MATHEMATICAL MODELING OF HETEROGENEOUS PROCESSES IN SYSTEMS: SOLID BODY- LIQUID ELECTROLYTE [[1]](#footnote-1)\*)

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Low-temperature discharge plasma with liquid electrodes is of great interest in the field of fundamental and applied researches. Due to the wide variety of types of plasma installations with liquid electrodes (two electrodes are immersed in a liquid; on electrode is immersed in a liquid, the other is above its surface; jet electrodes, etc.) there is possible a wide range of their application. For example, the transition from hydrocarbon energy to hydrogen energy required the search for cost-effective technologies for the hydrogen production. One of such technologies was the plasma electrolysis method. Also, the combustion process of a gas discharge with liquid electrodes can serve as a new method for metal-powder compositions obtaining.

In this paper, we propose a method for solving inverse problems arising when calculating the rate constants of near-electrode stepwise reactions in heterogeneous processes in systems “solid body – liquid electrolyte” with the substance disengagement both in the gas phase and in the form of porous film, powder. This numerical algorithm makes it possible to find the constant rates in the near-electrode processes in accordance with the specified experimental data on the yield, as well as to calculate the concentrations of substances participating in the near-electrode processes at specific points in time. The algorithm that implements the inverse problem is based on numerical optimization methods, while the solution of the kinetic equations system describing stepwise near-electrode reactions in a liquid electrode is solved by the Runge-Kutta method.

The verification of this methods was carried out by comparing the results of full-scale study with the calculated data obtained by the mathematical model describing the hydrogen yield in a solution of potassium hydroxide. The results of numerical studies are in good agreement with the experimental data of [1].

Also, to check the numerical algorithm for determining the rate of solid settlement on an electrode by way of example of zinc, there was developed a mathematical model of the zinc settlement from a sodium solution by sodium tetrahydroxozincate. This mathematical model takes into account the stepwise reactions parallel branches. These are hydrogen evolution and zinc settlement. Zinc is taken in the approximation of a porous film. Data verification was carried out according to experiments in [2].

References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLIX/Lt/ru/EP-Chebakova.docx) [↑](#footnote-ref-1)