



# TECHNICAL UNIVERSITY OF CRETE

Mineral Resources Engineering Department



PVT & Core Analysis Lab

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**PVT experimental setup**



**Reactor experimental setup**

- ✓ *PVT and phase behaviour laboratory measurements of reservoir fluids*
- ✓ *Measurements of Physical Properties of Petroleum and its Fractions*
- ✓ *Thermodynamic behaviour and dissociation kinetics of gas hydrate contained in sediments*
- ✓ *Asphaltenes deposition studies*
- ✓ *PVT simulation models based on EOS and ANN (MLT)*
- ✓ *Catalytic Processing of hydrocarbon mixtures*
- ✓ *Determination of Oil Pollutants in the environment*

**The PVT and Core Analysis Laboratory of the Mineral Resources Engineering Department of the Technical University of Crete was founded in 1991 and is housed in specially designed and comfortable premises in the University Campus of Chania situated in the island of Crete, Greece. Its major areas of activities currently are:**

✓ *Phase Equilibria and Thermodynamic Behaviour (PVT) Studies of Mixtures of Multiphasic Fluids at High Pressures and Temperatures*

The laboratory equipment includes a dual visual cell system installed in a thermostatically controlled airbath.

- Max working pressure : 520atm
- Max working temperature: 150°C.

**The experimental system is unique in Greece and has already been used to perform complete PVT studies on samples recovered from oil and gas condensate reservoirs.**

✓ *Compositional Analysis and Characterisation of Gas and Liquid Petroleum Samples*



**Oil / Gas composition analysis room**

- Gas Chromatograph-Mass Spectrometer,
- Fisson MD-80
- HPLC Waters with UV-DAD, RI, IR and ELS detectors
- Dual Gas Chromatography system Perkin Elmer 8700 equipped with FID, TCD and detectors
- FTIR, Perkin Elmer Spectrum 1000
- Pyrolysis unit CDS 1000 coupled to GC-MS
- Purge & Trap coupled to GC-MS

## ✓ *Reservoir Core Analysis Studies*



**Core permeability experimental setup**

- Porosity
- Absolute and relative permeabilities
- Fluid saturations
- Capillary pressure
- Wettability of the rock-fluids system
- Core flooding

## ACTIVITIES

- Phase equilibria and thermodynamic behaviour (PVT) studies of mixture of multiphase fluids at high pressures and temperatures.
- Compositional analysis and characterization of gas and liquid petroleum samples.
- PVT properties simulation models based on EOS and ANN
- Experimental determination of gas hydrate phase equilibrium at three (V-L-H) and two (L-H) phase region at high pressures.
- Experimental study of gas hydrate equilibrium inside porous media of berea sandstone cores and clayish sediments at high pressures.
- Compressibility study of clay sediments which contain gas hydrates at high pore pressures.
- Experimental determination of GH formation curve of gas azeotrope mixtures.
- Reservoir Core analysis studies.
- Measurements of Physical properties of Petroleum and its Fractions.
- Phase equilibria simulation of hydrocarbon mixtures
- Catalytic processing of hydrocarbon mixtures
- Asphaltenes deposition studies.

## **SPECIALTY EQUIPMENT & INFRASTRUCTURE**

- Equipment for evaluating phase equilibria and thermodynamic behaviour (PVT) of multiphasic mixtures at high pressures and temperatures, including a dual visual cell installed in a thermostatically controlled airbath
- Slim tube equipment for determining the minimum miscibility pressure of multiphasic mixtures at high pressures and temperatures.
- Isco syringe pump model 500D, max working pressure 260bar
- Isco syringe pump model 260D, max working pressure 530bar
- A high pressure multi-port core holder, biaxial loading.
- Autoclave reactor model Parr 4565M equipped with magnetic stirrer
- Gas booster model Haskel AGT 62/152H, max working pressure 1720bar
- Gas Chromatographs-Mass Spectrometers (GC-MS) Fisson MD-800 and Agilent Technologies CG 7890A / inert XL MSD 5975C.
- Gas Chromatographs (GC), HP5890 and Perkin-Elmer-8700
- Purge & Trap device for sample injection in GC ή GC-MS
- Pyrolysis gas chromatography unit (Py-GC)
- Thermal desorption device for sample injection GC ή GC-MS
- Liquid Chromatograph (HPLC) Waters 600, equiped with photodiode array detector Waters 996, differential refractometer detector Waters 410, evaporating light scattering detector PL-ELS 1000 and infrared detector FOXBORO.
- Infrared Spectrometer (FT-IR) Perkin-Elmer Spectrum 1000.
- Rock-Eval II pyrolysis system, DELSI Instruments RE 1000, for the characterization of organic matter in rocks and soils.
- Solid Phase Micro Extraction (SPME) and Solid Phase Extraction (SPE), for the extraction of volatile aromatic hydrocarbons from water and soil samples.
- Organic Elemental Analyzer FLASH 2000 Series - CHNS/O, for the determination of carbon, hydrogen, nitrogen and sulfur / oxygen concentration of organic mixtures.

