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# XEMIS

NEXT GENERATION GRAVIMETRIC  
SORPTION ANALYZER

Hidden Isochema is a world leader in the design and manufacture of high accuracy sorption instruments for research, development and production applications in materials science and related fields.

**IGASORP**  
Dynamic Vapor  
Sorption Analyzer



**XCS**  
Climate Control  
Systems



**ABR**  
Automated Breakthrough  
Analyzer



**XEMIS**

Next Generation Gravimetric  
Sorption Analyzer



**IMI**

High Accuracy Hydrogen  
Storage Analyzer



**MBR**

Membrane Permeation  
Analyzer



**IGA**

Gravimetric Gas  
& Vapor Sorption Analyzers



Full details on our complete range of products and services are available on our website.

[www.hiddenisochema.com](http://www.hiddenisochema.com)



The **XEMIS** is a high accuracy gravimetric sorption analyzer designed for operation with a wide range of gases and vapors at pressures up to 200 bar. Featuring next generation microbalance technology, it allows high resolution measurements on exceptionally small samples.

### WIDEST CONTROLLABLE PRESSURE RANGE OF ANY GRAVIMETRIC SORPTION ANALYZER

Automated switching between multiple pressure transducers allows active pressure regulation over **7 orders of magnitude**.

### UNIQUE EXOSENSING TECHNOLOGY FOR OPERATION WITH AGGRESSIVE SPECIES

Hidden Isochema's **Exosensing Technology** removes sensitive components from the balance chamber and allows safe, reliable operation with flammable, corrosive and toxic gases and vapors.

### OPTIMIZED PERFORMANCE FOR SAMPLE SIZES FROM 1 mg TO 5 g

Overall baseline stability, combined with symmetric geometry and minimized total buoyancy, offers performance unrivalled in a high pressure sorption analyzer.



ISOTHERM, ISOBAR AND  
HIGH PRESSURE TGA  
MEASUREMENTS IN A SINGLE  
AUTOMATED ANALYZER

XEMIS

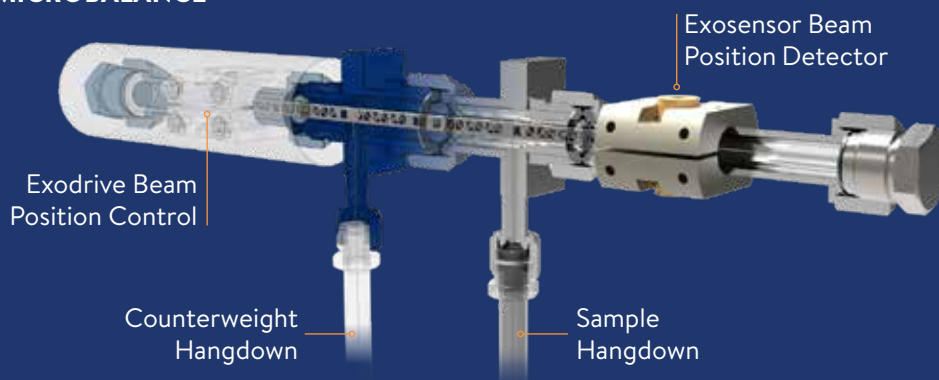
XEMIS

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# XEMIS OVERVIEW

## THE MICROBALANCE



### EXOSENSING TECHNOLOGY

Sensitive components removed from the microbalance chamber allows operation with corrosive species.



### NEXT GENERATION DESIGN

Symmetric geometry and precision design engineered microbalance maximizes sensitivity and minimizes buoyancy.



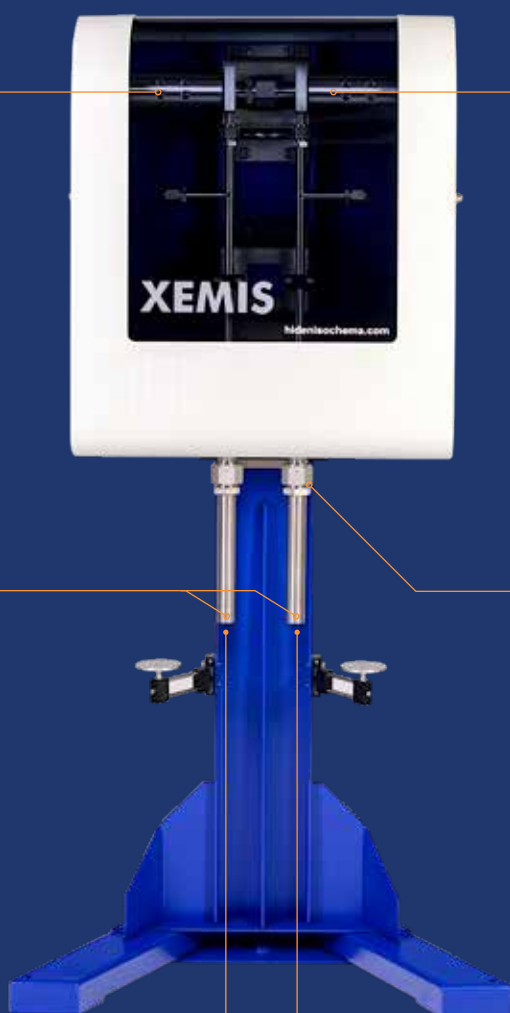
### TWIN THERMOSTATS

Intrinsic long term stability without the need for rezeroing or recalibrating captures true sorption behavior and records full sorption kinetic data over extended time periods.



