GLUCOSE OXIDASE IMMOBILIZATION ONTO CARBON NANOTUBE NETWORKING

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S u m m a r y

When elaborating the biosensor based on single-walled carbon nanotubes (SWNTs), it is necessary to solve such an important problem as the immobilization of a target biomolecule on the nanotube surface. In this work, the enzyme (glucose oxidase (GOX)) was immobilized on the surface of a nanotube network, which was created by the deposition of nanotubes from their solution in 1,2-dichlorobenzene by the spray method. 1-Pyrenebutanoic acid succinimide ester (PSE) was used to form the molecular interface, the bifunctional molecule of which provides the covalent binding with the enzyme shell, and its other part (pyrene) is adsorbed onto the nanotube surface. First, the usage of such a molecular interface leaves out the direct adsorption of the enzyme (in this case, its activity decreases) onto the nanotube surface, and, second, it ensures the enzyme localization near the nanotube. The comparison of the resonance Raman (RR) spectrum of pristine nanotubes with their spectrum in the PSE environment evidences the creation of a nanohybrid formed by an SWNT with a PSE molecule which provides the further enzyme immobilization. As the RR spectrum of an SWNT:PSE:GOX film does not essentially differ from that of SWNT:PSE ones, this indicates that the molecular interface (PSE) isolates the enzyme from nanotubes strongly enough. The efficient immobilization of GOX along the carbon nanotubes due to PSE is confirmed with atom-force microscopy images. The method of molecular dynamics allowed us to establish the structures of SWNT:PSE:GOX created in the aqueous environment and to determine the interaction energy between hybrid components. In addition, the conductivity of the SWNT network with adsorbed PSE and GOX molecules is studied. The adsorption of PSE molecules onto the SWNT network causes a decrease of the conductivity, which can be explained by the appearance of scattering centers for charge carriers on the nanotube surface, which are created by PSE molecules.