

ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫНЫҢ
Қ. И. Сәтпаев атындағы Қазақ ұлттық техникалық зерттеу университеті

Х А Б А Р Л А Р Ы

ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН
Казахский национальный исследовательский
технический университет им. К. И. Сатпаева

NEWS

OF THE ACADEMY OF SCIENCES
OF THE REPUBLIC OF KAZAKHSTAN
Kazakh national research technical university
named after K. I. Satpayev

ГЕОЛОГИЯ ЖӘНЕ ТЕХНИКАЛЫҚ ҒЫЛЫМДАР СЕРИЯСЫ



СЕРИЯ ГЕОЛОГИИ И ТЕХНИЧЕСКИХ НАУК



SERIES OF GEOLOGY AND TECHNICAL SCIENCES

4 (430)

ШІЛДЕ – ТАМЫЗ 2018 ж.
ИЮЛЬ – АВГУСТ 2018 г.
JULY – AUGUST 2018

ЖУРНАЛ 1940 ЖЫЛДАН ШЫҒА БАСТАҒАН
ЖУРНАЛ ИЗДАЕТСЯ С 1940 г.
THE JOURNAL WAS FOUNDED IN 1940.

ЖЫЛЫНА 6 РЕТ ШЫҒАДЫ
ВЫХОДИТ 6 РАЗ В ГОД
PUBLISHED 6 TIMES A YEAR

NAS RK is pleased to announce that News of NAS RK. Series of geology and technical sciences scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of geology and technical sciences in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of geology and engineering sciences to our community.

Қазақстан Республикасы Ұлттық ғылым академиясы "ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы" ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Web of Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

Б а с р е д а к т о р ы

э. ғ. д., профессор, ҚР ҰҒА академигі

И.К. Бейсембетов

Бас редакторының орынбасары

Жолтаев Г.Ж. проф., геол.-мин. ғ. докторы

Р е д а к ц и я а л қ а с ы:

Абаканов Т.Д. проф. (Қазақстан)
Абишева З.С. проф., академик (Қазақстан)
Агабеков В.Е. академик (Беларусь)
Алиев Т. проф., академик (Әзірбайжан)
Бакиров А.Б. проф., (Қырғыстан)
Беспәев Х.А. проф. (Қазақстан)
Бишимбаев В.К. проф., академик (Қазақстан)
Буктуков Н.С. проф., академик (Қазақстан)
Булат А.Ф. проф., академик (Украина)
Ганиев И.Н. проф., академик (Тәжікстан)
Грэвис Р.М. проф. (АҚШ)
Ерғалиев Г.К. проф., академик (Қазақстан)
Жуков Н.М. проф. (Қазақстан)
Кенжалиев Б.К. проф. (Қазақстан)
Қожахметов С.М. проф., академик (Қазақстан)
Конторович А.Э. проф., академик (Ресей)
Курскеев А.К. проф., академик (Қазақстан)
Курчавов А.М. проф., (Ресей)
Медеу А.Р. проф., академик (Қазақстан)
Мұхамеджанов М.А. проф., корр.-мүшесі (Қазақстан)
Нигматова С.А. проф. (Қазақстан)
Оздоев С.М. проф., академик (Қазақстан)
Постолатий В. проф., академик (Молдова)
Ракишев Б.Р. проф., академик (Қазақстан)
Сейтов Н.С. проф., корр.-мүшесі (Қазақстан)
Сейтмуратова Э.Ю. проф., корр.-мүшесі (Қазақстан)
Степанец В.Г. проф., (Германия)
Хамфери Дж.Д. проф. (АҚШ)
Штейнер М. проф. (Германия)

«ҚР ҰҒА Хабарлары. Геология мен техникалық ғылымдар сериясы».

ISSN 2518-170X (Online),

ISSN 2224-5278 (Print)

Меншіктенуші: «Қазақстан Республикасының Ұлттық ғылым академиясы» РҚБ (Алматы қ.).

Қазақстан республикасының Мәдениет пен ақпарат министрлігінің Ақпарат және мұрағат комитетінде 30.04.2010 ж. берілген №10892-Ж мерзімдік басылым тіркеуіне қойылу туралы куәлік.

Мерзімділігі: жылына 6 рет.

Тиражы: 300 дана.

Редакцияның мекенжайы: 050010, Алматы қ., Шевченко көш., 28, 219 бөл., 220, тел.: 272-13-19, 272-13-18,
<http://nauka-nanrk.kz/geology-technical.kz>

© Қазақстан Республикасының Ұлттық ғылым академиясы, 2018

Редакцияның Қазақстан, 050010, Алматы қ., Қабанбай батыра көш., 69а.

мекенжайы: Қ. И. Сәтбаев атындағы геология ғылымдар институты, 334 бөлме. Тел.: 291-59-38.

Типографияның мекенжайы: «Аруна» ЖК, Алматы қ., Муратбаева көш., 75.

Г л а в н ы й р е д а к т о р
д. э. н., профессор, академик НАН РК

И. К. Бейсембетов

Заместитель главного редактора

Жолтаев Г.Ж. проф., доктор геол.-мин. наук

Р е д а к ц и о н н а я к о л л е г и я:

Абаканов Т.Д. проф. (Казахстан)
Абишева З.С. проф., академик (Казахстан)
Агабеков В.Е. академик (Беларусь)
Алиев Т. проф., академик (Азербайджан)
Бакиров А.Б. проф., (Кыргызстан)
Беспаяев Х.А. проф. (Казахстан)
Бишимбаев В.К. проф., академик (Казахстан)
Буктуков Н.С. проф., академик (Казахстан)
Булат А.Ф. проф., академик (Украина)
Ганиев И.Н. проф., академик (Таджикистан)
Грэвис Р.М. проф. (США)
Ергалиев Г.К. проф., академик (Казахстан)
Жуков Н.М. проф. (Казахстан)
Кенжалиев Б.К. проф. (Казахстан)
Кожаметов С.М. проф., академик (Казахстан)
Конторович А.Э. проф., академик (Россия)
Курскеев А.К. проф., академик (Казахстан)
Курчавов А.М. проф., (Россия)
Медеу А.Р. проф., академик (Казахстан)
Мухамеджанов М.А. проф., чл.-корр. (Казахстан)
Нигматова С.А. проф. (Казахстан)
Оздоев С.М. проф., академик (Казахстан)
Постолатий В. проф., академик (Молдова)
Ракишев Б.Р. проф., академик (Казахстан)
Сейтов Н.С. проф., чл.-корр. (Казахстан)
Сейтмуратова Э.Ю. проф., чл.-корр. (Казахстан)
Степанец В.Г. проф., (Германия)
Хамфери Дж.Д. проф. (США)
Штейнер М. проф. (Германия)

«Известия НАН РК. Серия геологии и технических наук».

