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ELECTROCHEMICAL GOLD SOLUTION BY POLARISATION WITH INDUSTRIAL CHANGEABLE CURRENT

Nowadays changeable current is widely used in various shperes of chemical and electrochemical technology [1], for example for studying the texture of double electrical layer on the surface of an electrode, investigating the technique of different electrochemical processes and etc [2-4].

While providing symmetrical changeable current through the electrochemical cell there must not be evident any changes, because the product, restored during the catod semiperiod, must be oxidated back during the anod semiperiod.

It is possible to provide determined electrochemical process by polarization with industrial changeable current with frequency 50 Hr using metal electrodes having ventile effect (such as, berillium, alluminium, magnium, zinc, titan and etc) but it depends on conditions of electrolize electrode materials and etc [2]. As it is shown by the results of the experiment, some of them have straightening action (effect) in all electrolits, but the other have selective effects. From this point of view it is expedient to study electrochemical behavior of the electrode materials, metal corrosial firmness, as well as the possibility to use determined electrochemical reaction by polarisation with changeable current.

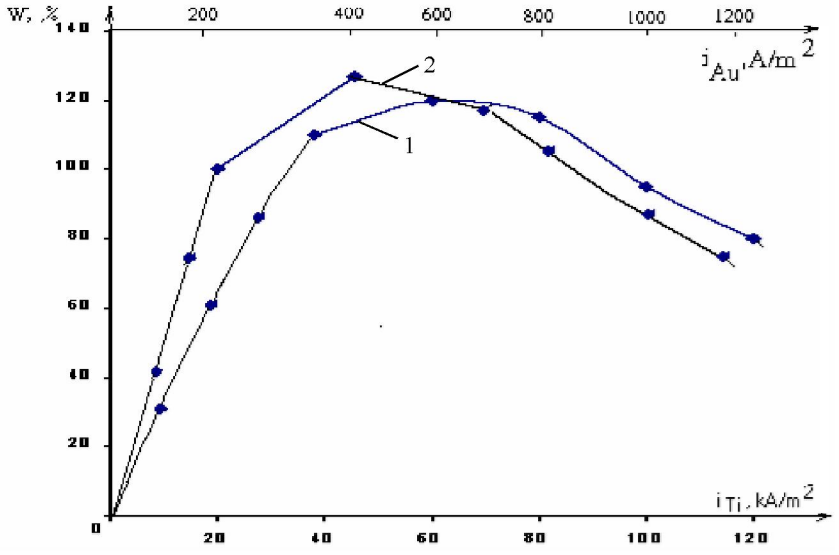
The behaviour of gold, used as an electrode, in solution of hydrochloric acid has been studied while providing symmetrical changeable current. In this case as an auodliary electrode serves the titan wire ekectrode. That s why the influence of various factors has been investigated, the density of electrical current particulary at the gold and titan electrodes, temperature and concentration of electrolit, durability of the electrolize and changeable current frequencyat the outlet on current (W, %)of dissolved gold.

The main research (investigation) has been done with industrial changeable current with 50Hr frequency in the glass electrolizer 200 ml in volume.

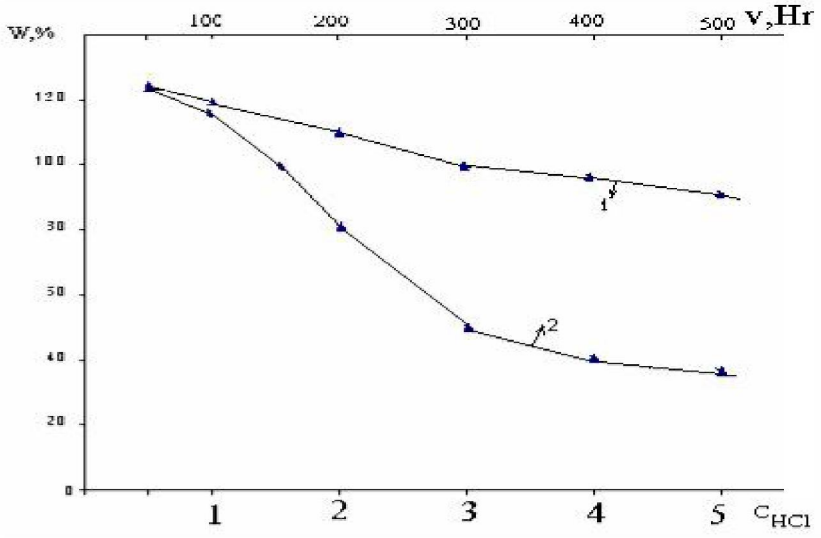
As electrodes it has been taken the golden plate, 99,999 % hall mark and metal titan wire. The interelectrode surface has been divided. It has been shown by prelimenary experiments that gold electrode dissolves. The durability of each experiment has been a quarter of an hour. At the end of the experiment the electrolit has been studied on having gold ions with iodimetric titering method [5]. Before each experiment the surface of gold electrode has been grinded with the paste on the basis of aliminium oxide, and properly washed up with bidistilators.

