

## SCIENTIFIC AND ORGANIZATIONAL REPORT

"Fluid Mechanics" Department

for 2019

### "INVESTIGATION of the INFLUENCE of BOUNDARY LAYERS on UNSTEADY PROCESSES in the flow of HETEROGENEOUS LIQUIDS»

During the reporting period, the following research were carried out in accordance with the thematic plan.

**Work 1:** Study of mass transfer in boundary layers under flow and filtration of gas-liquid systems.

**Researchers:** corresponding member of ANAS Geylani Panakhov, Dr. Eldar Abbasov, master Ibrahim Mammadov.

During the reporting period, the effects arising in the contact areas during the flow of multiphase systems were investigated, free convective, adsorption and capillary mechanisms were investigated depending on the media ratio.

If the resistance during mass transfer is constant, the turbulence surface leads to an increase in the intensity of the mass in 3-4 times. If resistance to mass transfer occurs in dispersed phases, surface turbulence increases the rate of mass transfer.

During the reporting period, the influence of temperature and pressure changes on the steady-state flow processes was also studied. The influence of the mechanism of gas nuclei formation under of temperature and pressure changes on hydrodynamic parameters in the course of binary systems is investigated.

**Work 2: Investigation of the properties of the effect of electrolytes on other porous media.**

**Researchers:** corresponding member of ANAS Geylani Panakhov, Dr. Professor Yasin Rustamov, Dr. Gulshan Agayeva, Dr. Afat Yuzbashieva.

During the reporting period, the conditions of control of electrokinetic and other processes in boundary layers under fluid filtration in porous media with addition of electrolytes were evaluated.

It is revealed that the deviation from Darcy's law in the flow of structured liquids is associated, in addition to changes in rheological characteristics, also continuously formed electric charges and their diffusion exchange. Researches in this direction are carried out.

The influence of temperature and pressure changes on the interfacial tension at the interface of the liquid and electrolyte surface was estimated.

### **Work 3: Study of the role of static electricity on the dynamics of gas expansion during flow in isothermal conditions.**

**Researchers:** corresponding member of ANAS Geylani Panakhov, Dr. Eldar Abbasov, M.S. Parviz Museibli

In this paper, the influence of the potential difference on the dynamics of gas formation in gas-liquids is studied, the methods of its regulation are studied and the influence of the pressure drop and the potential difference on the gas bubbles generation is compared.

It was found that the dynamics of the gas bubbles formation arising at certain values of the pressure drop can be controlled by the potential difference index.

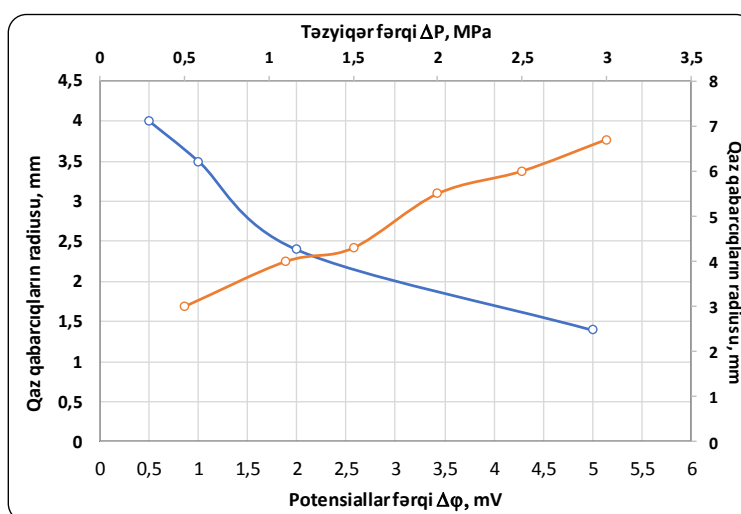
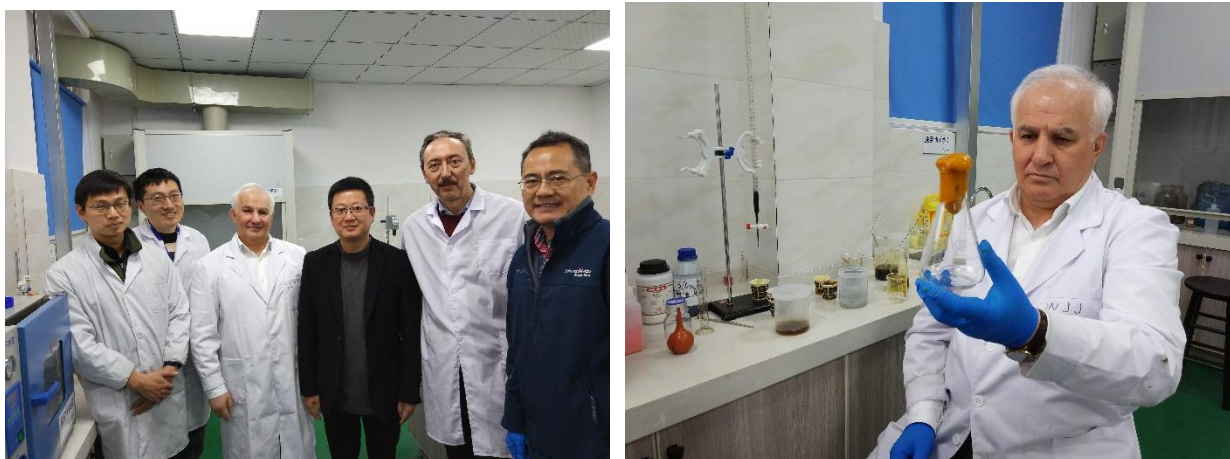


