M. Zhurinov, A. Bayeshov, A. Bayeshova, G. Iztleuov

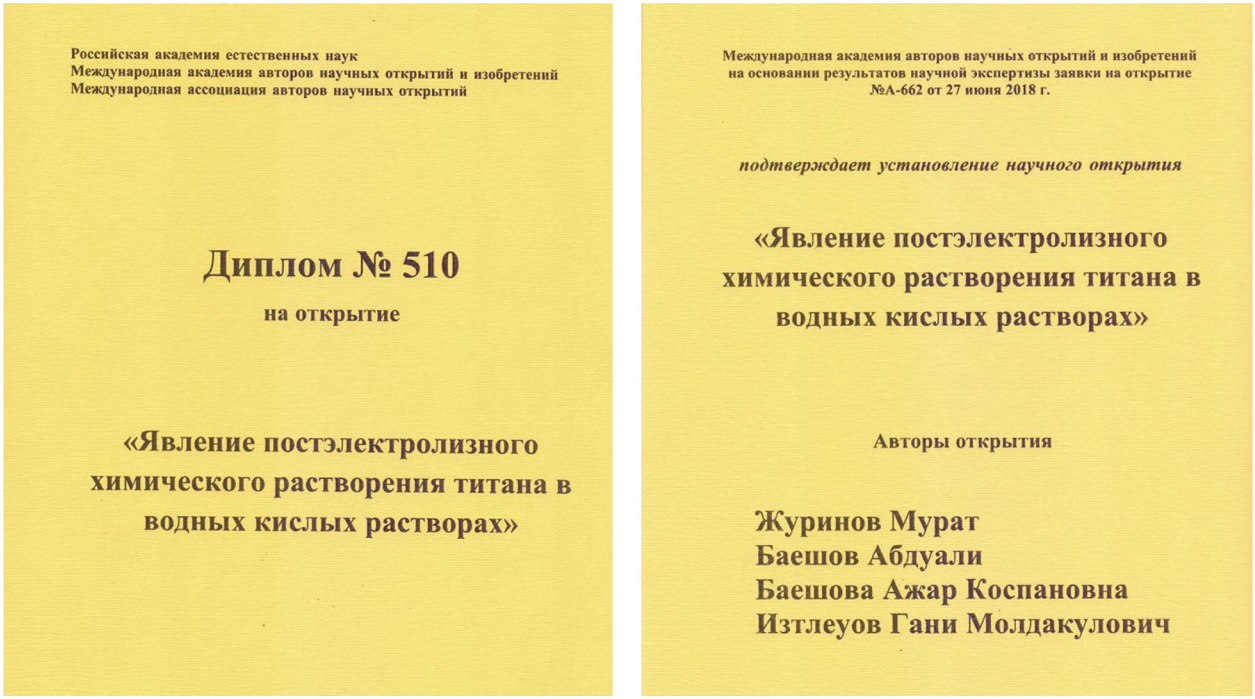
JSC "D. V. Sokolskiy Institute of Fuel, Catalysis and Electrochemistry", Almaty, Kazakhstan

ON THE NEW PHENOMENON OF POST-ELECTROLYZED CHEMICAL DISSOLUTION OF TITANIUM IN AQUATIC ACIDIC SOLUTIONS

We have established a previously unknown phenomenon of post-electrolyzed chemical dissolution of titanium in water solutions, which is that with the preliminary polarization of metal with transient currents (cathode impulse, industrial alternating currents), the oxide film is removed from the surface of titanium, leading to a change in the size of the electrode potential of titanium and its chemical dissolution in aquatic water solutions (sulphate, chloride). The results of the research were recognized by the International Academy of Sciences and the Russian Academy of Natural Sciences (Moscow, Russia) as a scientific discovery in the field of electrochemistry of metals. The priority of the opening begins in 2000 - when the authors received the first patent. Certificates and diplomas for the discovery have been issued to the D.V. Sokolsky Institute of Fuel, Catalysis and Electrochemistry (Almaty, Kazakhstan).

Titanium is known to have high chemical resistance in many excited environments, including chloride-ions. At normal temperatures, titanium is not affected by nitrohydrochloric acid or moist chlorine. Titanium in water solutions does not anodically dissolve, as it is instantly passive and the flow of currents in the electrochemical chain stops. However, these notions of the chemical resistance of titanium associated with its passiveness are at odds with known thermodynamic data. Analyzing by the value of the standard potentials, from a thermodynamic point of view, titanium is unstable, because the value of the ionization potentials of titanium atoms is much more negative than the standard potential of a standard hydrogen electrode. Therefore, theoretically, titanium should enter into the ion exchange process and displace hydrogen ions from water and therefore dissolve in aquatic environments. However, in practice, it does not dissolve, as it is instantly self-passive and becomes very stable not only in water, but also in various excited acidic solutions, including in sea water. The reason for the instant passiveness of titanium in these environments is the formation on its surface of insoluble in water, as well as in acidic and alkaline solutions, a thin protective oxide film that shields the surface of metal titanium from electrolyte ions. For the first time, we have experimentally discovered and theoretically substantiated the previously unknown new phenomenon of post-electrolyzed self-dissolution of titanium in aquatic solutions, i.e. it is established that after pre-treatment with cathode impulse currents or industrial alternating currents with 50 hertz frequency, titanium becomes chemically soluble [1-4].

