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Electronic processes in film structures of optochemotronic sensor electrodes

N.V.Masolova, N.N.Rozhitskii

Kharkiv National University of Radioelectronics,
14 Lenin Ave., 61166 Kharkiv, Ukraine

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Probability of tunnel charge transfer in film structure of modified electrode of a optochemotronic sensor has been calculated. The data obtained allow to determine the maximum subphase thickness providing a sufficient probability of charge tunneling. The current density across a 25 Å thick layer of $CH_3(CH_2)_{16}COOH$ fatty acid has been calculated. The study confirms that the use of modified electrodes in sensors for analytical purposes is of good prospects.

Проведен расчет вероятности туннельного переноса заряда в пленочной структуре модифицированного электрода оптохемотронного сенсора. Полученные данные позволяют определить значение максимальной толщины субфазы, при котором вероятность туннелирования заряда достаточно велика. Рассчитана величина плотности тока через слой жирной кислоты $CH_3(CH_2)_{16}COOH$ толщиной 25 Å. Проведенное исследование подтверждает перспективность применения модифицированных электродов в сенсорах, используемых для аналитических целей.

The number of studies in the field of new sensors and sensor-based analytical procedures has been increased dramatically during last few years. The sensors are subdivided into several types depending on the primary signal being generated in the sensitive layer. Those types include optical, electric, electrochemical (EC) (including amperometric and potentiometric) sensors, etc. [1].

In the EC sensors, the component to be determined reacts with the sensitive layer directly on the electrode or in the near-electrode solution layer. The selectivity of an amperometric sensor is defined by the electrode material nature, that is, by the potential value providing electrochemical reactions involving the component to be analyzed. The output signal of potentiometric sensors is the electrode potential. These sensors function in reversible manner, and the electrode potential measurement does not disturb the electrode-solution electrochemical equilibrium. It is the distinction between the potentiometric and amperometric sensors. The response sensitivity of the former is lower than that of the latter as a rule.

Optical sensors use the principle of light absorption, reflection of the primary light beam, or the luminescence generation [2]. Those instruments differ from EC sensors by their insensitivity to electromagnetic and radiation fields and are capable of the analytical signal transmission over considerable distances without distortions; those are also less expensive as compared to the EC sensors. The electrical sensors are based on changes in their electrical conductance due to presence of the substance to be analyzed. No matter what is the sensor type, the general requirements thereto are high selectivity and high measurement sensitivity. For example, when a concentration is measured using an EC sensor, the measurement threshold is within the range of 10^{-4} to 10^{-6} %. In optical sensors, it is just a light signal that is used as the exciting factor, thus, the analytical results become dis-