### ENHANCED FUNCTIONALITY

All-metal construction with high quality VCR fittings ensures reliable operation at high pressures, with quick, easy sample loading.



COUNTERWEIGHT SIDE

SAMPLE SIDE



### THERMOSTATED ENCLOSURE

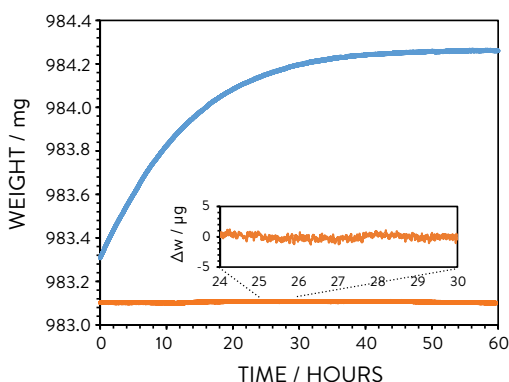
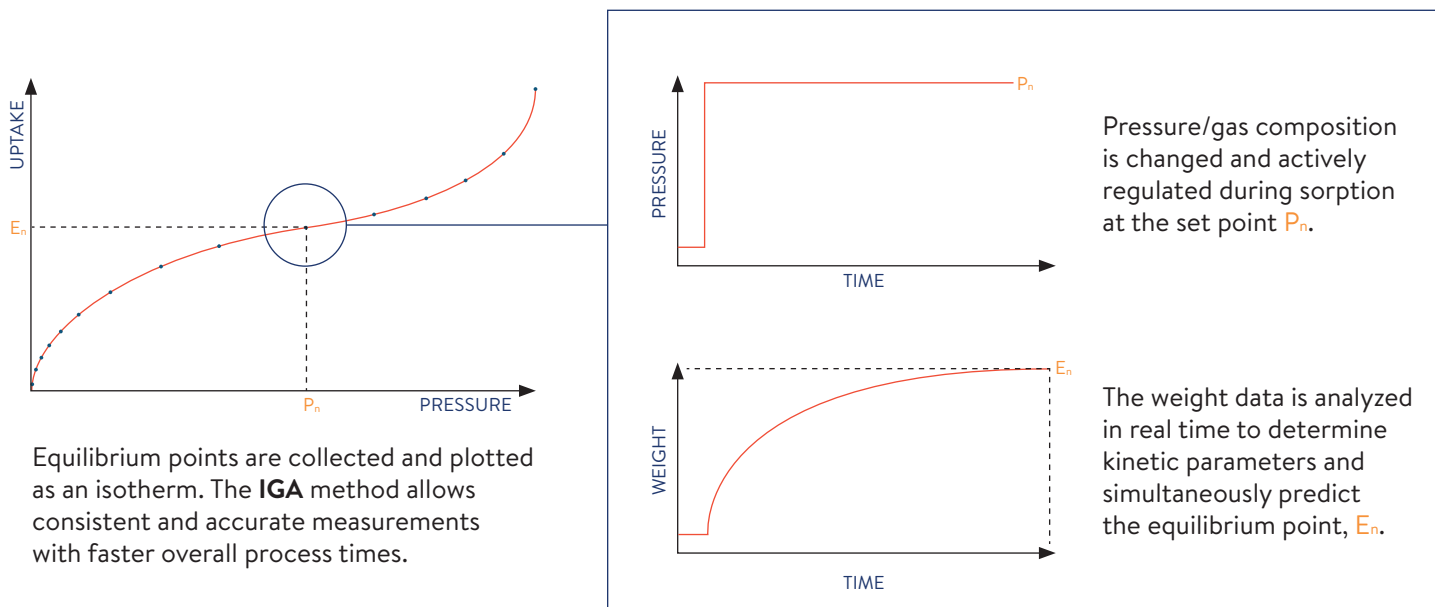


### ADVANCED GAS CONTROL SYSTEM

Featuring active pressure regulation.

# THE IGA METHOD

The **XEMIS** uses Hiden Isochema's unique **IGA** (Intelligent Gravimetric Analysis) method for simultaneous, automated determination of sorption kinetics and equilibrium isotherms.



## KINETIC ANALYSIS

The long term balance stability and isobaric operation of the **XEMIS** allows analysis of the kinetics of sorption and reaction processes over extended timescales.

