

Determination of permeability and porosity of rocks

- Determination of oil and water saturation
- Determination of open porosity, absolute gas permeability, bulk and matrix densities
- Determination of speed of elastic wave transmission (calculation of elastic moduli)
- Determination of fluid saturation status using NMR (nuclear magnetic relaxation) method
- Determination of water-retaining capacity coefficient
- Special studies in reservoir conditions

Extraction and drying of samples in accordance with National State Standard 26450.0



Samples are cleaned from hydrocarbons with an extraction method in various organic solvents for determination of permeability and porosity of rocks. ShVL-05.3 Laboratory Exhaust Fume Hood made of EXPERT.

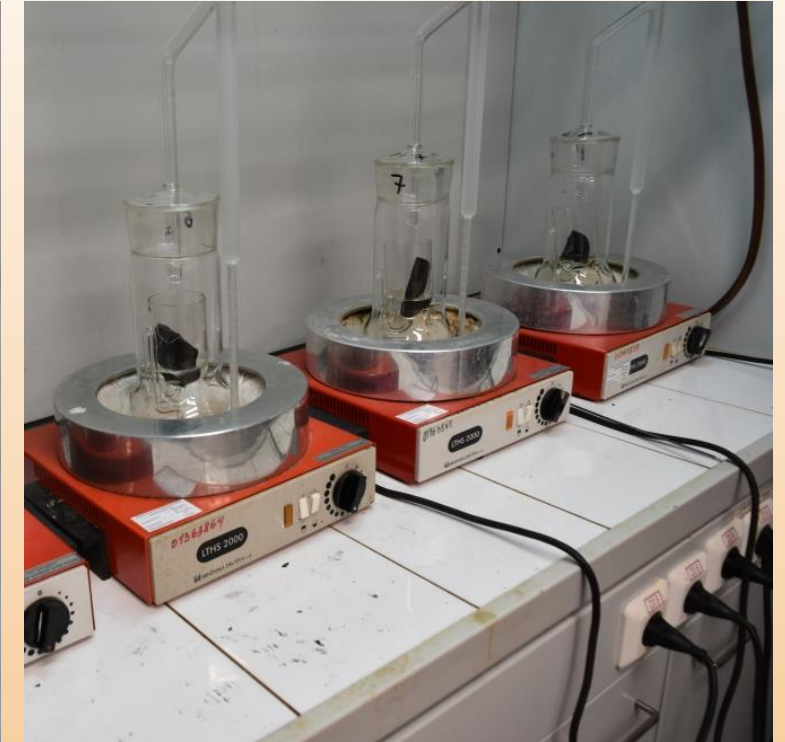
WiseTherm® heating mantles of Witeg Germany



Drying of samples up to the constant weight is carried out in EKROS PE-4610 Drying Oven according to National State Standard 26450.0-85, after drying the samples store in desiccator with the calcined silica gel

Determination of residual water and oil saturation of rock samples using Zaks Apparatus

The residual water and oil saturation of the isolated core samples is determined by an extraction and distillation method using Zaks Apparatus in hot toluene vapors



Determination of residual oil and water saturation of rocks using retort method



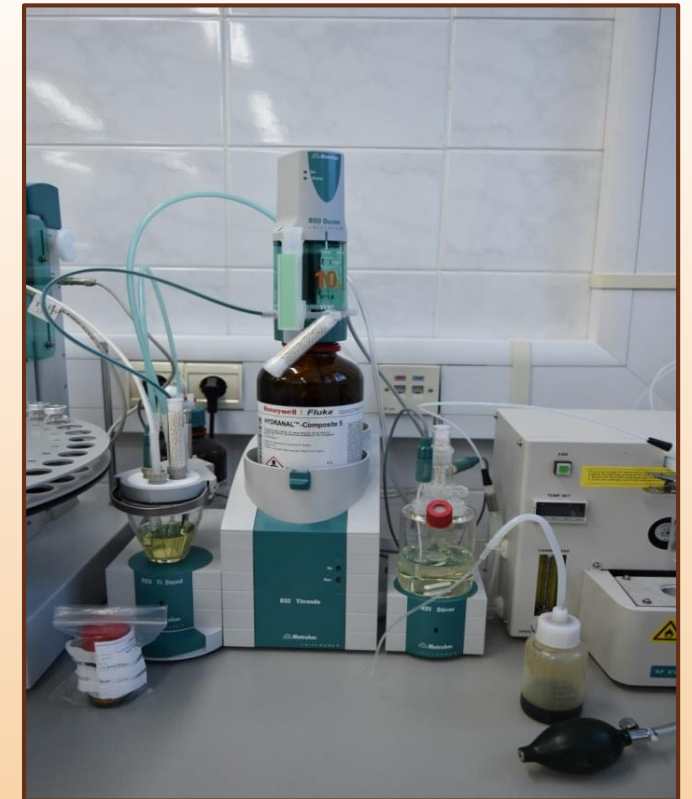
The principle of the retort method consists in heating of core sample up to high temperatures. Oil and water evaporate from core material sample, and then they condensed and gather in the graduated receiving test tube. Samples gradually heat up to 175 °C for water release, and then up to 650 °C for oil release.



