



Exploration & Production  
Laboratory

**E&PLAB**

**INA**



## ABOUT US

The Exploration & Production Laboratory, based in Zagreb, is dedicated to improve and support exploration, field development and oil and gas production.

We are offering an innovative approach and tailored made solutions according to the clients' needs in the field of petroleum, geology and geothermal exploration and production, natural gas storage, EOR (Enhanced Oil Recovery) & CCUS (Carbon capture, utilisation and storage) projects through high quality performance of laboratory analyses and data interpretation related to business of the entire energy sector.

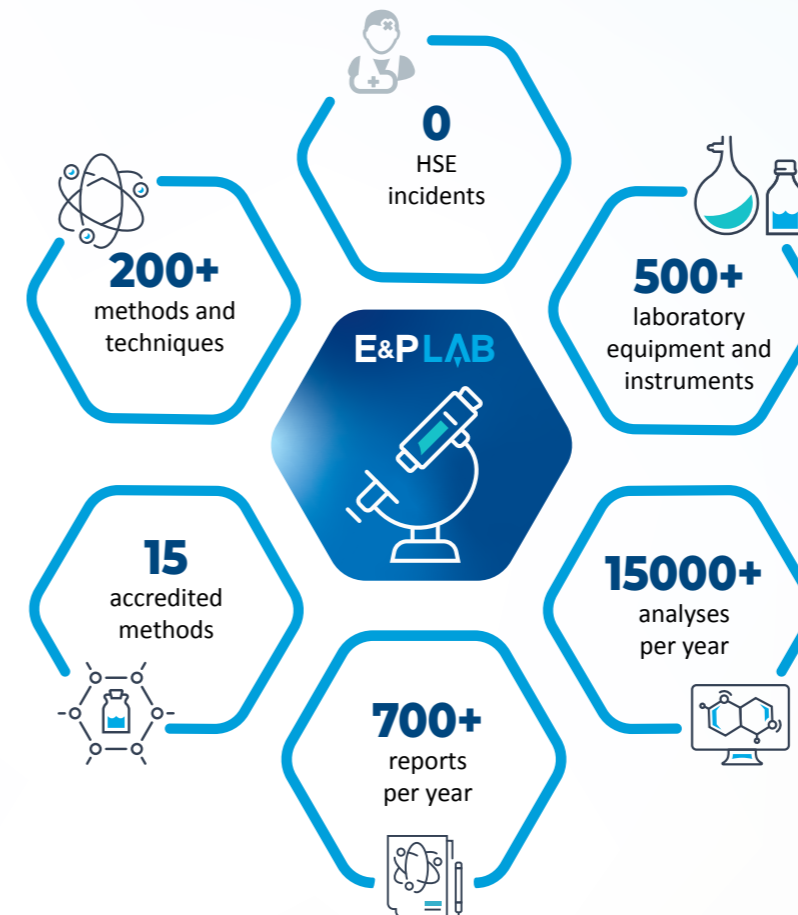
We contribute to the community through education and student internships, as well as through effective cooperation with scientific research institutions and faculties.

We cover all needs for laboratory analyses and monitoring with highest level of quality and expertise in oil, gas and energy industry.

### The scope of the E&P Laboratory is defined through:

- Proactive participation in exploration and defining new exploration areas and petroleum systems,
- Technical support for the field development and for oil and gas production,
- Quality performance of rock and fluid laboratory analyses (oil, natural gas, condensate, water) from geological, geochemical, petrophysical, thermodynamic, corrosion and physical and chemical aspect
- High quality laboratory reports and studies with data interpretation.

The Laboratory also provides services to external clients. Through professional cooperation with clients, we introduce new methods and adapt existing ones according to the clients' needs with the purpose of improving business processes by obtaining quality laboratory data and solving various engineering challenges on real core and fluid samples.