Fig. 1

During the reporting period, the employees of the Department successfully completed the project on “Development of a new hydrodynamic method for optimizing the process of displacement of residual oil reserves” with the support of the SOCAR Scientific Foundation and were represented at the meeting of the Bureau of the FRTE ANAS as Project Manager ANAS Corresponding member Geylani Panakhov.

In the reporting period, the Department staff took an active part in the international scientific conference "Modern problems of applied mathematics and innovative technologies in oil and gas production", dedicated to the 90th anniversary of the outstanding scientist, laureate of the State prize, honored worker of science and technology, academician Azad Mirzajanzadeh.

From 17 to 30 March 2019 corresponding member of ANAS Geylani Panakhov and leading researcher of this Department, Ph. D. Eldar Abbasov was on a scientific trip to the People's Republic of China and the Socialist Republic of Vietnam.



During the scientific trip, representatives of the scientific teams of GCC Group Corp. And IMM held a scientific and practical conference and joint research with the Institute of Advanced Technology in Fengcheng (Jiangxi province). Under the leadership of corresponding member of ANAS Geylani Panakhov, the Foundation was laid for continuing the research in the field of viscous-elastic compositions and other materials relevant for the oil and gas industry, creating the basis for field application in the oil and gas fields of China, the Republic of Azerbaijan, the Russian Federation and other countries.



Based on the results of the experiments conducted by Geylani Panakhov and Eldar Abbasov in the laboratories of the Fechnen Institute, new compositions of viscous-elastic compositions were investigated, as well as laboratory and field studies were planned.

From 25 to 30 March 2019 employees of the Department "Fluid Mechanics" corresponding member of ANAS Geylani Panahov and leading researcher of the Department, Dr. Eldar Abbasov took part in a scientific and practical conference organized by the joint Russian-Vietnamese enterprise "Vietsovetro" in Dalat (Republic of Vietnam). On March 29, IMM employees, invited by Vietnam's leading oil and gas production company, made a scientific report on the topic "Experience in corrosion control of installations and technological pipeline systems in the offshore fields of Azerbaijan and proposed solutions for corrosion protection of oil pipelines and pipelines in the offshore fields of the oil company "Vietsovetro". Employees of IMM ANAS also demonstrated the importance of corrosion prevention by cleaning pipelines from various accumulations, based on developments in the Department of "Fluid Mechanics", proposed a new effective method and made a presentation at the technical Council of the enterprise.



As a result, it was noted that the management of the enterprise "Vietsovetpetro" is interested in cooperation on the application of innovative technologies on the oil fields of Vietnam in marine conditions and attaches importance to the expansion of mutually beneficial relations.

Employees of the Department also conducted oil production operations at Binagadi Oil Company in connection with the intensification of oil production and changes in the injection profile control in 6 production and one injection wells.



During the reporting period, 5 articles were published, 2 articles were accepted for publication:

1. Панахов Г.М., Аббасов Э.М. Управление процессом капиллярной неустойчивости при гидродинамическом воздействии на пласт // Azərbaycan Neft Təsərrüfatı, № 4, 2019. – С. 29 – 36.

2. Панахов Г.М., Аббасов Э.М., Юзбашиева А.О., Балакчи В.Д. Особенности набухания глин в растворах электролитов // Нефтепромысловое дело, №4, 2019. – С. 94-109 (<http://dx.doi.org/10.17122/ogbus-2019-4-93-109>).

