

## Short Description

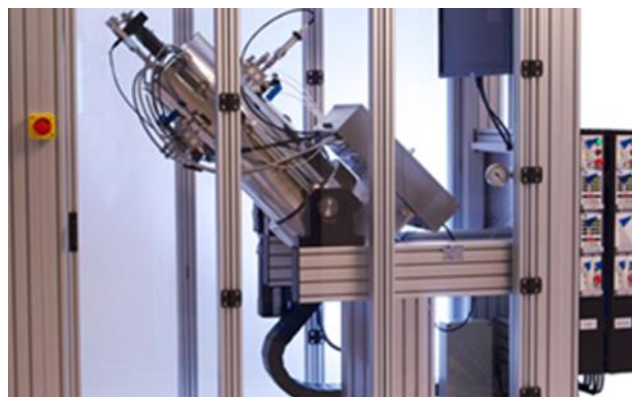
Experimental determination of pressure and temperature regions with liquid-vapor transitions in reservoir fluids and property measurement at relevant conditions for reservoir and production operations

## Deliverable

A report with data related to the determination of liquid-vapor equilibria at low and high pressure, with live reservoir fluids, including compositional analysis of the resulting streams

## Benefits

- In-house workflow to optimize cost by establishing a sequential approach from constant mass tests to depletion tests
- Integrated experimental campaign within the same lab as geochemistry and flow assurance
- Simultaneous QA&QC and modeling work to facilitate consistency
- Capability to work with visual / blind cell, depending on fluid type
- Tests in workflow may include swelling tests for EOR



High pressure visual cell (Sanchez)

## Differential Features

- Laboratories (CoreLab, SLB) do not work in an integrated manner among PVT, geochemistry and solid formation tests, which is facilitated in TechLab
- Capability to characterize samples with low volumes (200-300 cc) in some stock tank oil characterizations that typically need liters.
- Modeling expertise that combines liquid-vapor with solid formation of both aqueous and hydrocarbon phases to complete the analysis while the sample is in the lab
- Capacity to work with representative samples or synthetically generated mixtures with real atmospheric liquid and a model gas sample



Visualization of liquid-vapor interface in PVT Test. The cell comes with an interpretation software to establish volumetrics



## Requirements

- Samples of stock tank oil (Atmospheric)
- Samples of live fluid or separator gas and liquid
- Field reference conditions (pressure temperature of reservoir, wellhead and separator)

## Limitations

- Temperature up to 200 °C
- Pressure can reach up to 24000 psia
- Recommended mud contamination at less 10 wt.% for MDT Sample.
- High Viscosity (Extra Heavy Oil) and low API degree require the use of the blind cell

## The Product in Depth

Depending on the objective of the study, the workflow can be adapted, but the following steps are generally followed: Initially, samples are restored to reservoir conditions, leaving them for some days to adjust and re-dissolve any phase so that the fluid is monophasic.

An aliquot is extracted so that the composition of the fluid is measured after generating atmospheric samples upon depressurization of the containers. This is done with the help of a gasometer and via chromatography of the gas and liquid phases.

Another sub-sample is sent to the PVT cell for the volumetric tests to determine saturation pressure, densities, and gas-oil ratios representing the path of the fluid in the production system (3 CCE tests), and the impact of depletion (CVD / DL tests), and in the facilities (separator test).

200-300 cc are spared to characterize the stock tank oil, following an in-house protocol with distillation of cuts thru a mini-TBP column, and characterization of the resulting streams in terms of density, viscosity and molecular weight.

## Some Use Cases

- *Pao de Açucar, Seat : Waxy Gas Condensate and Volatile oil where the analyses in the visual cell evidenced the cha*
- *Leon (GoM): Testing at the maximum of the available pressure (reservoir at 28 000psia).*
- *Tuttu (Alaska, USA) and Akacias: Analysis of Extra Heavy Oil (API <10) with an in-house protocol to assess the dynamic effects of transportation into the saturation pressure*
- *CKN (Vietnam): Bottomhole samples contaminated by water in a set of very lean gas condensates (GOR > 100000 scf/stblenges for low temperature*

