

# PCTPro-E&E

Volumetric Sorption Measurements



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## From vacuum to high pressure

- Precision volumetric measurements of gas sorption
- Multiple gas system
- Pressure-composition isotherms (**PCT**)
- Kinetic measurements
- Cycling reversible reaction measurements
- Sorption gas analysis

Hy-Energy  
K&P Technologies

 **SETARAM**  
Instrumentation  
K&P Technologies

The **PCTPro-E&E** is a fully automated Sievert's instrument for the measurement of gas sorption properties of different materials. With its ability to rapidly switch between gases and wide range of sample holders it is ideally suited for the fast growing field of Energy & Environment, specifically for the study of CCS (carbon capture and sequestration) and methane sorption onto geological substrates.

## The HIGHLIGHTS

### Volumetric Sorption technique

- **Incomparable versatility:** the **PCTPro-E&E** operates from vacuum to high pressure (200 bar) on multiple volume Gas Doser (5 to 1200 ml) to tackle a wide variety of applications. Moreover the **PCTPro-E&E** is designed to study sorption of a large choice of gases (Carbon Dioxide, Methane, Nitrogen, Argon, Hydrogen,...).
- **Wide range of temperature:** the **PCTPro-E&E** covers a temperature range from -260°C to 500°C with different optional sample holders.
- **Large variety of samples:** the **PCTPro-E&E** is designed to work on powders (CO<sub>2</sub> storage materials, catalysts), on fibers (carbon), on thin films (food and pharmaceutical packagings, electronics), in liquids (CO<sub>2</sub> capture solvents).
- **Highly automated:** Automatic pressure range switching is available between high and low pressure transducers (from 0.001 to 200 bar). The **PCTPro** software includes 13 automated processes for system preparation, sample preparation and 4 types of measurements (kinetics, PCT, cycling kinetics and cycling PCT).
- **Portable equipment:** the **PCTPro-E&E** is portable and can be combined with other characterization techniques (X-Ray, neutron diffraction).

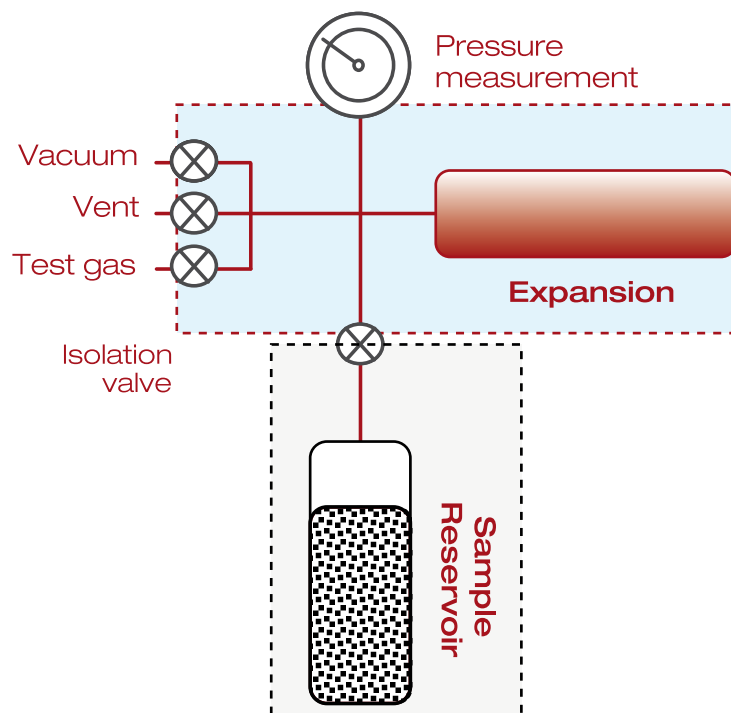
## PRINCIPLE

The **PCTPro-E&E** is based on the Sievert's method.

A sample at known pressure and volume is connected to a reservoir of known volume and pressure through an isolation valve.

Opening the isolation valve allows new equilibrium to be established.

Gas sorption is determined by difference in actual measured pressure ( $P_f$ ) versus calculated pressure ( $P_c$ ).

