Red-Ox processes in aqueous solutions under low-temperature glow discharge electrolysis

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The fundamental aspects of low-temperature glow discharge (LTGD) electrolysis action on water and water solutions of different classes of inorganic and organic compounds were revealed. It was shown that the formation of liquid bipolar bifunctional electrode which is aconductor ofsecond kind is the basis of faraday processes. This fact is the peculiarity of LTGD electrolysis and that differsit from the classic electrolysis [1–2]. The use of LTGD electrolysis, when the cathode is in a liquid phase and the anode is at some distance from the liquid surface, makes it possible to produce nonequilibrium oxidation processes in the liquid being treated. Oxidation processes occur in the liquid which cannot be effected by using conventional electrolysis or the action of arc-corona-, townsend- or barrier-discharge plasma on the liquid.

The changes of physical-chemical properties of water solutions, features of electrochemical processes during the reduction of metals were investigated. We have carried out studies on the use of LTGD electrolysis for the purification of industrial wastewater containing inorganic heavy metal salts, radioisotopes and a wide range of organic compounds, including heavy biodegradable nonionic surfactants and microbiological contaminants.

The possibility of LTGD electrolysis application for trans-uranium and trans-plutonium compounds extraction using continuous acting reactorhas been considered. High effectiveness of this method of above-mentioned elements extraction has been showed. The relative contribution of filtration of the solutions based on nature waters in a whole effect of liquid environments purification from trans-uraniumelements during the LTGD electrolysis has been determined. The effect of extraneous salts on the degree of solutions purification from radioactive elements was determined. The dependence of degree of the purification from initial concentrations of radioactive elements and the number of recycles during processing of liquid in continuous reactor was examined. The stability of voluminous glow-discharge plasma from current strength in electrochemical circuit was considered. The degree of purification of liquids was determined to be influenced by solution expenditure, current strength and voltage on reactor electrodes. Purification degree was shown to depend on particles aggregation time and their subsequent separation by filtration (Fig. 1). The effect of LTGD electrolysis on Sr and Cs extraction, as well as joint influence of glow discharge and inorganic substances, adsorbing and deposited Cs and Sr, was investigated. Cs was shown to be detained slightly

on filters during electrolysis, whereas in case of Sr purification degree can be 90 % and higher.

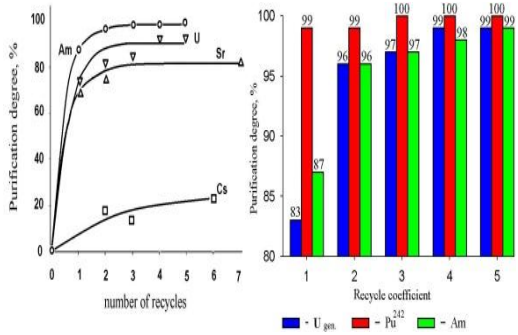

Fig. 1. The purification degree of aqueous solutions of radioactive isotopes

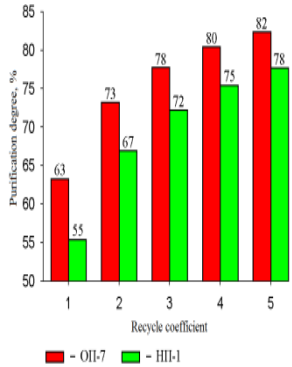

Fig. 2. Dependence of purification degree of solutions containing surfactants on the recycle rate

When organic surface-active substances (SAS) get into water reservoirs, they violate their sanitary regime: the supply of dissolved oxygen in water is depleted, the concentration of petroleum products increases owing to their emulsification in the surface films. Furthermore, because of the high foaming capacity of SAS, the surface of water reservoirs has a considerable amount of foam, which spoils the appearance of the water reservoir and prevents the use of it for recreation and other purposes. The use of LTGD electrolysis allows one to achieve the almost complete decomposition of the SAS contained in waste waters and to obtain CO_2 and water as decomposition end products (Fig. 2). Comparison of this method with other electrical methods for the destruction of SAS shows its far higher efficiency. We have carried out a study of the influence of the main technological factors with the development of a mathematical model of a process for the cleaning of aqueous solutions from nonionogenic SAS. The efficiency of water purification of pathogenic microorganisms was shown in Fig. 3, 4.

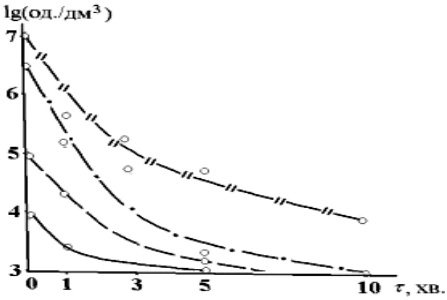

Fig. 3. Dynamics of the death of *kolifag* drinking water under the influence of the LTGD electrolysis

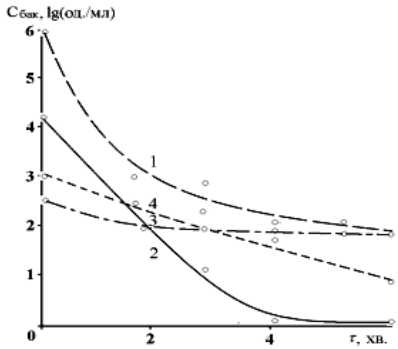

Fig. 4. Dynamics of death of bacteria in the drain water under the influence of the LTGD electrolysis: 1-TMC; 2-LCP; 3-*clostridia*; 4-*enterococci*

References

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2. A. V. Kravchenko [et al.]. Plasma Chemistry (2004) 38 : 375.

Электрохимическое модифицирование Bi_2Te_3 и гетероструктур Bi_2Te_3–Te адатомными слоями Pb

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Наноструктурирование является одним из наиболее перспективных путей достижения высоких термоэлектрических характеристик материалов на основе теллуридов металлов [1, 2]. В докладе рассматриваются подходы к наноинженерии теллуридов висмута и свинца, основанные на электрохимическом осаждении адатомных слоев Pb на Bi_2Te_3 и гетероструктуры Bi_2Te_3–Te. Нами установлено, что катодное осаждение Pb при потенциале, большем равновесного потенциала $E(Pb^{2+}/Pb)$, протекает на теллуриде висмута как электрохимическая реакция, ограниченная формированием одного атомного слоя продукта (адатомного слоя), подобно электроосаждению адатомного слоя на теллур, изученному ранее [3]. Однако свойства атомных слоев Pb на теллуриде висмута и теллуре существенно различаются. В первом случае циклы катодного осаждения и