Determination of the mass fraction of bound and free water in core

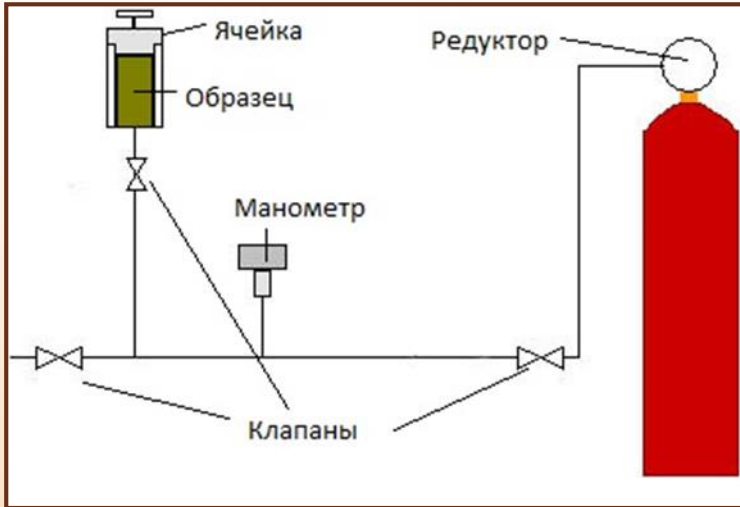
Determination of the mass fraction of bound and free water in core

852 Titrando is multifunctional device; with its help it is possible to determine free and bound water in rock within range from 0.0001 to 100%.



**TITRANDO 852 Automatic Titration
System**

Determination of open porosity using gas-volumetric method and absolute gas permeability



UltraPoroPerm-500 Gas Porosimeter and Permeameter

The open porosity coefficient is measured by method of saturation of gas with the known characteristics, the pore volume calculated through change of gas pressure in the camera of the known volume according to Boyle-Mariotta's Law.

The open porosity and the apparent density (ρ_b) are determined using this method.



The absolute gas permeability coefficient for samples of cylindrical form, is determined by a standard technique at stationary filtration in accordance with National State Standard 26450.2-85 "A method of determination of absolute gas permeability coefficient at stationary and non-stationary filtration" using UltraPoroPerm-500 device. The permeability measurement in the stationary mode takes place with three-axis compression of the sample in Hassler's core holder. The essence of the method consists in determination of gas flow rate through a rock sample at the constant filtration speed. At the same time the flow rate is determined by the gas volume which passed through the sample for the fixed time interval at the constant difference of pressures. The size of gas permeability is measured in 10^{-3} mkm² (millidarcy) and calculated using Darcy's Law.