ISSN 2518-170X (Online),

ISSN 2224-5278 (Print)

Собственник: Республиканское общественное объединение «Национальная академия наук Республики Казахстан (г. Алматы)

Свидетельство о постановке на учет периодического печатного издания в Комитете информации и архивов Министерства культуры и информации Республики Казахстан №10892-Ж, выданное 30.04.2010 г.

Периодичность: 6 раз в год

Тираж: 300 экземпляров

Адрес редакции: 050010, г. Алматы, ул. Шевченко, 28, ком. 219, 220, тел.: 272-13-19, 272-13-18,
<http://nauka-nanrk.kz/geology-technical.kz>

© Национальная академия наук Республики Казахстан, 2018

Адрес редакции: Казахстан, 050010, г. Алматы, ул. Кабанбай батыра, 69а.

Институт геологических наук им. К. И. Сатпаева, комната 334. Тел.: 291-59-38.

Адрес типографии: ИП «Аруна», г. Алматы, ул. Муратбаева, 75

E d i t o r i n c h i e f

doctor of Economics, professor, academician of NAS RK

I. K. Beisembetov

Deputy editor in chief

Zholtayev G.Zh. prof., dr. geol-min. sc.

E d i t o r i a l b o a r d:

Abakanov T.D. prof. (Kazakhstan)
Abisheva Z.S. prof., academician (Kazakhstan)
Agabekov V.Ye. academician (Belarus)
Aliyev T. prof., academician (Azerbaijan)
Bakirov A.B. prof., (Kyrgyzstan)
Bespayev Kh.A. prof. (Kazakhstan)
Bishimbayev V.K. prof., academician (Kazakhstan)
Buktukov N.S. prof., academician (Kazakhstan)
Bulat A.F. prof., academician (Ukraine)
Ganiyev I.N. prof., academician (Tadjikistan)
Gravis R.M. prof. (USA)
Yergaliev G.K. prof., academician (Kazakhstan)
Zhukov N.M. prof. (Kazakhstan)
Kenzhaliyev B.K. prof. (Kazakhstan)
Kozhakhmetov S.M. prof., academician (Kazakhstan)
Kontorovich A.Ye. prof., academician (Russia)
Kurskeyev A.K. prof., academician (Kazakhstan)
Kurchavov A.M. prof., (Russia)
Medeu A.R. prof., academician (Kazakhstan)
Muhamedzhanov M.A. prof., corr. member. (Kazakhstan)
Nigmatova S.A. prof. (Kazakhstan)
Ozdoev S.M. prof., academician (Kazakhstan)
Postolatii V. prof., academician (Moldova)
Rakishev B.R. prof., academician (Kazakhstan)
Seitov N.S. prof., corr. member. (Kazakhstan)
Seitmuratova Ye.U. prof., corr. member. (Kazakhstan)
Stepanets V.G. prof., (Germany)
Humphery G.D. prof. (USA)
Steiner M. prof. (Germany)

News of the National Academy of Sciences of the Republic of Kazakhstan. Series of geology and technology sciences.

ISSN 2518-170X (Online),

ISSN 2224-5278 (Print)

Owner: RPA "National Academy of Sciences of the Republic of Kazakhstan" (Almaty)

The certificate of registration of a periodic printed publication in the Committee of information and archives of the Ministry of culture and information of the Republic of Kazakhstan N 10892-Ж, issued 30.04.2010

Periodicity: 6 times a year

Circulation: 300 copies

Editorial address: 28, Shevchenko str., of. 219, 220, Almaty, 050010, tel. 272-13-19, 272-13-18,
<http://nauka-nanrk.kz/geology-technical.kz>

© National Academy of Sciences of the Republic of Kazakhstan, 2018

Editorial address: Institute of Geological Sciences named after K.I. Satpayev
69a, Kabanbai batyr str., of. 334, Almaty, 050010, Kazakhstan, tel.: 291-59-38.

Address of printing house: ST "Aruna", 75, Muratbayev str, Almaty

NEWS

OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN

SERIES OF GEOLOGY AND TECHNICAL SCIENCES

ISSN 2224-5278

Volume 3, Number 430 (2018), 186 – 194

UDC 622.323(574)

G. Zh. Moldabayeva, G. P. Metaksa, Zh. N. Alisheva

KazNTU named after K. I. Satpayev, Almaty, Kazakhstan.

E-mail: moldabayeva@gmail.com, gmetaksa@mail.ru, zhannat_86.2007@mail.ru

**SCIENTIFIC-TECHNICAL BASICS OF VISCOSITY REDUCTION
OF THE KAZAKHSTANI OILS, WHICH PROVIDE
A SIGNIFICANT INCREASE OF OIL RESERVOIRS**

Abstract.

The aim of the work: Scientific-technical basics of viscosity reduction of the Kazakhstani oils, which provide an essential increase of oil reservoirs.

In modern economic conditions, the oil and gas industry of Kazakhstan continues to remain in the area of active growth, along with maintaining its high investment attractiveness.

The contrast of experimental results on the study of spectral responses to external pulse effects and theoretical developments on the types of equilibrium for interplanetary cycles allows us to draw the following conclusions:

1. Obtaining information on changes in the state of the interface between phases by measuring spectral responses provides the necessary potential for searching for cause-effect relationships in all ranges of external influences.

2. The change in the quantitative relationships in the "impact-response" system is suggested to be estimated by the formula of Smirnov A.P., which makes it possible to reflect three-stage processes in the whole variety of their manifestations.