*Our laboratory team consists of highly educated experts, petroleum, geological and chemical engineers and top technicians with many years of professional experience in the oil and gas industry.*

## VISION AND MISSION

### VISION

We want to enable quality and stimulating support for our clients and to help them create and develop quality projects, as well as make the best business decisions.

### MISSION

With a multidisciplinary, innovative approach and proactive cooperation, we offer quality laboratory services to our clients and participate as an important stakeholder in business process improvement of the INA Group.

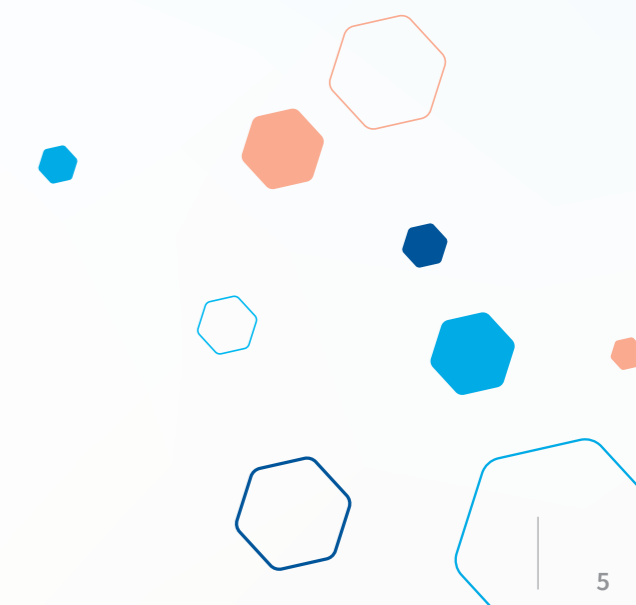
We develop socially responsible businesses through cooperation with the academic community, encouraging student practice and education.



## QUALITY ASSURANCE AND ACCREDITATION

Expertise in the implementation of certain analytical methods is confirmed by the Accreditation Certificate No. 1048 issued by the Croatian Accreditation Agency according to standard HRN EN ISO/IEC 17025:2017 for testing selected characteristics of natural gas, crude oil, lubricating oils, aqueous solutions of ethylene glycol and additives for crude oil.

Competency, systematic approach and quality in performing tasks have been confirmed by the ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 and ISO 50001:2018 certificates issued to INA, d.d.

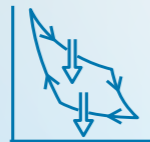


## EXPERT DISCIPLINES

Corrosion



Fluid characterisation



Geochemistry



Geology



Rheology



Thermodynamics - PVT

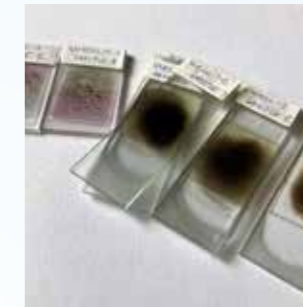


Petrophysics and core analyses



## SAMPLING AND SAMPLE PREPARATION

- Sampling of natural gas, gas condensate, crude oil, water and other process fluids on the field
- Rock sampling (wellsite, outcrop, core storage)
- Rock and fluid sample preparation for different laboratory analysis
- Recombination of reservoir fluids according to the production data