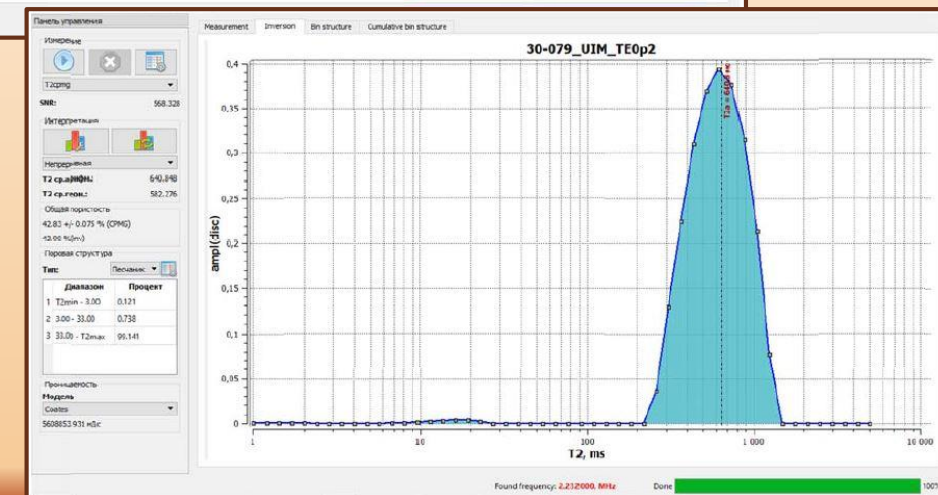
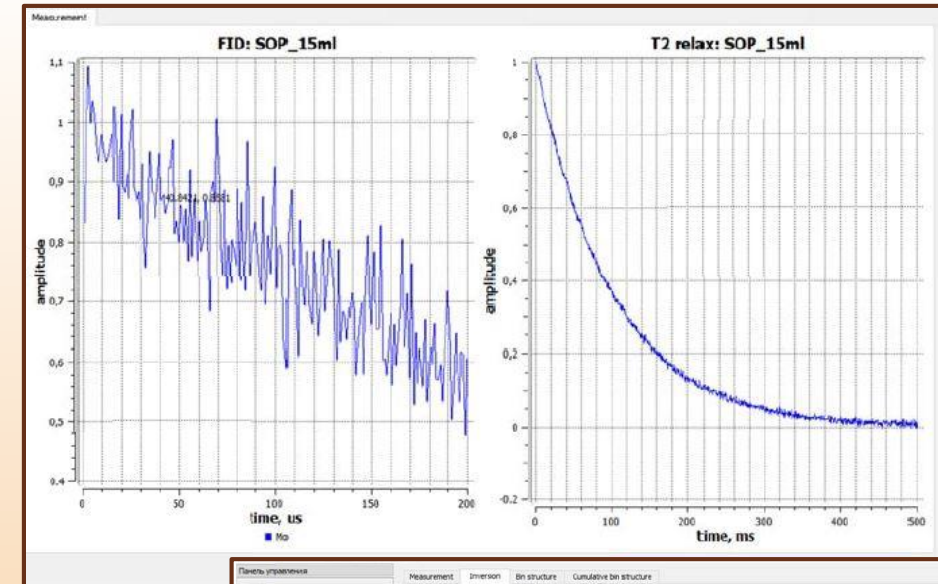
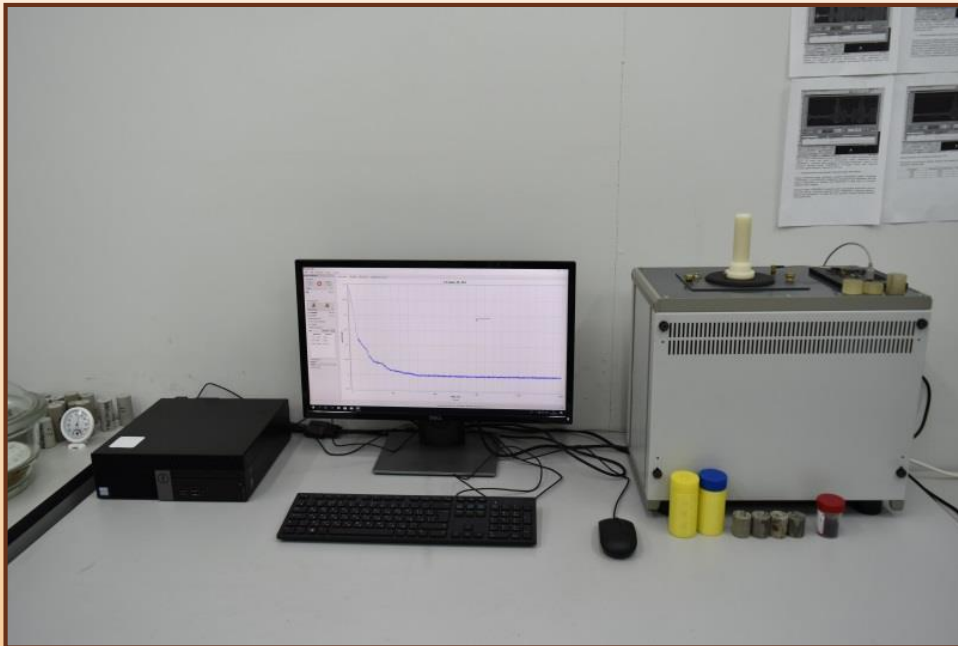
Porosity determination according to National State Standard 26450.1-85 (liquid saturation)

The essence of the method consists in determination of voids of the sample, its external volume, through the difference of the dry and liquid saturated sample mass, and calculation of porosity coefficient, the bulk and apparent matrix density by mathematical calculations.