3. It is shown that the state of water (supplier of hydrogen and oxygen) at the interface between phases affects the processes of synthesis and decomposition of hydrocarbons. The observed effect is of practical importance in the development of geotechnology to reduce viscosity under natural underground conditions.

Keywords: oil recovery, impact-response, spectral composition, interface, property management, natural occurrences.

One of the favorable factors for this is the development of the positive dynamics of the global oil and gas industry, which determines the expanded opportunities for sales of products in foreign markets and the liquidity availability, which is available for investment in exploration and extraction. Export volumes of hydrocarbons are growing. At the same time, Kazakhstan has great prospects with the expansion of production capacity of a number of existing fields; and the oil refining sector and the sale of petroleum products in order to increase the added value of products and more complete provision of the domestic market with petroleum products [1-3].

Nowadays the scale of oil and gas production has increased significantly and is being introduced into the development of a field with complex geological-physical conditions, the most important problem of increasing the completeness of oil extraction from the subsoil is being solved, since the average value of the oil recovery coefficient is 0.3-0.4 [4-9].

Thus, the formulation of the objectives of the extraction completeness from oil reservoirs, that have reached the economic limit of operation, becomes particularly relevant in the modern oil and gas industry. However, it becomes economically unprofitable to solve such problems with the help of modern methods of increasing oil recovery, since the scientific-technical basics of hydrocarbon synthesis (UW) in the conditions of natural occurrence are insufficiently worked out. Therefore, in order to create a new geotechnology it is necessary to change the scientific paradigm, which considers the oilfield as an unchanged

statically natural formation conditioned by previous transformations, called the oilfield. This definition (place of birth) much more fully reflects the essence of the dynamic approach to solving the problem of increasing oil recovery, because it allows us to consider the conditions of occurrence as a functioning long-term reactor operating at a certain speed of hydrocarbon synthesis (UW). By pumping lighter components, certain conditions are created for the viscosity increase, which can be reduced by natural reactor hydrogenation with hydrogen, which is present in excess in formation water. Therefore, the main attention in our work is paid to the methods of water decomposition in reservoir conditions. If the conditions of hydrogenation in a natural reactor are provided, it will work at a set speed and chemical composition [10]. Since any process begins and is initiated by the state of the phase separation boundary, in this work the results of the experiments on the spectral composition studies of the responses to the external influence on the phase separation boundary for Kazakhstan UW are shown.

Methods of work conduction. The well-known postulate "all processes start and proceed at the interface of phases" was used in the physical modeling of the synthesis and decomposition of hydrocarbons. For this purpose an experimental module, consisting of an acting device (pulse signal generator) and a receiver in the form of a USB spectrometer in the kilohertz range, was created. In the natural reactor of the formulated module there is water with an oil slick, information about the state of which is brought to tungsten electrodes, which are located on the border of the "oil-water" phase. The electrodes are at a distance of 1/4 and 3/4 of the length of the measuring unit. Impact on the interface is carried out at the frequency of water decomposition (42.8 kHz).

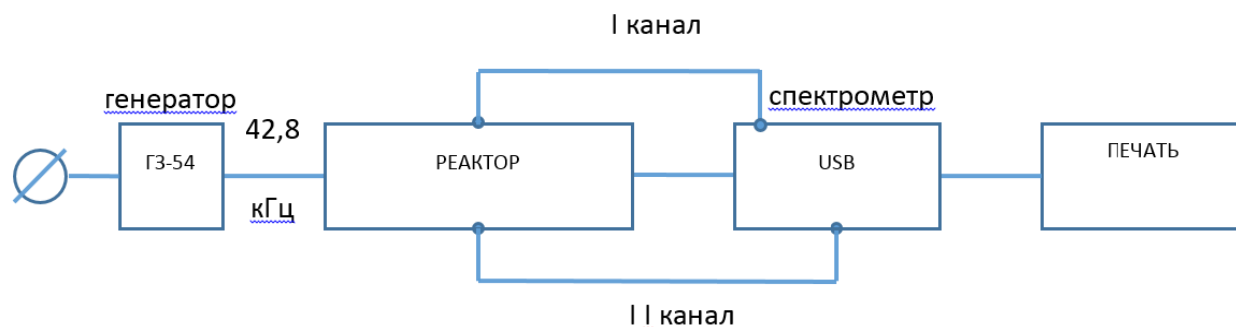
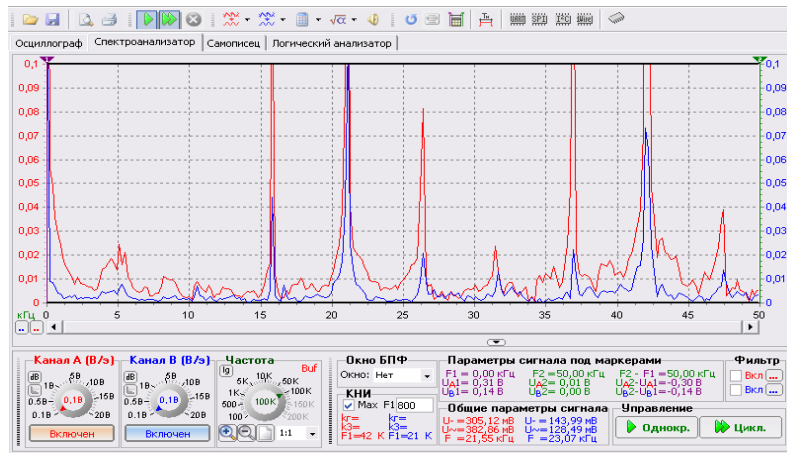