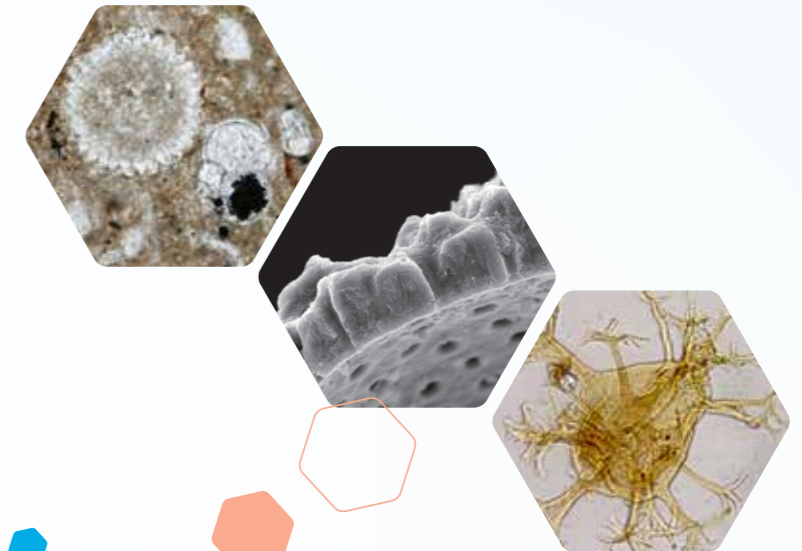
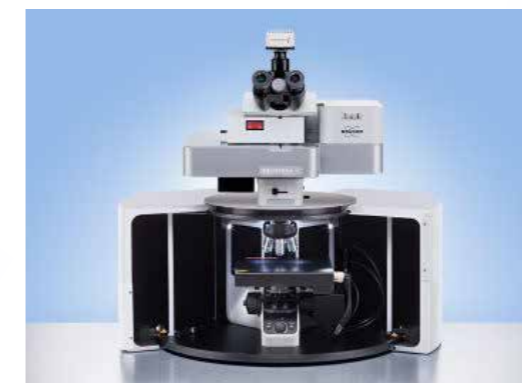
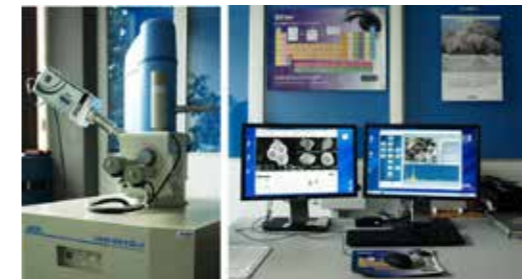


## GEOLOGY

We perform biostratigraphic, petrographic and sedimentological laboratory analyses and interpretation ranging from urgent preliminary analyses, detailed reports, studies, complex reviews of existing data to basin assessments and sedimentological modeling.

We are equipped with state-of-the-art laboratory equipment such as a scanning electron microscope (SEM/EDS), a Raman confocal microscope and a large number of optical microscopes for various purposes.

- Biostratigraphic analysis (chronostratigraphic determination, fossil content, paleoecology, palinofacies, interpretation of biofacies and paleoenvironment)
- Petrographic and sedimentological analysis (classification of rocks, mineral composition, structural and textural characteristics, UV inspection, diagenesis, provenance, grain size and shape, sorting, maturity, micro-porosity, SEM & EDS analysis, Raman mineral identification and phase analyses, digital image pore space phase analysis, interpretation of lithofacies and determination of depositional environments, construction of lithology columns)
- Sedimentological modelling (integration and interpretation of biostratigraphic, petrographic and sedimentological studies, geochemical, petrophysical and all other available data for the purpose of defining facies and their distribution)





## GEOCHEMISTRY

Organic geochemistry determines the distribution, composition, and fate of organic matter in the geosphere on both bulk and molecular levels, combining aspects of geology, chemistry and biology.

Geochemistry is primarily used in the process of petroleum exploration by providing source rock determination and petroleum potential evaluation, genetic hydrocarbon characterization and correlation, as well as detection of migration, alteration, and transformation of hydrocarbons phenomena.