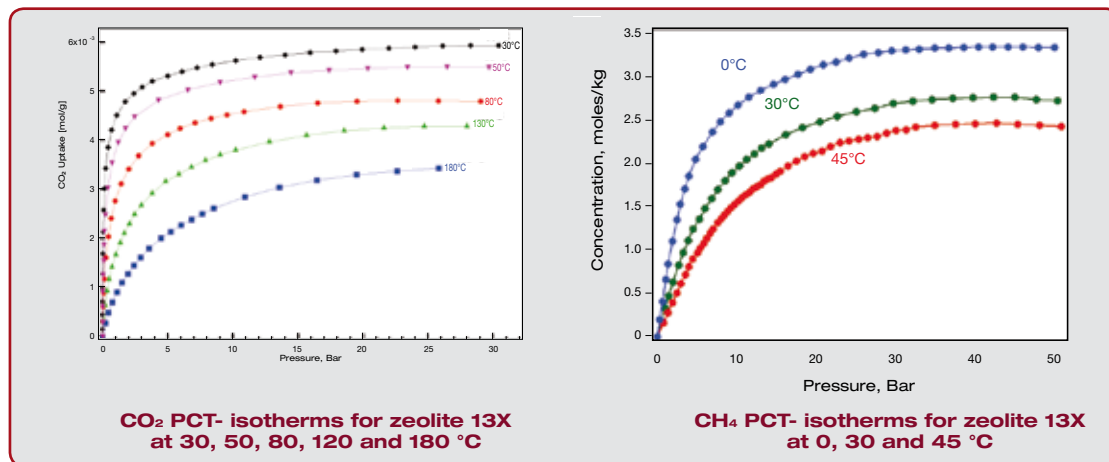


## TYPES OF SORPTION MEASUREMENTS

**PCTPro-E&E** is designed for the measurements of gas sorption on a single sample with a wide range of multiple dosing volumes combined with PID Pressure and PID Temperature control systems. Types of measurements include:

- **Temperature programmed desorption (TPD)** dynamic measurements
- **True kinetics and rate constants** over the full sorption or desorption range as a function of pressure and temperature
- **Pressure-Composition Isotherms (PCT, PCI)** for determination of equilibrium temperatures, pressures, and thermodynamics (figure below).
- **Charge and discharge cycling** with repeated kinetic measurements to study long-term cycling effects on capacity and kinetics.

The **PCTPro E&E** is well suited for gas-solid sorption in any forms (powders, bulk, films), as well as gas-liquid sorption.



## ACCESSORIES

Six different sample cells are available for airless transfer capability:

- **Standard Stainless Steel sample holder** for 200 bar and 400°C
- **Stainless Steel High-temperature sample holder** for 100 bar and 500°C
- **Liquid sample holder** for 100 bar and 400°C
- **Thin Film sample holder** for 100 bar and 400°C
- **CryoPro**: the low temperature solution from -260°C to 100°C for 200 bar
- **MicroDoser**: the very small sample solution (from 1 to 500 mg)

## THE RGAPro MASS SPECTROMETER FOR SORPTION GAS ANALYSIS



RGAPro

The **RGAPro** is a stand-alone residual gas analyzer designed to work with the **PCTPro-E&E** or any other gas reaction/handling systems for real-time compositional analysis. Incorporating a quadrupole mass spectrometer, the **RGAPro** has the ability to measure gases at pressures ranging from Ultra High Vacuum to High Pressure (200 bar) without impacting primary process measurements.

## Applications

The **PCTPro-E&E** enables detailed characterization of the sorption properties of a wide range of materials including the following examples:

### Gas-reaction compounds and high surface area adsorbents:

- Carbon materials (nanopowders, films, fibers, nanotubes)
- Adsorbents for CO<sub>2</sub> storage and separation
- Activated alumina (gas and liquid purification)
- Molecular sieves (zeolites, MOF's, etc. for gas separation and vapor removal)
- Methane adsorption on substrates

**Catalysts:** activity, surface area, pore size distribution

**Packaging:** accurate measurement of the transport of moisture and gas in the packaging (food, pharmaceutical)

**Pharmaceutical compounds:** sorption and transportation of moisture and organic vapors

View the application notes in your field, available for download, by visiting [www.setaram.com](http://www.setaram.com)!

A huge database is in the [Application Library](#) area of our website. We have also included a powerful search engine that will enable you to find the most applicable data.

## Specifications

Temperature range	- 260°C to 500°C with different sample holders options
Calibrated reservoirs	5 high pressure calibrated volumes
Operating pressure range	From vacuum to 200 bar Pressure regulation: automated PID software controlled Aliquot sizing – Fixed P, ΔP or f(ΔP)
Pressure measurements	4 pressure transducers Pressure regulation: 2 transducers for vacuum to 200 bar Experiment pressure: 1 transducer for vacuum to 200 bar 1 transducer for vacuum to 5bar Accuracy: 1% of the reading
Maximum sensitivity	3 μmole of gas (with the MicroDoser attachment)
Sorption Gas	Carbon Dioxide, Methane, Nitrogen, Argon, Hydrogen...



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