Figure 1 – Functional pattern of the experimental module. Experimental results

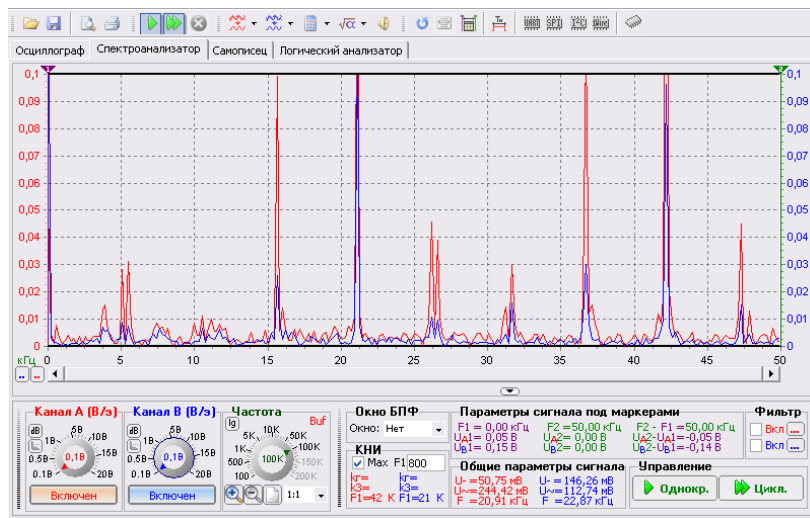
Akzhar. When applying impulses at a frequency of 42.8 kHz onto the oil slick of the Ak-zhar oilfield it can be noted that the amplitude values of the first channel are 2-3 times larger than the values of the second channel. At the same time, the spectral composition of the responses does not correspond to the positions of the harmonic series of the acting frequency (see figure 2a). So the response of the supplied frequency shifted to 1.3-1.5 kHz to the low frequencies for both channels. Proportional to the response rate (41.6 kHz) there is a response with a maximum of 21 kHz - which is the first harmonic of the response's fundamental frequency. After it there should theoretically be present the responses on the 2nd and 3rd harmonics of this frequency. They're not on the spectrogram. However, there are responses with large amplitudes at frequencies 36.5 and 16 kHz. In the high-frequency region there are responses (at) near 47 kHz. This is the spectral composition of the responses at the interface of the oil-water phases in the initial state.

At the same time, the harmonic series of the action supplied to the slick is easy to identify, since it corresponds to frequent decomposition of water, i.e. for water the characteristic frequencies are 42.8; 21.4; 10.7; 5.3; 2.6 kHz. The other responses (36.5; 16, etc.) correspondingly reflect the structural components of the oil slick.

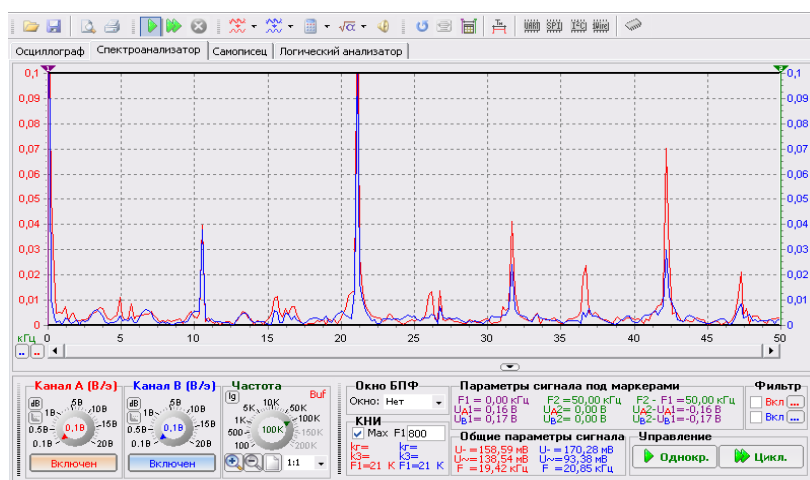
After 8 hours of exposure the appearance of the spectrogram has changed significantly (see figure 2b), indicating a change in the chemical composition of the interface. Firstly, the response at the fundamental frequency $\Delta f = 42,8 - 41,8 = 1 \text{ kHz}$ shifted towards lower frequencies by 1 kHz, i.e. less than in the original state, and secondly-there were new responses at frequencies 26; 26,5 and 5; 5,5, which have a doublet structure. The appearance of doublets is a sign of uneven reactions progression along the length of the experimental reactor.