### GEOCHEMICAL ANALYSES

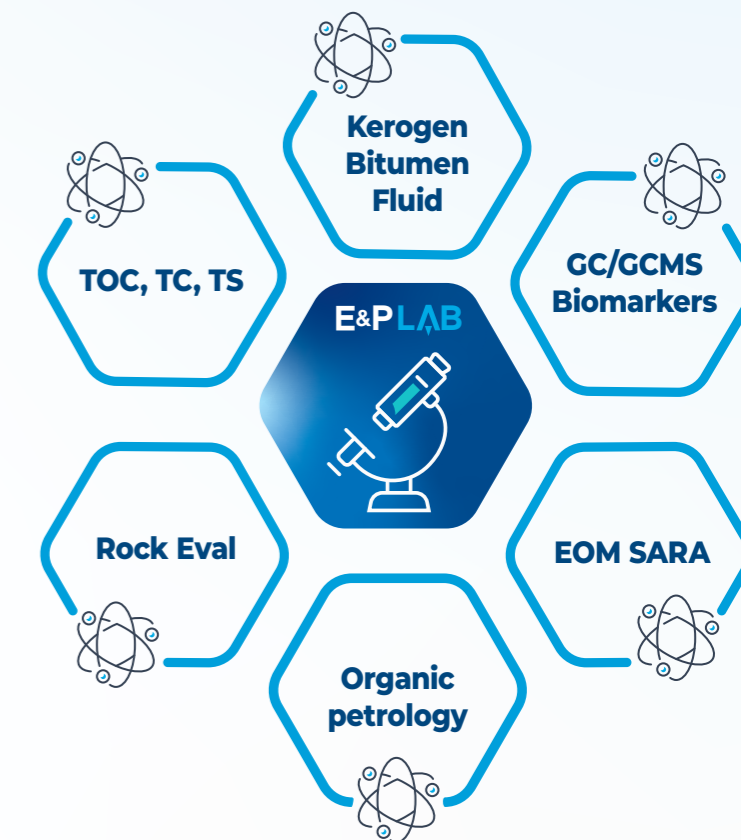
- Source rock determination
- Petroleum potential
- Organic facies, kerogen type
- Thermal maturity
- Geochemical characterisation of hydrocarbons
- Biomarker analyses
- Genetic correlation
- Migration and accumulation studies
- Reservoir geochemistry
- Definition of petroleum & geological relation, interpretation and reconstruction of depositional environment and depositional conditions, ecosystems

### GEOCHEMICAL MODELING

- Data integration and interpretation for basin modelling

### OTHER

- Chemical composition of rock and sludge
- Acid solubility test of rock and sludge
- Stabilization/solidification of drill cuttings
- Geochemical investigation of environmental pollution





## CORE ANALYSES

Measuring the petrophysical properties of cored material defines the pore space and its size, determines fluid saturation and the ability to produce hydrocarbons, obtain geothermal energy and store carbon dioxide.

A detailed understanding of oil and gas reservoirs, reservoir volume and reserves estimation with determination of production plan, requires additional precise measurements obtained on core samples utilizing special core analysis.

### ROUTINE CORE ANALYSES

- Total and spectral gamma log for precise core depth and log correlation
- Profile permeability on whole core
- Porosity and permeability at standard or reservoir conditions
- Grain density and grain-size distribution analysis
- MicroCT – Digital Rock Analysis

### SPECIAL CORE ANALYSIS

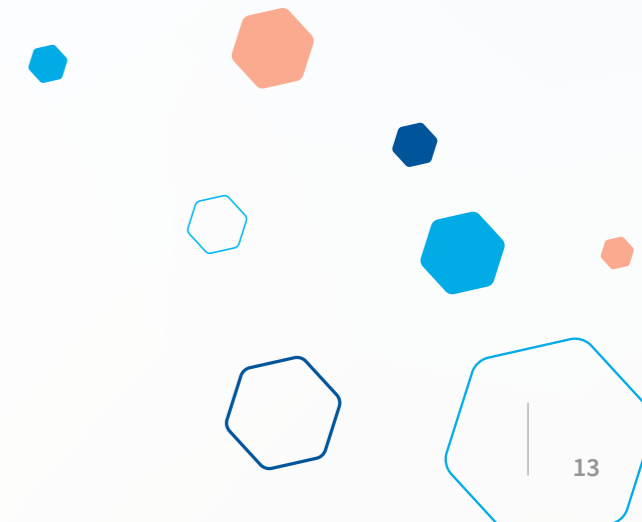
- Capillary pressure, formation factor and resistivity index
- Relative permeability at standard or reservoir conditions for implementation in reservoir simulation
- Specific permeability
- Pore volume compressibility
- Caprock analysis for underground gas storage
- Permeability change test & return permeability