## **RESEARCH AND DEVELOPMENT PROJECTS**

1. “MOREOIL , Evaluation of the Miscible Gas Injection In Oil Reservoirs by Monitoring the Asphaltenes Concentration”, Funded by: EU
2. “ANAXIMANDER, Exploration and Evaluation of the Eastern Mediterranean Sea Gas hydrates and the Associated Deep Biosphere”. Funded by : EU
3. Development of a set of ANN models to predict the volumetric ratios and the physical properties of the phases flowing through the Vx multiphase flowmeter. Funded by Schlumberger

4. Development of a set of ANN models to predict k-values during reservoir simulation, Funded by KAPPA
5. Development of an ANN model to predict the PVT properties of the MDT/OFA downhole samples. Funded by Schlumberger
6. Development of a fully automated data processing system for gas chromatographs based on machine learning methods. Funded by Schlumberger
7. Development of a method to estimate the shrinkage factor range for recovered reservoir fluid samples. Funded by Schlumberger
8. Experimental measurements and testing of core plugs recovered by the Epsilon-1 well. Funded by Energean.
9. SARA Analysis of solid deposits and crude oil from the Prinos field well PA-35. Funded by Energean
10. "Increase of the domestic capacity recycling used mineral oils" Funded by: General Secretary of Research and Technology
11. "Development of a neural network model for the determination of PVT properties of hydrocarbon fluids" Funded by: Schlumberger
12. "Development and pilot application of a completed system for the optimization of lubricants production in the refinery of MOTOR OIL Hellas" Funded by: General Secretary of Research and Technology
13. "Experimental study of the fluid properties of the exploratory well Epsilon-1", Funded by: KAVALA OIL
14. "Physical bioremediation of organic pollutants in the subsoil and in water reservoirs" Funded by the General Secretary of Research and Technology
15. "Feasibility study for the determination of the mud filtrate contamination of reservoir fluid samples" Funded by: OILPHASE
16. "Experimental study and modeling of GH formation conditions and migration mechanisms in marine sediments and the associated release of the enclathrated gas in marine environment" Funded by: European Social Fund & National Resources EPEAEK II \_ PYTHAGORAS.II.
17. "Hydrate Autoclave Coring Equipment System" Funded by: EU, Sustainable Marine Ecosystems MAST3 (EVK3-2000-00549).
18. "Study of the influence of mineralogy and overburden pressure on the phase behavior and formation kinetics of structure II gas hydrates contained in marine sediments." Funded by: EU Research Access to the European infrastructure for energy reserve optimization, EIERO.
19. "Determination of reservoir wettability. Study of surface effects in oil-water-rock systems and of their effect in oil production". Funded by: Research Committee , Technical University of Crete
20. "Geochemical study of the oil produced in exploratory well PN-2 in North Prinos reservoir". Funded by: Wintershall AG, Kassel
21. "Experimental study of the rock properties of the exploratory well PN-2 in North Prinos reservoir", Funded by: North Aegean Petroleum Corporation (NAPC)

22. "Experimental study of the fluid properties of the exploratory well PN-2 in North Prinos reservoir", Funded by: North Aegean Petroleum Corporation (NAPC)
23. "Experimental and theoretical study of the behaviour of gas condensates PVT mixtures fluid properties in the North Sea", Funded by: Delft University
24. "Evaluation of the fluid of the production well PN-2 in North Prinos reservoir", Funded by: North Aegean Petroleum Corporation (NAPC)
25. "Experimental study of asphaltenes composition and development conditions for the oil produced in North Prinos reservoir", Funded by: North Aegean Petroleum Corporation (NAPC)
26. "Development of a novel process for seawater desalination and condensation of water solutions and waste water effluents by using GH".  
Funded by: European Social Fund & National Resources EPEAEK II \_ ARCHIMIDIS II.
27. Evaluation of all the PVT reports issued for the Prinos Reservoir. Funded by North Aegean Petroleum Corporation (NAPC)