Determination of porosity by nuclear magnetic relaxation method

The device is intended for determination of porosity, moisture content, clay content of natural and artificial porous materials by the method of nuclear magnetic resonance, used for petrophysical core and reservoir fluids studies



Determination of real matrix density

The real density of rock is determined on the grinded core samples and sludge by the picnometer method and using the Le Chatelier bottle according to National State Standard 8735-88.



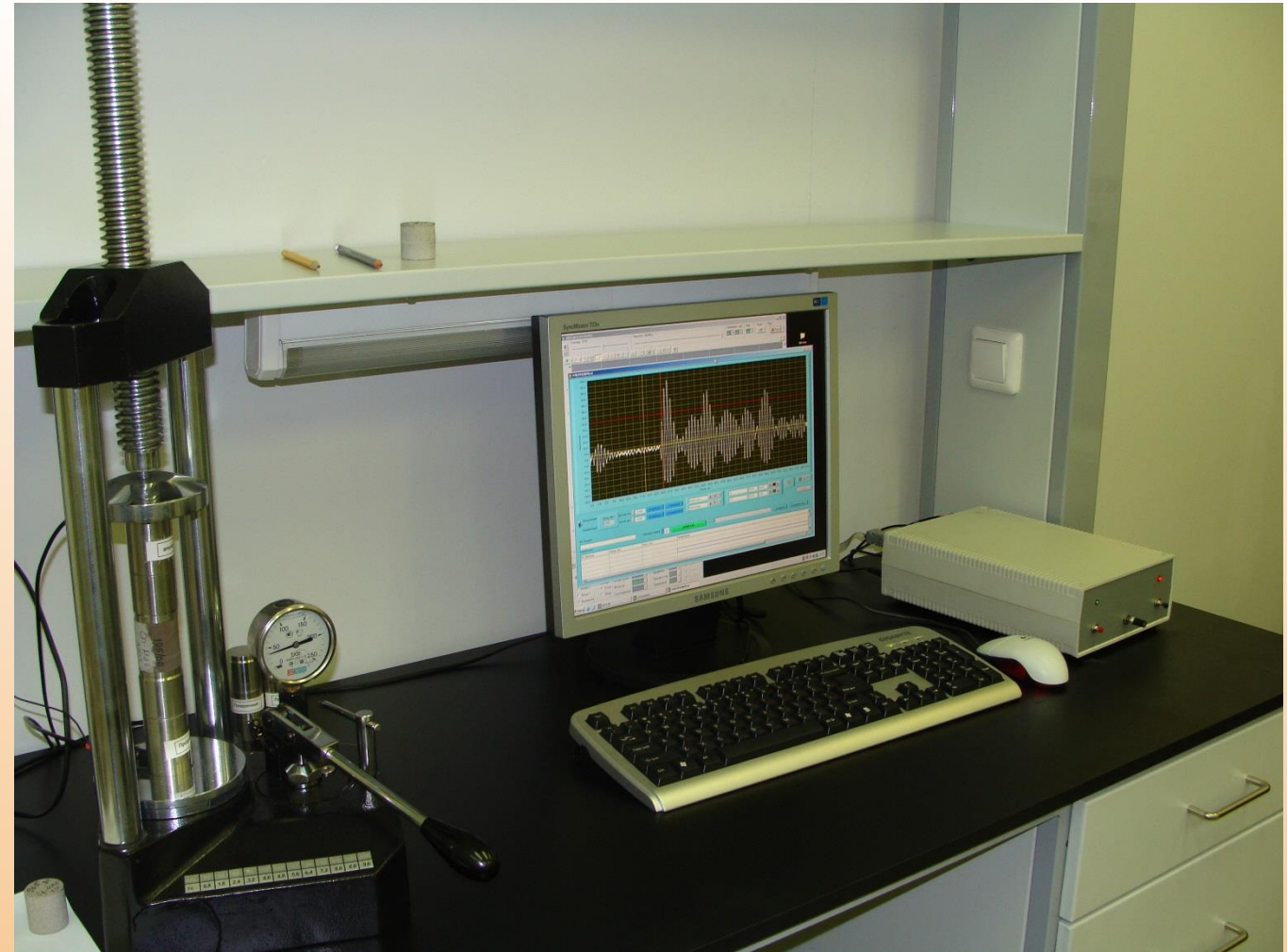
Determination of water-retaining capacity coefficient by the centrifuge method