a – Theinitialslick

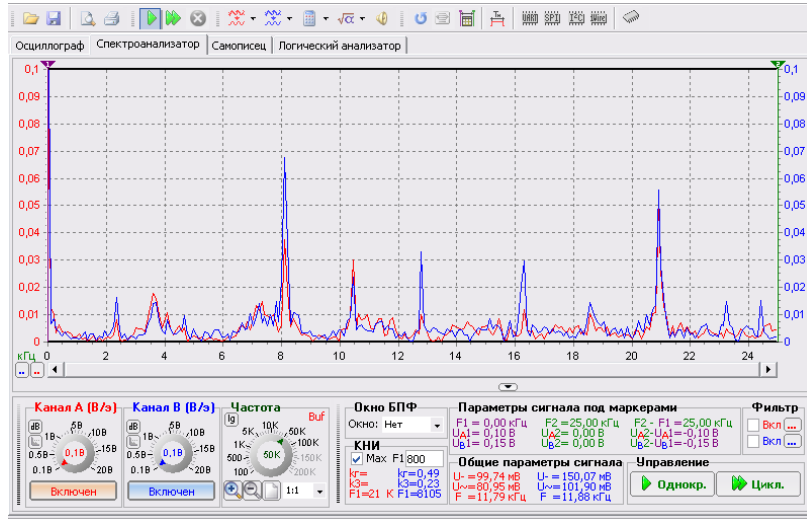


b – After exposure during 8 hours

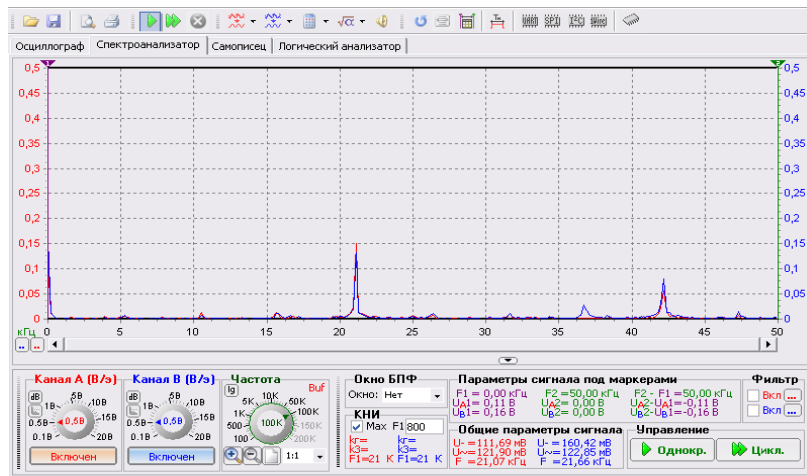


c – After 3 days of aging

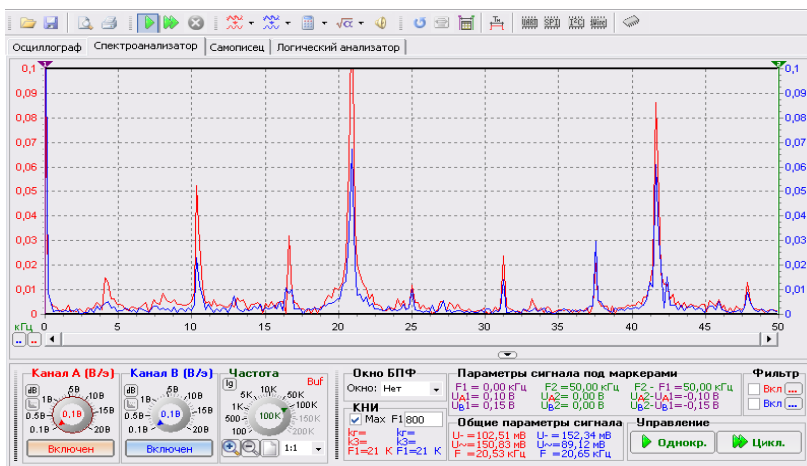
Figure 2 – The spectral composition of the boundary responses (Akzhar)



a – Theinitialstate



b – After exposure during 24 hours



c – After 2 days of aging

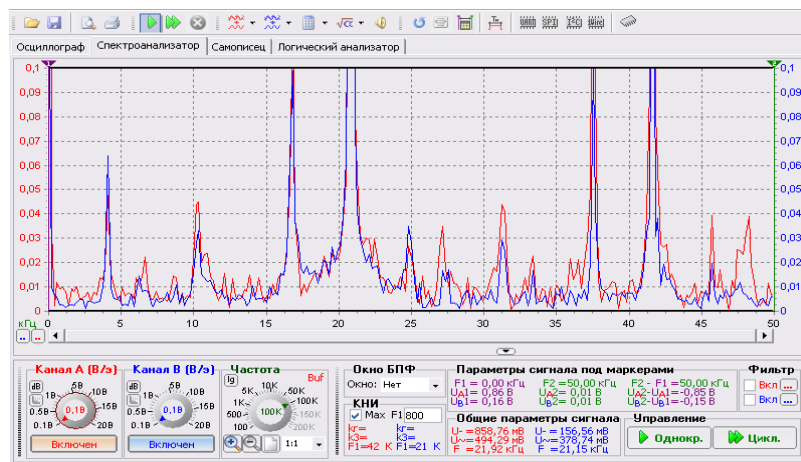
Figure 3 – The spectral composition of the “oil Karabulak – water” interface response

The spectrogram of the responses, taken after 3 days of aging, gives an idea about the stability of new structural components (see figure 2c). Here, the spectrogram has almost no displacement of the main frequency of the action, but the amplitude response value is half less of the first harmonic (21.2 kHz), which means that the response is dominated by larger elements of the structure that are no subject to any changes (to aging). On the 2nd and 3rd harmonics their numbers are less, but they correspond to a number of the fundamental frequency.

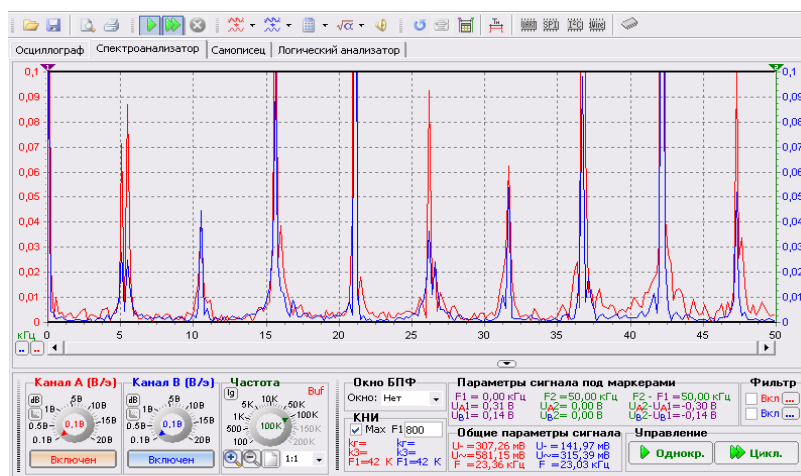
Thus, based on the obtained results, it can be concluded that under the influence of the water decomposition frequency on the interface new structural elements appear both from the synthesis of larger structures, on the basis of water, and also from the decomposition of hydrocarbon, which acquire a high-frequency response.

A similar study was given for a composition consisting of an oil slick from the Karabulak oilfield on the surface of tap water mineralization. In the initial state (figure 3a.) the spectrogram is similar to the response shown in figure 2. The main difference is the appearance of low-frequency responses near 22, 17, 14, 6 kHz, which can be considered as signs of the appearance of the structures of the main chemical composition of the researched oil.

After processing the composition during the day (figure 3b) the type of response spectrogram has changed significantly-the responses at low frequencies have disappeared. The response to 21 kHz has amplitude twice the amplitude of the original signal, which is the main sign of changes in the chemical



a – The initial state (reactor orientation: East-West)



b – After exposure during 24 hours (reactor orientation: North-South)

Figure 4 – The spectrogram of the response of the composition "oil Zhanatan - water"

composition of the phase boundary components in the direction of larger regular structures. In the course of aging (figure 3c.) these structures do not change their acquired peculiarities, i.e. the responses are stored at frequencies 37, 32, 21, 10.5 kHz. The main feature of this spectrogram is the absence of displacement at the frequency of exposure, which means full coverage of the acting signal of the entire volume of the reactor.