The scientific significance of the discovery lies in the fact that for the first time a new phenomenon of post-electrolyzed chemical dissolution of titanium electrode was found, primarily (before the electric current is turned off) initiated by cathode impulse currents or industrial AC. As the results of the experiments, this is the restoration and destruction of dense thin oxide layers, constantly present on the surface of titanium. In this case, the surface of the metal is released from the protective oxide layer and then the "bared" titanium begins to chemically dissolve like an electronegative metal, releasing on its surface active atomic hydrogen and sending trivalent ions of titanium to a solution volume that form different titanium compounds. The authors have experimentally proved that the process of dissolving titanium, at the same time, continues after the interruption of the current, i.e. after electrolysis.



Российская академия естественных наук
Международная академия авторов научных открытий и изобретений
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«Явление постэлектролизного химического растворения титана в водных кислых растворах»

Авторы открытия

Журинов Мурат
Баешов Абдуали
Баешова Ажар Коспановна
Изтлеуов Гани Молдакулович

Формула открытия

«Установлено неизвестное ранее явление постэлектролизного химического растворения титана в водных кислых растворах, заключающееся в том, что при предварительной поляризации металла нестационарными токами (катодно импульсными, промышленными переменными), происходит удаление оксидной пленки на поверхности титана, приводящее к смещению величины электродного потенциала титана и его химическому растворению в водных кислых растворах (сернокислых, солянокислых)»

Приоритет открытия

25 сентября 2000 г.- по дате изобретения «Способ получения сульфата титана (III)», (Предварительный патент Республики Казахстан на изобретение №12601) .

На основании в соответствии с действующим законодательством правовых положений Устава Международная академия авторов научных открытий и изобретений выдала настоящий диплом на открытие
«Явление постэлектролизного химического растворения титана в водных кислых растворах»

Журинову Мурату

Президент Российской академии естественных наук **О.Л.Кузнецов**

Президент Международной академии авторов научных открытий и изобретений **В.В.Потоцкий**

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The scientific discovery confirms the theoretical possibility of chemical dissolution of electronegative metals in aquatic solutions. The practical significance of the discovery is expressed in the fact that there is a new direction in science in the field of chemistry and titanium technology. It becomes possible to obtain valuable compounds of titanium by post-electrolyzed chemical dissolution of its waste in the form of grab irons, facings and powders unusable in practice.

As known, titanium compounds are widely used in the field of chemistry and metallurgy, as well as in the national economy. For example, titanium hydroxide (IV) - as a sorbent, titanium dioxide - as a pigment for dyes, and salts of trivalent titanium - as restorers in chemical processes and as charge carriers when restoring hard-to-restore anions of selenium (VI), tellur (VI) and arsenic (V), as well as when receiving ultra-dispersed copper nanopowders. Ammonium titanyl sulfate is widely used in leather treatment. The methods developed by the authors allow to significantly expand the scope of both known and new titanium compounds.

For this discovery, we were given a diploma No. 510 (25.01.2019) by the decision of the Presidency of the International Public Academy of Authors of Scientific Discoveries and Inventions, Moscow.

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М. Ж. Журинов, А. Баешов, А. К. Баешова, Г. Изтлеуов

Институт топлива, катализа и электрохимии им. Д. В. Сокольского, Алматы, Казахстан

О НОВОМ ЯВЛЕНИИ ПОСТЭЛЕКТРОЛИЗНОГО ХИМИЧЕСКОГО РАСТВОРЕНИЯ ТИТАНА В ВОДНЫХ КИСЛЫХ РАСТВОРАХ

Установлено неизвестное ранее явление постэлектролизного химического растворения титана в водных растворах, заключающееся в том, что при предварительной поляризации металла нестационарными токами (катодно импульсными, промышленным переменными), происходит удаление оксидной пленки на поверхности титана, приводящее к смещению величины электродного потенциала титана и его химическому растворению в водных кислых растворах (сернокислых, солянокислых). Результаты исследования авторов признаны международной академией наук и Российской академией естественных наук (г. Москва) научным открытием в области электрохимии металлов. Приоритет открытия начинается с 2000 г. – даты получения авторами первого патента. Свидетельства и дипломы на открытие выданы Институту топлива, катализа и электрохимии им. Д. В. Сокольского (г. Алматы).

М. Ж. Жұрынов, А. Баешов, А. К. Баешова, Г. Изтлеуов

«Д. В. Сокольский атындағы жанармай, катализ және электрохимия институты» АҚ, Алматы, Қазақстан

ТИТАННЫҢ ҚЫШҚЫЛ СУ ЕРІТІНДІЛЕРІНДЕ ЭЛЕКТРОЛИЗДЕН КЕЙІНГІ ХИМИЯЛЫҚ ЕРУІНІҢ ЖАҢА ҚҰБЫЛЫСЫ ТУРАЛЫ

Титанның су ерітінділерінде электролизден кейінгі химиялық еруінің бұрын белгісіз болып келген құбылысы анықталды, титанның электрод потенциалының өзгеруіне және оның қышқыл су ерітінділерінде (күкірт қышқылы, тұз қышқылы) химиялық еруіне әкелетін металды стационарлық емес тоқтармен (катодты импульс, өнеркәсіптік айнымалылар) алдын ала поляризациялау кезінде титанның бетінде оксид пленкасы жойылады. Авторлардың зерттеу нәтижелерін Халықаралық ғылым академиясы мен Ресей жаратылыстану ғылымдары академиясы (Мәскеу қ.) металл электрохимиясы саласындағы ғылыми жаңалық ретінде таныды. Ашылым басымдылығы 2000 жылдан – авторлардың алғашқы патент алған күнінен басталады. Ашылымға алынған куәліктер мен дипломдар Д. В. Сокольский атындағы жанармай, катализ және электрохимия институтына берілді (Алматы қ.).