

# PCTPro

Volumetric Sorption  
Measurements  
by Setaram



A trademark of KEP Technologies group

# PCTPro



The PCTPro 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), methane sorption onto geological substrates, and porous solids characterization.

## HIGHLIGHTS include:

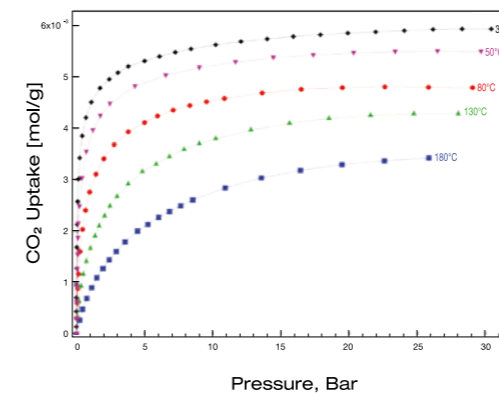
- **Incomparable versatility:** the PCTPro operates from vacuum to high pressure (200 bar) on multiple volume gas doser (5 to 1200 ml) to tackle a wide variety of applications. Moreover the PCTPro is designed to study sorption of a large choice of gases (Carbon Dioxide, Methane, Nitrogen, Argon, Hydrogen,...).
- **Wide range of temperature:** the PCTPro covers a temperature range from -260 °C to 500 °C with different optional sample holders.
- **Large variety of samples:** the PCTPro is designed to work on powders (CO<sub>2</sub> storage materials, catalysts, MOFs), on fibers (carbon), on thin films (food and pharmaceutical packagings, electronics), in liquids (CO<sub>2</sub> capture solvents), coatings etc...
- **Highly automated:** automatic pressure range switching is available between high and low pressure transducers (from 0.001 to 200 bar). The PCTPro software includes 15 automated processes for system preparation, sample preparation and 4 types of measurements (kinetics, PCT, cycling kinetics and cycling PCT).
- **Portable equipment:** the PCTPro is portable and can be combined with other characterization techniques (X-Ray, neutron diffraction, calorimetry).

## TYPES OF SORPTION MEASUREMENTS

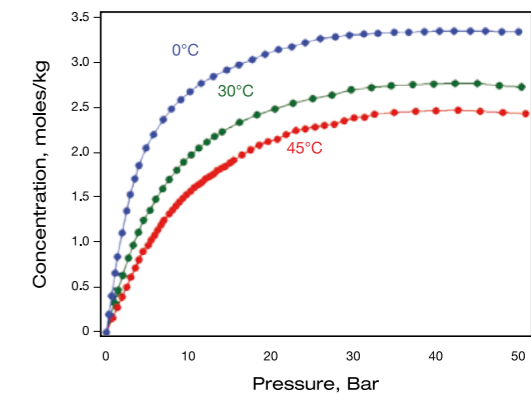
PCTPro is designed for the measurements of gas sorption on a single sample with a wide range of multiple dosing volumes combined with PID Pressure and PID Temperature control systems. Types of measurements include:

- **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 in adsorption or desorption mode).
- **Charge and discharge cycling** with repeated kinetic measurements to study long-term cycling effects on capacity and kinetics.

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



CO<sub>2</sub> PCT- isotherms for zeolite 13X at 30, 50, 80, 120 and 180 °C



CH<sub>4</sub> PCT- isotherms for zeolite 13X at 0, 30 and 45 °C

## ACCESSORIES

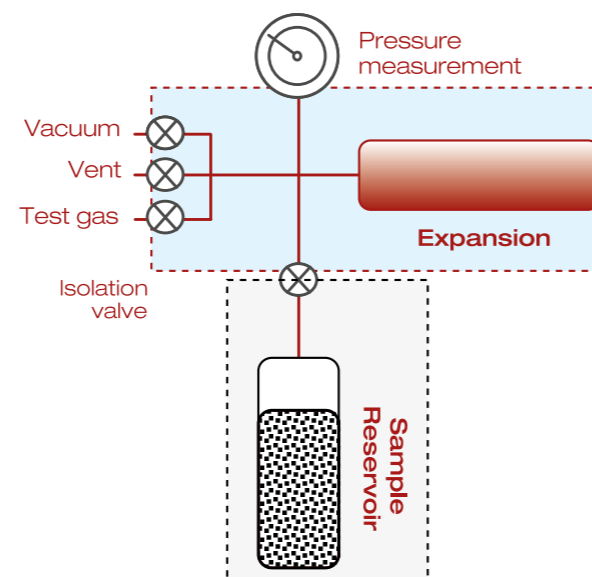
- **Standard Stainless Steel sample holder** for 200 bar and 400 °C
- **Stainless Steel High-temperature sample holder** for 100 bar and 500 °C
- **Small/Large sample holders** for the best flexibility against sample size and heterogeneity
- **Liquid sample holder** for 100 bar and 400 °C
- **Thin Film sample holder** for 100 bar and 400 °C
- **CryoPro** for low temperature from -260 °C to 100 °C for 200 bar
- **MicroDoser** for very small sample (from 1 to 500 mg)

## PRINCIPLE

The PCTPro 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 (Pf) versus calculated pressure (Pc).



## THE RGAPro MASS SPECTROMETER FOR SORPTION GAS ANALYSIS

The RGAPro is a stand-alone residual gas analyzer designed to work with the PCTPro 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.



See PCTPro application notes

## APPLICATIONS

The PCTPro 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 gas in the packaging (food, pharmaceutical)

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

<b>Temperature range</b>	-260 °C to 500 °C with different sample holders options
<b>Calibrated reservoirs</b>	5 high pressure calibrated volumes
<b>Operating pressure range</b>	From vacuum to 200 bar Pressure regulation: automated PID software controlled Aliquot sizing – Fixed P, ΔP or f(ΔP)
<b>Pressure measurements</b>	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 5 bar Accuracy: 1% of the reading
<b>High accuracy option</b>	Accuracy < 0,12% of the reading (vacuum to 18 bar) Accuracy < 0,025% full scale (vacuum to 200 bar)
<b>Maximum sensitivity</b>	3 μmole of gas (with the MicroDoser attachment)
<b>Sorption gas</b>	Carbon Dioxide, Methane, Nitrogen, Argon, Hydrogen, Deuterium, Helium, Oxygen, Neon, Ammonia, n-alkanes from C2 to C6, more on request.

Option : AKTS Thermokinetics software for comprehensive investigation of reaction or decomposition 

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