To understand the reaction from the diurnal rotation, spectrograms of responses were taken at different positions of the experimental modulus relative to the cardinal directions (see figure 4). In the initial state, when the reactor is located along the East-West direction, the response spectrogram has the same regularities that are inherent in the initial "oil-water" compositions for other oil fields, i.e. there are responses of the harmonic series of the acting frequency (42,8; 21; 10; 5). These responses characterize specific features of the formation of water structures, as they reflect the process of water decomposition (42,8 Puharich frequency [11]). To assess the impact of the change in the state of the oil surface from the Zhanatan field, one may consider frequencies of 37.5, 32, 16.5 kHz, the amplitudes of which are commensurable with the magnitude of the acting signal. These are signs of a resonant response. The basis for this assumption is the almost identical speed of propagation of mechanical (acoustic) waves in the water and oil environments [12, 13].

After an impact on the Puharich frequency during 24 hours (figure 4), with the orthogonally (N-S) changed orientation of the ditch, a unique spectrogram of the response was obtained in which the entire harmonic series for water and oil has doublet responses shifted 1- 2 kHz relative to the main signal. It should be noted that almost all responses have amplitude values commensurate with the response of the impact frequency. This experimental fact means that in the entire volume of the reactor, the processes of formation of both small (47 kHz) and larger structures occur in the most boundary composition. At the same time, a regular structured film becomes the master of specific formations, the state of which it can control. The observed effect of the occurrence of regularity of responses makes it possible to predict the results of external action on the change in the rate of HC synthesis under natural conditions.

Scope of application of results. For a comparative analysis of the qualitative features of the change in the state of the phase boundary during the course of the action, a table of the spectral composition of the responses for three oil fields was compiled: Akzhar, Zhanatan, Karabulak.

Spectral composition of responses for water and oil harmonics of the interface (Akzhar, Zhanatan, Karabulak)

Conditions of the experiment (oil field)	Amplitude of spectral response, B									
	Frequencies of the harmonic series of water, KHz				Frequencies of the harmonic series of oil, KHz					
	41,6	20,5	10,5	5	37	32	25	16	8	
Ak-Zhar, initial condition of oil	0,22	0,15	–	0,02	0,1	0,02	0,08	0,1	–	
Ak-Zhar, 8 hours of treatment	0,25	0,15	–	0,025	0,1	0,01	0,05	0,1	–	
Ak-Zhar, aging 72 hours	0,02	0,15	0,04	0,01	0,02	0,04	–	0,1	–	
Karabulak, initial condition of oil	–	0,05	0,03	–	–	–	–	0,03	0,07	
Karabulak, 24 hours of treatment	0,1	0,15	–	–	<0,05	–	–	–	–	
Karabulak, aging 48 hours	0,09	0,15	0,03	–	0,03	–	0,03	0,03	–	
Zhanatan, initial condition of oil East-West	0,2	0,03	0,045	0,055	0,15	0,045	0,04	0,15	–	
Zhanatan, 24 hours of treatment North-South	0,22	0,15	0,12	0,05	0,18	0,15	0,09	0,17	–	

Tabular data indicate that during the treatment the amplitude of the responses varies, both for the components of the harmonics of the water series, and for the special frequencies of the oil film. In this case, the response of each oil field has specific features. Therefore, when developing software for properties management, it is necessary to take into account the individual characteristics of the oil field [14, 15].

In dynamical systems, whose potential for external influences exceeds the possibilities for the material to return to the previous type of equilibrium - the processes of melting, dissolution, chemical reactions, plastic deformation, etc., the transition to a new state takes place in stages, accompanied first by the destruction of weaker bonds, then by intermediate and most energy-intensive bonds.

The quantitative relations in the multistage process of the phase transition fit well in the equation of Smirnov A. P. [17]:

$$I_n \eta / (1 - \eta) - I_n \eta_i / (1 - \eta_i) = \varepsilon_i ((D - D_i) / D_i)^n .$$

This relationship establishes the link of the energy necessary for the transition to another state of the multiparticle system in the condition of a change in the fraction of particles in the excited state from η_i to η (the left side of the equation). The right-hand side of the equation of equilibrium characterizes the energy of the change in the measure of action on the system from D_i to D (D can be temperature, magnetic field, pressure, frequency, density, velocity and other parameters changing under the action of external forces).

Analysis of the systemic bonds [17] in a solid, carried out for four levels of consideration, showed that the value of ε_i can be equal to 1, 10, 100, 1000 depending on the type of energy conversion during the interaction process. For example, in the process of decomposition of water by energy storage substances, three types of resonance interactions were identified, in which ε_i has values of 10, 100, 1000.

Thus, this equation can characterize several types of equilibrium in which the quantitative relations between the excited and unexcited elements of the structure are balanced by changing the physical properties of the substance. If this relationship has the force of law, then in already existing types of equilibrium, inter phase and intra-phase - these relationships must be satisfied. The left side of the equation gives a quantitative representation of the changes in the reacting system, and the right reflects all the varieties of responses to the external action mathematically described by the value of the power-law dependence of n . The physical meaning of this indicator reflects the change in properties in the A, 2D, 3D dimensions.

Experimentally observed values of the degree n :

$$n = 1; \quad n = 1/2; \quad n = 3/2.$$

An exponent $n = 1$ is characterized by changes in properties, which are described by linear relationships, for example, frequency, refractive index, diffusion, and others. We used this relation with $n = 1$ to determine the interaction frequency for environments moving with different velocities. The well-known formula of Krasilnikov V.A. [12] is a particular case of this law. In the matrices of systemic relationships that we have developed, the exponent equal to one is used for processes and states of level 1 of consideration.

The exponent $n = 1/2$ (square root) can be used for the second level of consideration (2D processes), where changes in states associated with the transformation of electromagnetic energy into mechanical one and vice versa prevail. In our case, these are processes and states of the second level of consideration (exponent relations).