The main criteria of estimating the results has been the outlet of dissolving gold by current, which was calculated with decrease of mass of the gold electrode at one semiperiod of changeable current.

As it is seen from pic.l, the line 1, as the density of current at titan electrode increases from 20-60 kA/m^2



Pic. 1. The influence of the density of electrical current at the titan (1) and the gold (2) electrodes at the outlet of dissolving gold by current.
Conditions:
C_{HC}i=0,5 M; i_{Ti}=60kA/m^2;
i_{Au}=400A/m^2; t=25° C; t=0,25 of an hour



Pic. 2. The influence of hydrohloric acid concentration (1) and frequency of changeable current (2) at the outlet of gold (III) with current. The conditions are the same as in pic. 1

the outlet of dissolving gold achieves its maximum point - 124%. Further increasing of current density leads to decrease of the current outlet. It is also investigated the influence of currentdissolving gold. In this case the density of current at the titan electrode is always constant and it is equal to 60kA/m^2. Pic. 2, the line 2, it is seen in the interval of density of current from 100-400 A/m^2 the gold outlet current sharply increases, and with the further increasing of current density till 1200 A/m^2 slowly decreases.

The dissolving of gold electrode, with the formation of ions Au (III) while providing sinusoidal changeable current through gold and titan electrodes, can be explained in the following way:

During the anod semiperiod of changeable current at the titan electrode it is formed oxide layer which has ventile semiconductive ability, that leads to preventing electric current reaction in the chain, that s why at the gold electrode there' s no practically any electrochemical reaction. During the catod semiperiod it occurs giving off hydrogen gas, through the reaction:

$$2H + 2e \rightarrow H_2 \qquad (1)$$

and partly restoration of titan oxide layer and in this way current goes through easily. At this moment the gold electrode will be in the anod semiperiod and it is the following reaction on:

$$Au - 3e \rightarrow Au^{3+}. \qquad (2)$$

As it is seen the titan electrode in this case fulfills the function of straigtening and auxiliary electrode.

Increasing outlet of current at dissolving gold with increasing current density at titan electrode (look p. l), may be explained by enlarging the rapid of semiconductive oxide layer formation. During increasing the current density higher than 60 kA/m^2 the current outlet gold (III) ascends, as at high current density at titan electrode it s formed more friable oxide layers, which have less semiconductive abilities (6). Besides, at high current density it can be electrohallmark of titan oxide layer. Decreasing of current outlet of gold electrode 400 A/m^2, it is evidently explained by the partly passivenes of the gold electrode. According to the got results, the temperature increasing sufficiently enlarges the current outlet of dissolving gold. It is a fact that in the hydrohloric acid solution at high temperature enlarges the part of chemical reaction dissolving reaction. It is also known [7], that gold dissolves in th hot hydrohloric acid. With the change of hydrochloric acid concentration the process of dissolving gold decreases, it is caused by screening the electrode surfase with metal chlorides. It can be explained not only with passivenes of gold electrode but also with increasing rapud of outside reactions.

It has been also learnt the change of the current outlet of dissolving gold with changeable current (look pic. 2, line 2) at the limit 50-70 Hr. The maximum dissolving of gold electrode occurs at the frequency 50 Hr.

That's why, by polarisation with changeable current with the help of titan elctrode, the dissolving of gold electrode is taking place. The rapid of gold dissolving depends mainly on electrolize condition.

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Резюме

Тұз қышқылында өндірістік айнымалы токпен поляризациялау кезіндегі алтынның электрохимиялық қасиеті зерттелді. Айнымалы токпен поляризациялау кезінде алтынның ерігіштігі көрсетілді.

Резюме

Исследовано электрохимическое поведение золота в соляной кислоте методом электролиза при поляризации промышленным переменным током. Показано, что золото интенсивно растворяется при электролизе под действием переменного тока.

УДК 541.13

Институт катализа
и электрохимии МОН РК

Поступила 2.02.06г.