### DIGITAL ANALYSES OF ROCKS AND POROUS MATERIALS

Digital analyses provide an in-depth insight into the structure and pore space of the scanned sample. We use nondestructive methods, i.e. SEM and micro tomography (x-CT), to create 3D digitized models suitable for digital analyses and simulations.

Most valuable rock properties obtained by digital analyses are:

- Porosity and permeability
- Distribution of pore and throat size
- Distribution of grain size
- Capillary pressure
- Electrical properties and tortuosity
- Geomechanical properties



## EOR, CCUS & GEOTHERMAL PROJECTS

The EOR (Enhanced Oil Recovery) project is one of INA's most important investment projects in continental Croatia with the aim of obtaining additional quantities of hydrocarbons at the Žutica and Ivanić exploitation fields.

We provide a day-to-day intensive support for the successful implementation of field optimization and well stimulation projects in onshore oil and gas fields.

Our laboratories have state-of-the-art-equipment for the application of new technologies in the field of EOR, CCUS and GT projects.

### EOR STUDIES (INJECTION OF CO<sub>2</sub>, N<sub>2</sub>, METHANE, RICH OR LEAN GAS)

- EOR solubility study and swelling test
- EOR waterflooding, polymer and or surfactant injection study

### SPECIAL STUDIES OF RELATIVE PERMEABILITIES

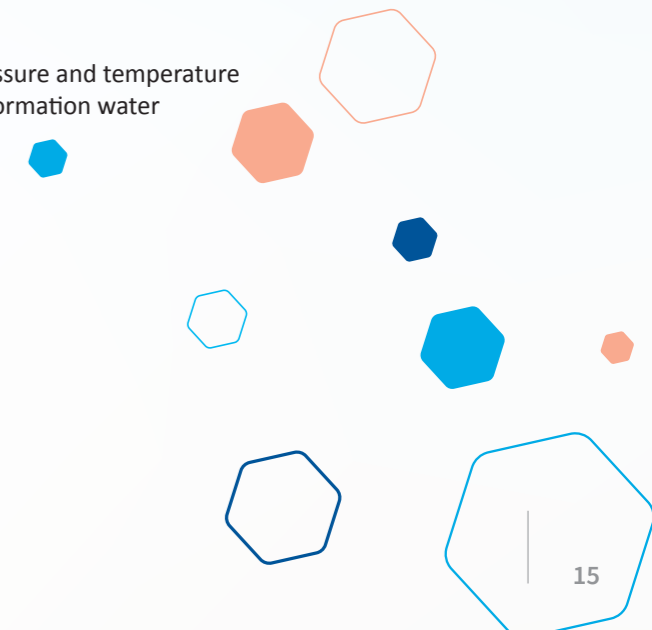
- Gas Condensate Blockage Study
- Steady state & unsteady state oil/water and gas/oil relative permeability test at reservoir conditions

### ADVANTAGES OF USING STATE-OF-THE-ART TECHNOLOGIES

- The best possible solution for maximum exploitation of old wells and reservoirs
- Extend the lifetime of mature oil and gas fields
- Lower the carbon footprint with an active participation in the green transition
- Using existing infrastructure and knowledge to create additional values
- Gaining of extra profit and savings by implementing the best possible solutions based upon conducted laboratory studies

### GEOTHERMAL STUDIES

- Phase behavior of the geothermal formation water under reservoir pressure and temperature
- Determination of the amount and composition of gas dissolved in the formation water
- Experimental studies on corrosion inhibition
- Experimental study of scale inhibitors