The water-retaining capacity is determined by the centrifuge according to the company standard “Rocks. Measurement procedure of water-retaining capacity coefficient of samples of rocks using the centrifuge”, certificate № 253.13.17.253/2005. The amount of water-retaining capacity of rocks is characterized by a ratio of volume of the retained water in rock pores at specified value of capillary pressure created by the centrifuge mode to the open pore volume of rock. The water-retaining capacity is an informative complex indicator of quality of collectors, it reflects lithological and mineralogical characteristics, reservoir properties and structure of pore volume of rocks, their ability to accumulation of fluids in deposit, is used for calculation of parameters of porosity and saturation, pore tortuosity



Speed determination of elastic wave transmission

Dynamic method of elastic moduli study
 Speed measurement of elastic wave transmission through the rock sample allows calculating Poisson's ratio, Young's modulus, the shear modulus and the bulk modulus.



Measurement of capillary characteristics and electrical resistivity in reservoir conditions



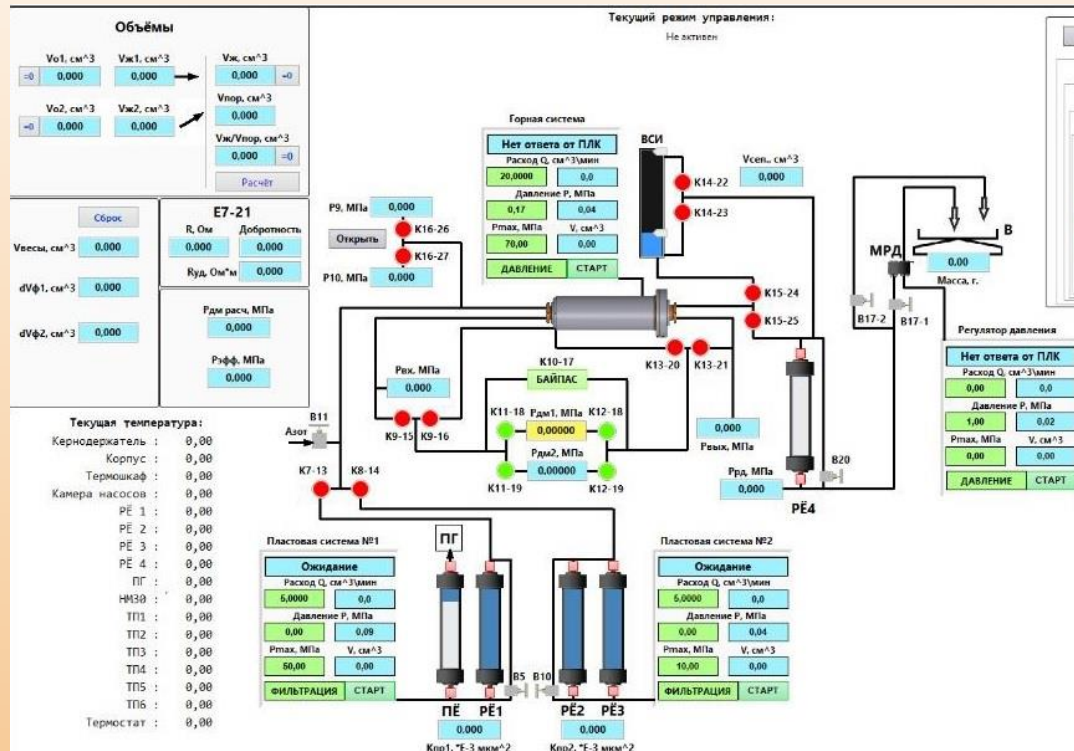
System for study of capillary properties and electrical resistivity of core samples in reservoir conditions “PIK-IGK-PL” (Software-based measuring complex – Individual gravimetric capillarimeter) made by Geologika JSC. The system is intended for determination of capillary pressure in the core saturated with reservoir fluids, method of semi-impenetrable membrane and electrical resistance on the double electrode scheme in thermobaric conditions. Measurements are taken at value of overburden pressure up to 70 MPa, temperature up to +150 °C, pore-water pressure up to 3 MPa.

