

High-pressure PVT and thermophysical properties

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Operated by

Description

High-pressure PVT and thermophysical properties

The PVT apparatus is designed for studying high-pressure phase equilibrium and phase transition of fluid mixtures, including mixtures encountered in CO₂ transport and storage. The PVT apparatus is equipped with other supporting units, which can be operated individually for measuring various thermophysical properties. In general, the facility can be used to study phase behaviour in CO₂ transport and storage and to measure the relevant density, viscosity, heat properties.

The PVT apparatus 240/1500 FV from Sanchez Technologies has a stainless-steel cell with a motor driven piston at one end to vary the cell volume precisely. It has a maximum volume of 240 cm³ and can operate up to 200 °C and 150 MPa. There is a sapphire window at the other end of the cell which allows visual observation of all the space inside the cell. The sample inside the cell can be agitated by means of a mechanical stirrer attached to the head of the piston. The stirrer has retractable blades to reduce the dead volume of the PVT cell. The apparatus can be used for phase equilibrium and phase transition studies for high-pressure fluid mixtures in general.

The system is equipped with other supporting units: a recombination unit for high-pressure fluid mixtures, a gas meter for measuring released gas from samples, a high-pressure pump with a filter for organic deposit study, a high-pressure capillary viscometer, a high-pressure vibrating tube density meter, and a Setaram C80 calorimeter. In addition, we also have low-pressure density and viscosity meters, and a quartz crystal resonator for viscosity measurement. This allows for a systematic study of phase equilibrium and thermophysical properties (density, viscosity, heat properties).

Scientific Environment

The facilities at the CERE PVT laboratory are supported by skilled technical and scientific staff. They have been used for various projects and therefore under constant use and maintenance. They are often used in connection with other facilities in the same lab including various analytical instruments and core flooding units.

State of the Art

The PVT 240/1500 FV works up to 200 °C and 1500 bar with full visibility and small dead volume. The density meter can work up to 200 °C and 1400 bar. The viscosity

CCUS Technologies

Storage

- Pressure/injection
- Dynamic modelling

Feedstock

- H₂ Transport
- CO₂ Transport

Research Fields

- Modelling
- Physical processes
- Engineering
- Thermodynamics

Scale of Facility

- Lab Scale
- TRL 4-6
- Simulation

Research Facility

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meter can work up to 200 oC and 1500 bar. The calorimeter with specially designed cells can work for high pressures (maximum pressure depending on mixtures).

Areas of Research

The facility can be used for studying CO₂ storage in depleted oil reservoirs, phase behavior of fluid mixtures containing CO₂ in storage and transport, and a more generic study of phase equilibrium and thermophysical properties of fluid mixtures related to CCS. Some typical measurements include

- Phase behavior of CO₂-oil mixtures like saturation pressures, swelling tests, routine petroleum PVT (constant composition expansion, differential liberation, and constant volume depletion).
- Density, viscosity, and heat properties of CO₂-hydrocarbon mixtures, CO₂-brine mixtures, and potentially hydrogen containing mixtures.
- Reaction heat for CO₂ capture systems.
- Phase behavior of CO₂-brine like solubility (measured in a different unit).
- Compositional analysis using various instruments including GC of gas mixtures, simulated distillation of hydrocarbon liquids, and physical distillation of hydrocarbon liquids or similar mixtures.

These units can also be utilized for customized studies on special fluid mixtures.

Facility Availability

Unit of Access (UA)

Day

Availability Per Year (in UA)

90 days

Forms of Access

In Person, Contract Research, Cooperative Research

Present Facility State of Access

Fully Accessible

Expected Duration, Reason and Impact on Services Until Access is Fully Restored

Dependent on other projects

Average Duration of a Typical Access

30 days

Operational or Other Constraints

Specific Risks

none

Legal Issues

none

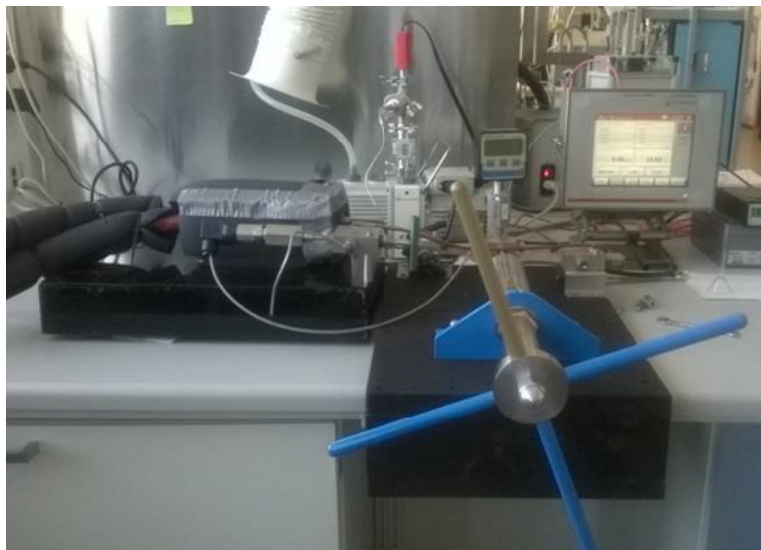
Figures



DTU

High-pressure PVT 240/1500 FV for phase behaviour study

High-pressure vibrating tube density meter



DTU



High-pressure calorimeter for measurement of heat properties

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High-pressure capillary viscometer



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