Responses for 3D levels of consideration include processes associated with the impact of the dynamic effect of daily rotation of the planet, where the space-time parameters are determined by Kepler's third law [18-21].

Comparison of experimental results on the study of spectral responses to external impulse actions and theoretical developments based on the types of equilibrium for intraplanetary cycles allows us to draw the following conclusions:

1. Obtaining information on changes in the state of the interface between phases by measuring spectral responses provides the necessary potential for searching for cause-effect relationships in all ranges of external influences.

2. The change in the quantitative relationships in the "impact-response" system is suggested to be estimated by the formula of Smirnov A.P., which makes it possible to reflect three-stage processes in the whole variety of their manifestations.

3. It is shown that the state of water (supplier of hydrogen and oxygen) at the interface between phases affects the processes of synthesis and decomposition of hydrocarbons. The observed effect is of practical importance in the development of technology to reduce viscosity under natural underground conditions.

The results of the work were obtained during the implementation of the topic AP05130483 "Scientific and technical basis for reducing the viscosity of Kazakhstani oils, which provide a significant increase in oil recovery from oil fields" (2018-2020).

REFERENCES

- [1] <http://mirznanii.com/a/24190/povyshenie-nefteotdachi-plastov>
- [2] Pezron E., Leibler, Ricard A. Audebert. Reversible Gel-formation Induced by Ion Complexation. 2. Phase Diagrams // *Macromolecules*. 1988. Vol. 21, N 4. P. 1126-1131.
- [3] Tam K.C., Tiu G. Role of ionic species and valency of the steady shear behavior of partially hydrolyzed polyacrylamide solutions // *Colloid and polym. sci.* 1990. Vol. 268, N 10. P. 911-920.
- [4] Mishchenko I.T., Bravicheva T.B., Ermolaev A.I. Selection of the method of operation of wells with hard-to-recover reserves. M.: Publisher "Oil and Gas" of Gubkin RSUOG, 2005. 448 p.
- [5] Metaxa G.P. Development of theoretical bases of an estimation and the forecast of a condition of rocks at electromechanical influences: the Author's abstract. Doct. dis. on spec. 25.00.20. 2006. 44 p.
- [6] Guliy G.A. Scientific bases of discharge-impulse technologies; resp. ed. B.Y. Mazurovsky; Academy of Sciences of Ukraine. Design Bureau of Electrohydraulic. Kiev: Naukova Dumka, 1990. 208 p.
- [7] Reference book on oil extraction / Ed. Dr. Tech. H.K. Gimatudinov. M.: Subsoil, 1974. 704 p.
- [8] Curtis C. Heavy oil reservoirs / S. Curtis, R. Kopper, E. Decoster, A. Guzman-Garcia, C. Huggins, L. Knauer, M. Minner, N. Kupsch, LM Linares, H. Rough, M. Waite // *Oilfield Rev.* 2002. Autumn. P. 30-51.
- [9] Jabour C. Oil Recovery by Steam Injection: Three-phase Flow Effects / C. Jabbour, M. Quintard, H. Bertin, M. Robin // *J. of Pet. Science and Engineering*. 1996. Vol. 16. P. 109-130.
- [10] Goncalves S. Absorbance and Fluorescence Spectroscopy on the Aggregation Behavior of Asphaltene-Toluene Solutions / S. Goncalves, J. Castillo, A. Fernandez, J. Hung // *Fuel*. 2004. N 83. P. 1823-1828.
- [11] Zotov B.C., Alnabuda A.C.D. et al. The method of gas-impulse processing of wells. SPb.: "Galea Print", 2004. 200 p.
- [12] Krasilnikov V.A. Acoustics, Sound and ultrasonic waves in air, water and solids / 3rd ed. M., 1960.
- [13] Merkulov A.A., Nazin S.S. Impulse and acoustic technologies of oil production intensification and apparatus for recording the parameters of the process of impact // *International technological symposium "Intensification of oil and gas production"*. M., 2003.
- [14] Basniev K.S., Dmitriev N.M., Rosenberg G.D. Oil and gas hydromechanics: Textbook for higher education institutions. M.-Izhevsk: Institute for Computer Research, 2005. 544 p.
- [15] Moldabayeva G.Z. Determination of the variability of the properties of aqueous solutions and hydrocarbons under electrophysical influence and the development of a method for reducing viscosity: Abstract of Cand. dis. Almaty, 2004. on the headings: Processing of oil and oil gases. Production of petroleum products. BBK 35.514 (5Kaz).
- [16] Howard E. Johnson. Pulse generator for oil well and method of stimulating the flow of liquid: Pat No. 5836393, USA (published on 17.11.1998).
- [17] Smirnov A.P. General laws governing the development of phase transitions. LGU. Riga. 1978. P. 3-28.
- [18] Yavorsky B.M., Detlaf A.A. Handbook of Physics. M.: High school, 1989. 608 p.
- [19] Metaxa G.P., Buktukov N.S. Types of equilibrium for interplanetary cycles (nano-level of consideration). LAP LAMBERT Academic Publishing. Germany, 2016. P. 75.
- [20] Sarmurzina R.G., Karabalin U.S., Metaxa G.P. The way of influence on fluid-containing systems. Patent of the Republic of Kazakhstan. No. 26482 of December 14, 2012.
- [21] The generator with adjustable pressure pulse PGRI-100. Technical description and user manual PGRI-100.000 TO / Malakhovsky branch of ANPF "Geophysics". M., 1994. 22 p.

Г. Ж. Молдабаева, Г. П. Метакса, Ж. Н. Алишева

Қ. И. Сагпаев ат. ҚазҰТЗУ, Алматы, Қазақстан

**ҚАБАТТЫҢ МҰНАЙ БЕРГІШТІГІН АЙТАРЛЫҚТАЙ АРТТЫРУ МАҚСАТЫНДА
ҚАЗАҚСТАНДЫҚ МҰНАЙ ТҮТҚЫРЛЫҒЫН ТӨМЕНДЕТУДІҢ
ҒЫЛЫМИ-ТЕХНИКАЛЫҚ НЕГІЗДЕРІ**

Аннотация.