## PVT ANALYSES

PVT analyses are one of the most important analyses in reservoir characterization, and they must be performed immediately at the beginning of the production life of the reservoir. With the obtained experimental data, it is possible to create an accurate thermodynamic model of the reservoir fluid and use it to describe the behavior of the reservoir fluid. Furthermore, additional PVT studies in combination with petrophysical tests allow the application of secondary and tertiary methods of increasing the depletion. In terms of experimental fluid characterization, we are implementing tailored workflows for investigation of reservoir oil, gas-condensate or brine samples, either taken as the separator or downhole fluids. Using the PVT laboratory results it is possible to estimate the reserves of oil and gas and to forecast reservoir fluid's properties within reservoir simulation models.

### Reservoir Oil:

- Wellstream analysis – determination of reservoir fluid composition
- Constant Composition Expansion test (CCE)
- Differential Liberation (DL)
- Separator test

### Gas-condensate

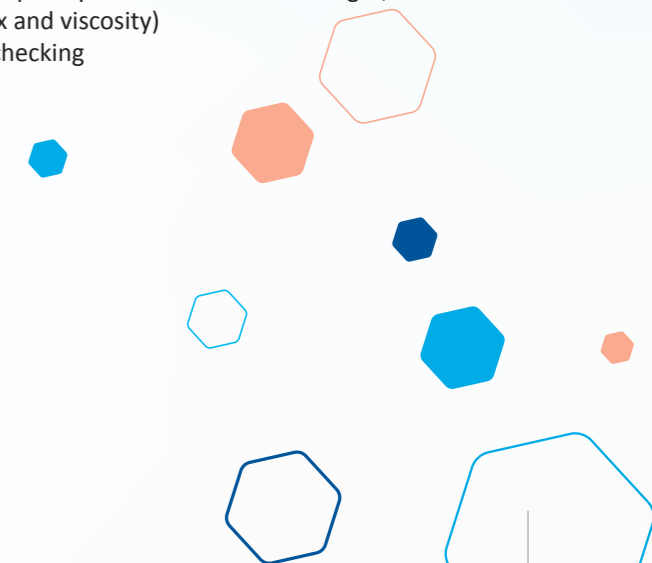
- Wellstream analysis – determination of reservoir fluid composition
- Constant Composition Expansion test (CCE)
- Constant Volume Depletion (CVD)

### Individual analyses

- Basic and extended composition analyses (gas chromatography, GC) of liquid hydrocarbons and natural gas, with calculation of its properties (heating values, density and specific density, Wobbe index and viscosity)
- P-V curve and flash test on separator or downhole samples for quality checking
- Determination of liquid density at standard or HPHT conditions
- Fractional distillation of liquid hydrocarbons (C7+, C10+ methods)
- Viscosity of reservoir fluids at different HPHT conditions
- Separator fluid recombination

### PVT STUDIJE

- EOS characterization – equation of state (PVT software)
- complete PVT study of oil, gas condensate or gas



## CORROSION MONITORING

Since in the oil industry, metals are exposed to corrosion, the continuity of operation of process plants and the safety of people involved in the process are disrupted.

In order to prevent and reduce the effect of corrosion, we use different methods and techniques, as well as the most modern laboratory equipment.

The use of appropriate methods for corrosion control and monitoring on selected materials quantitatively measures the degree of corrosion, enables quality corrosion management as well as protection of oil, gas and other infrastructure systems.

The most commonly used methods of monitoring and testing corrosion effects are:

- Fluid corrosion testing in the atmospheric and elevated p, T conditions
- Efficiency testing of the corrosion inhibitor in the atmospheric conditions and elevated p, T conditions
- Material resistance testing to the corrosive activity
- Analysis of well stimulation fluids, packer fluid corrosion test
- Solving corrosion problems in the production, transport and fluid storage
- The pilot station for corrosion evaluation and Corrosion monitoring in the field

