 under identical conditions. Thus, the H-terminated electrode is slightly inferior to the glass-carbon electrode in terms of electron transfer kinetics and can be effectively used as an electrode material.

A modification of the H-terminated electrode surface by the electrocatalyst of Prussian Blue was carried out, which made it possible to create electrochemical sensors based on it [2]. The cyclic voltammograms of modified H-terminated electrodes show a characteristic pair of peaks inherent in the deposited electrocatalyst and Prussian Blue/Berlin White corresponding to the redox transition.

Analytical characteristics of a sensor based on an H-terminated electrode modified with an electrocatalyst of Prussian blue were investigated in flow-injection mode. The linear range of detectable H2O2 concentrations using such a sensor: from 5·10-7 to 5·10-4 M. The sensitivity for the sensor was 0.25 mA·M-1·cm-2. In this case, the reduction current of H2O2 is higher than the background current of oxygen reduction by more than 300 times.

Financial support through Russian Science Foundation grant # 19-13-00131 is greatly acknowledged.

References:

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