Two-phase filtration modeling in reservoir conditions

Complex for study of core permeability and porosity in the system of two-phase filtration SMP-FES2A (reservoir simulator) made by Kortech LLC.

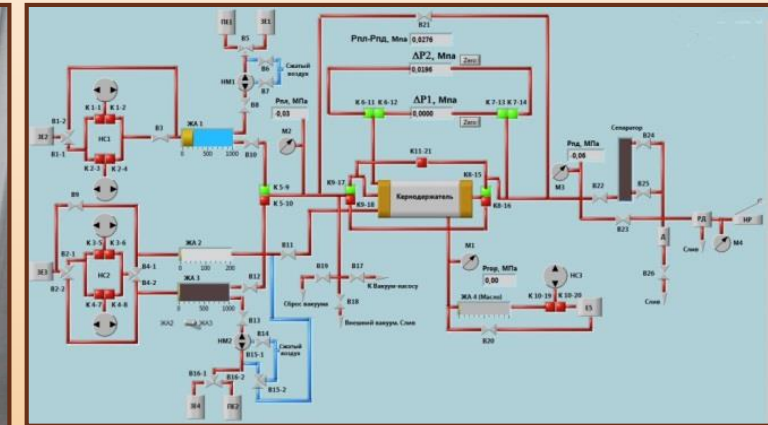
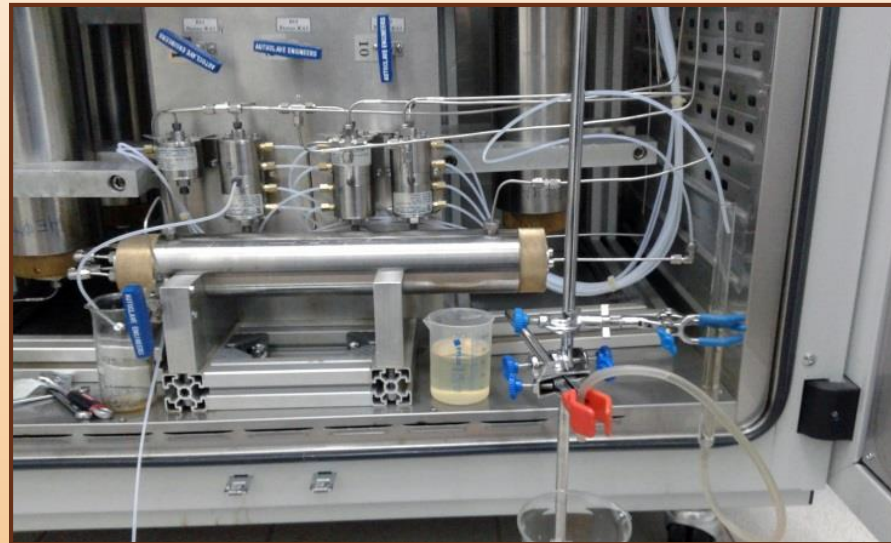
SMP-FES2A Layer Modeling System is the completely automated laboratory unit for complex carrying out experiments for two-phase filtration in reservoir conditions according to Industry Standard 39-235-89 and Industry Standard 39-195-86.

Measurements are taken at value of overburden pressure up to 80 MPa, temperature up to +150 °C, pore-water pressure up to 50 MPa.



Two-phase filtration modeling in reservoir conditions

PLAST-ATM.10 Petrophysical Automated Laboratory System is modular, computerized system for carrying out two-phase filter experiments configured for studies of absolute and relative permeability ratio determination of core material samples at stationary and non-stationary filtration, oil recovery factor determination and also filter experiments carried out under specialized conditions of the customer for increasing layer oil recovery. All experiments are carried out under thermobaric conditions which are similar to reservoir ones.



Three-phase filtration modeling in reservoir conditions

The device PIK-OFP-AEI is intended for study of relative permeability ratio of core samples by stationary and non-stationary methods in reservoir conditions.

The x-ray system of three-phase saturation measurement is a part of the complex (liquid/liquid/gas). The X-ray transparent core holder from composite material allows to receive radiography of the core sample which is in reservoir conditions.

Measurements are taken at value of overburden pressure up to 70 MPa, temperature up to +150 °C, pore-water pressure up to 40 MPa.