*3.5% of the world's GDP is lost annually through corrosion.*

## FLUID CHARACTERISATION AND RHEOLOGY

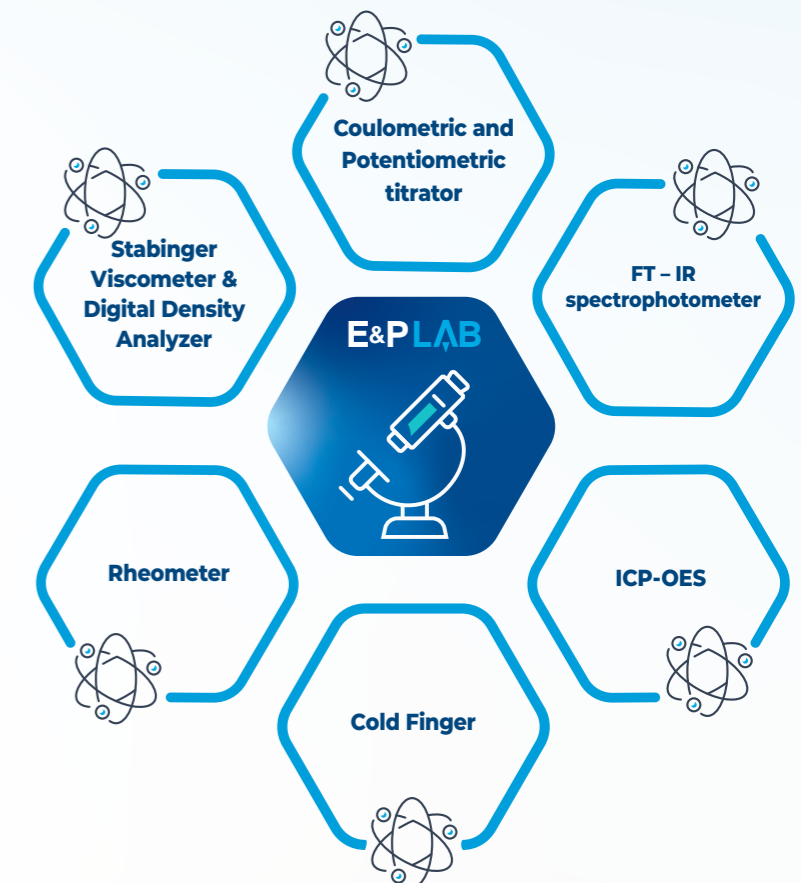
The characterization of crude oil and gas condensate enables to classify them taking into consideration their physical and chemical properties. The properties of crude oil and gas condensate are very important in the design and operation of almost every piece of equipment in the oil industry. According to standard ASTM, ISO and UOP methods, the following characteristics are determined for this purpose: density, viscosity, content of paraffin wax and asphaltenes, distillation curve, content of sulfur, pour point, content of water, etc.

The transport of crude oil must be achieved with minimal energy consumption. Therefore, one of the conditions for the unobstructed transportation of crude oil with an increased content of paraffin wax is the prior modification of crude oil rheological properties. In addition to the rheological properties of untreated crude oil samples (flow curve, viscosity curve, wax appearance temperature, Cold Finger analysis), the rheological properties of crude oil samples with the addition of additives are also determined (pour point depressant, demulsifier, deparaffinator, paraffin inhibitor, etc.) in order to improve the rheological crude oil properties.

The content of hydrogen sulfide and thiols in natural gas and gas condensate is monitored. In laboratory, monitoring of lubricating oils, water solutions of ethylene glycol (antifreeze) and triethylene glycol from process equipment is carried out in order to optimize their consumption and monitor the condition of process equipment (corrosion), as well as the efficiency of equipment and processes.

## WATER ANALYSES

For the purpose of characterisation of formation, process and other industrial waters, monitoring production processes and corrosion, water analyses are carried out and include pH-value determination, electrical conductivity, salinity, analysis of anions and metals, hydrogen sulfide, carbon dioxide and other parameters.



## REFERENCE LIST



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