3. Шахвердиев А.Х., Панахов Г.М., Ренджи Цзян, Аббасов Э.М. Газощелочное воздействие на пластовую систему с целью извлечения остаточных запасов нефти // Инженер-нефтяник, №3, 2019. – С. 23 – 30.

4. Geylani M. Panahov, Ali B. Aliyev, Gulnar M. Salmanova, Nazrin B. Naghiyeva / Wave flow of viscous fluid in elastic tube // Transactions of ANAS, issue Mechanics, Vol. 39, №7, 2019. – pp. 47 – 51.

5. Parviz T. Museibli On the electrostatic field in expansion dynamics of gas bubbles // «Вестник Самарского государственного технического университета, серия «Физико-математические науки», 2019. (accepted for printing).

6. Parviz T. Museibli Mathematical modelling effect of electrostatic field forming in flow on hydraulic characteristics of two phase mixture // Advances and Applications in Mathematical Sciences, 2019 (accepted for printing).

7. Geylani M. Panahov, Eldar M. Abbasov, Parviz T. Museibli and Sayavur I. Bakhtiyarov An Effect of Electrokinetic Phenomena on Non-linear Wave Propagation in Bubbly Liquids // International Journal Of Fluid Mechanics Research, 2019. (accepted for printing).

During the reporting period the staff of the Department presented 4 abstracts of the conference:

1. Шахвердиев А.Х., Панахов Г.М., Ренджи Цзян, Аббасов Э.М. Газощелочное воздействие на пластовую систему с целью извлечения остаточных запасов нефти // Материалы 14-я международной научно-практической конференции "Новые идеи в науках о Земле", Россия, г. Москва, ул. Миклухо-Маклая д.23, 03-05 апреля 2019 г.

2. Geylani M. Panahov, Parviz T. Museibli, Ibrahim J. Mammadov On the electrostatic field in expansion dynamics of gas bubbles // Abstracts of International Conference "Modern Problems of Mathematics and Mechanics" devoted to the 60th anniversary of the Institute of Mathematics and Mechanics, 23-25 October, 2019, Baku, Azerbaijan.

3. Geylani M. Panahov, Eldar M. Abbasov, Afet O. Yuzbashiyeva, Vusale J. Balakchi Clay swelling characteristics in electrolyte solutions // Abstracts of International Conference "Modern Problems of Mathematics and Mechanics" devoted to the 60th anniversary of the Institute of Mathematics and Mechanics, 23-25 October, 2019, Baku, Azerbaijan.

4. Geylani M. Panahov and Eldar M. Abbasov Evaluation of the reservoir technological parameters of in-situ generated CO<sub>2</sub> gas-liquid slug // Abstracts of International Conference "Modern Problems of Mathematics and Mechanics" devoted to the 60th anniversary of the Institute of Mathematics and Mechanics, 23-25 October, 2019, Baku, Azerbaijan.

During the reporting period, corresponding member of ANAS Geylani Panahov led the initial discussions in the Specialized councils of IMM ANAS. He is a member of the Specialized boards in IMM and ASOIU. Corresponding member of ANAS Geylani Panahov is the Chairman of the state examination Commission at the Department of "Theoretical mechanics and theoretical mechanics" of BSU and teaches at this Department. Corresponding member of ANAS Geylani Panahov is a member of the editorial Board in the magazines "Azerbaijan oil industry", "Oil and Gas business" and "Bulletin of the Academy of Sciences of Bashkortostan".

Corresponding member of ANAS Geylani Panahov carries out scientific supervision of 3 PhD students.

Corresponding member of ANAS Geylani Panahov, prof. Yasin Rustamov and Dr., associate Professor Eldar Abbasov teach various disciplines in the magistracy of IMM.

Head of the Department Geylani Panahov and senior researcher Afat Yuzbashieva teach at BSU, Geylani Panahov is the Chairman of the State examination Commission of BSU for bachelor's degree defense in the specialty "Mechanics".

During the reporting period, corresponding member of ANAS Geylani Panahov and Dr., associate professor Eldar Abbasov participated in the preparation and release of the next issue of ANAS Transactions magazine (issue "Mechanics") - 2019, vol.39, No. 7.

In the course of the report, leading researcher Eldar Abbasov led the production practice of the IV course of the faculty of Mechanics and Mathematics of Baku State University M-050 and M-043 groups on 050502 specialty "Mechanics" from 18.02.2019 to 31.03.2019.

Department head,

Corresponding member of ANAS

Geylani Panahov