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ПОВЕДІНКА ТИТАНУ В МАТРИЧНИХ ТА ТВЕРДОМУ ПРОТОННОМУ ЕЛЕКТРОЛІТАХ ГАЗОВИХ СЕНСОРІВ ДЛЯ МОНІТОРИНГУ ПОВІТРЯНОГО СЕРЕДОВИЩА

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THE BEHAVIOUR OF TITANIUM IN MATRIX AND SOLID PROTONIC ELECTROLYTES OF GAS SENSORS FOR MONITORING AMBIENT AIR

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ABSTRACT

A unified series of electrochemical ammetric-type sensors has been created for monitoring ambient air, titanium being used in the sensors as a current-conducting base for the electrodes. On producing electrochemical cells for the sensors by compacting titanium powder a current-conducting cage of porous catalytically active electrodes is produced. These electrodes are in the medium of solid protonic or matrix electrolytes used in the sensors. The work was aimed at determining conditions under which the current-conducting cage of porous titanium possesses corrosion resistance appropriate for the sensors.

It has been revealed that in matrix electrolytes of halides and carbonate on porous titanium at a potential of E>1.1 V (s.h.e.) under high overvoltage processes attenuated with time take place to release halogens (LiCl) and oxygen (KF, K_2CO_3). At E<0.2 V reduction of surface oxides and formation of titanium hydrides proceed in these solutions. In a solid protonic electrolyte based on antimonic acid hydrate at the potentials indicated oxidation of titanium and formation of hydrides are observed. Within 0.2<E<1.1 V porous titanium possesses high corrosion resistance in the electrolytes of both types. Under these conditions only double electric layer currents can be revealed in cyclic voltammograms.

At porous titanium activated with thin-layer coatings of Pt RuO_2, Co_3O_2, MnO_2 in acid matrix electrolytes the E – pH dependence characteristic of these catalysts is violated due to conjugated reactions of oxidation of titanium and reduction of the active components. For the same reason after porous titanium activated with RuO_2 has been anodically polarized in a solid protonic electrolyte there is observed a slow drift of currentless potential to its stationary value. The formation of an oxide layer is accompanied by increasing corrosion resistance of titanium within the 0.2<E<1.1 V range and a corresponding decrease in ground current in the sensors.

With taking these results into a process has been developed for producing corrosion- resistant cage gas-diffusion electrodes for ammetric-type sensors.

KEY WORDS: electrochemical sensors, monitoring ambient air, matrix electrolyte, solid protonic electrolyte, titanium, corrosion.