Жұмыстың мақсаты: Мұнай қабаттарының мұнай беругіштігін айтарлықтай арттыру мақсатында қазақстандық мұнайдың тұтқырлығын азайту үшін ғылыми-техникалық негізде құру.

Қазіргі экономикалық жағдай барысында Қазақстанның мұнайгаз саласы оның жоғары инвестициялық тартымдылығын сақтай отырып, белсенді өсу аймағында болуды жалғастыруда.

Сыртқы импульстік әсер етуіге спектрлік жауап (жаңғырық) және теориялық әзірлемелер түрлері бойынша эксперименттік нәтижелерін салыстыру барысында тепе-теңдік үшін планета ішілік зерделеу бойынша цикл мынадай қорытындылар жасауға мүмкіндік береді:

1. Қазақстандық мұнайдың тұтқырлығын азайту процесін программалық қамтамасыз ету міндеті барысында, әр кенорнында әртүрлі болғандықтан, анықталған әсер етудің жауабының (жаңғырықтың) спектрлік құрамын зерттеу үшін физикалық үлгілеу жүргізу керек болды.

2. Спектрлік жауапты өлшеу жолымен фазаның бөліну шекарасының өзгеруі жайлы ақпарат алу – барлық сыртқы әсер ету диапазонының себеп-салдарлық өзара байланысының қажетті қуатын іздеу болып табылады.

3. «Әсер ету-жауап алу» жүйесінде сандық қатынастардың өзгеруін үш стадиялық процестің көптрлік пайда болуын көрсетуге мүмкіндік беретін А.П.Смирновтың формуласымен бағалау ұсынылды.

Түйін сөздер: мұнай бергіштік, әсерге жауап беру, спектрлік құрам, бөліну шекарасы, қасиеттерді басқару, тау жыныстарының табиғи орны.

Г. Ж. Молдабаева, Г. П. Метакса, Ж. Н. Алишева

КазНИТУ им. К. И. Сатпаева, Алматы, Қазақстан

НАУЧНО-ТЕХНИЧЕСКИЕ ОСНОВЫ СНИЖЕНИЯ ВЯЗКОСТИ КАЗАХСТАНСКИХ НЕФТЕЙ, ОБЕСПЕЧИВАЮЩИХ СУЩЕСТВЕННОЕ ПОВЫШЕНИЕ НЕФТЕОТДАЧИ ПЛАСТОВ

Аннотация.

Цель работы: Разработка научно-технических основ снижения вязкости казахстанских нефтей, обеспечивающих существенное повышение нефтеотдачи пластов.

В современных экономических условиях нефтегазовая отрасль Казахстана продолжает находиться в зоне активного роста, наряду с сохранением ее высокой инвестиционной привлекательности.

Сопоставление экспериментальных результатов по изучению спектральных откликов на внешние импульсные воздействия и теоретических разработок по видам равновесия для внутрпланетных циклов позволяет сделать следующие выводы:

1. Получение информации об изменениях химического состава границы раздела фаз путем измерения спектральных откликов обеспечивает необходимый потенциал поиска причинно-следственных взаимосвязей во всех диапазонах внешних воздействий.

2. Изменение количественных соотношений в системе «воздействие-отклик» предложено оценивать по формуле Смирнова А.П., дающей возможность отражать трехстадийные процессы во всем многообразии их проявлений.

3. Показано, что состояние воды (поставщика водорода и кислорода) на границе раздела фаз влияет на процессы синтеза и разложения углеводородов. Обнаруженный эффект имеет практическое значение при разработке технологии снижения вязкости в условиях природного залегания.

Ключевые слова: нефтеотдача, воздействие-отклик, спектральный состав, граница раздела, управление свойствами, природные залегания.

**Publication Ethics and Publication Malpractice
in the journals of the National Academy of Sciences of the Republic of Kazakhstan**

For information on Ethics in publishing and Ethical guidelines for journal publication see <http://www.elsevier.com/publishingethics> and <http://www.elsevier.com/journal-authors/ethics>.

Submission of an article to the National Academy of Sciences of the Republic of Kazakhstan implies that the described work has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint, see <http://www.elsevier.com/postingpolicy>), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. In particular, translations into English of papers already published in another language are not accepted.

No other forms of scientific misconduct are allowed, such as plagiarism, falsification, fraudulent data, incorrect interpretation of other works, incorrect citations, etc. The National Academy of Sciences of the Republic of Kazakhstan follows the Code of Conduct of the Committee on Publication Ethics (COPE), and follows the COPE Flowcharts for Resolving Cases of Suspected Misconduct (http://publicationethics.org/files/u2/New_Code.pdf). To verify originality, your article may be checked by the Cross Check originality detection service <http://www.elsevier.com/editors/plagdetect>.

The authors are obliged to participate in peer review process and be ready to provide corrections, clarifications, retractions and apologies when needed. All authors of a paper should have significantly contributed to the research.

The reviewers should provide objective judgments and should point out relevant published works which are not yet cited. Reviewed articles should be treated confidentially. The reviewers will be chosen in such a way that there is no conflict of interests with respect to the research, the authors and/or the research funders.

The editors have complete responsibility and authority to reject or accept a paper, and they will only accept a paper when reasonably certain. They will preserve anonymity of reviewers and promote publication of corrections, clarifications, retractions and apologies when needed. The acceptance of a paper automatically implies the copyright transfer to the National Academy of Sciences of the Republic of Kazakhstan.

The Editorial Board of the National Academy of Sciences of the Republic of Kazakhstan will monitor and safeguard publishing ethics.

Правила оформления статьи для публикации в журнале смотреть на сайте:

www.nauka-nanrk.kz

ISSN 2518-170X (Online), ISSN 2224-5278 (Print)

<http://geolog-technical.kz/index.php/kz/>

Верстка *Д. Н. Калкабековой*

Подписано в печать 30.07.2018.

Формат 70x881/8. Бумага офсетная. Печать – ризограф.

13,4 п.л. Тираж 300. Заказ 4.