The minimal variation in the weight reading for an empty sample holder (the orange trace) provides a highly stable baseline reading above which kinetic processes can be accurately characterized.

- ▶ Isotherm, isobar and high pressure TGA measurements in a single automated analyzer
- ▶ Exosensing technology for compatibility with flammable, corrosive and toxic gases and vapors
- ▶ Symmetric geometry, with ultra low total system buoyancy for high accuracy measurements at high pressures
- ▶ Measurements at temperatures from 77 K to 500 °C over the full pressure range
- ▶ Fast and accurate analysis of equilibria and kinetics using the IGA method
- ▶ Full automation and advanced programmability including multiple gas inlet switching and automated species decontamination

# XEMIS MODELS

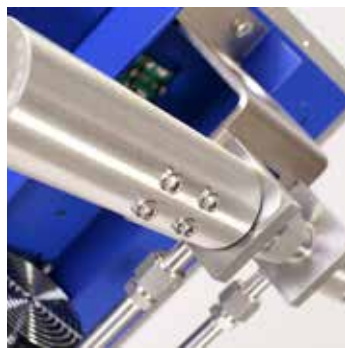


## XEMIS-001

High resolution pure gas sorption analyzer.

### OPERATING MODES

PURE GAS  
MODE



## XEMIS-002

High resolution pure gas and vapor sorption analyzer.

### OPERATING MODES

PURE GAS  
MODE



VACUUM VAPOR  
MODE



## XEMIS-003

Versatile pure and mixed gas sorption analyzer.

### OPERATING MODES

PURE GAS  
MODE



DYNAMIC  
MIXED GAS MODE

### OPTIONAL

DYNAMIC  
VAPOR

MASS  
SPECTROMETER



## XEMIS-100

Powerfully combining the features of the other **XEMIS** models, the **XEMIS-100** is a flexible mixed gas and vapor sorption analyzer.

### OPERATING MODES

PURE GAS  
MODE



VACUUM VAPOR  
MODE



DYNAMIC  
MIXED GAS MODE

### OPTIONAL

DYNAMIC  
VAPOR

MASS  
SPECTROMETER



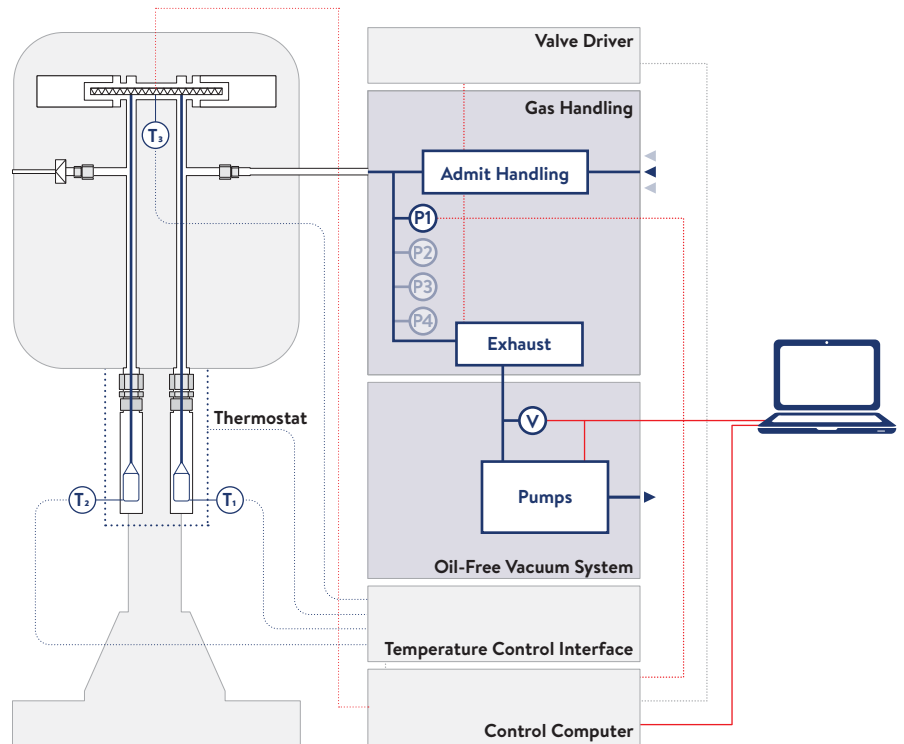
# XEMIS-001

High resolution pure gas sorption analyzer, for precise characterization of sorption equilibria and kinetics.

The **XEMIS-001** operates with a wide range of gases including flammable, toxic and corrosives species, and features automatic decontamination and shutdown for rapid, safe sample exchange.

## Typical application areas:

- ▶ Carbon capture and storage
- ▶ Hydrogen and natural gas storage
- ▶ Gas solubility in ionic liquids
- ▶ Nanoporous material characterization
- ▶ Gas sorption on geological materials



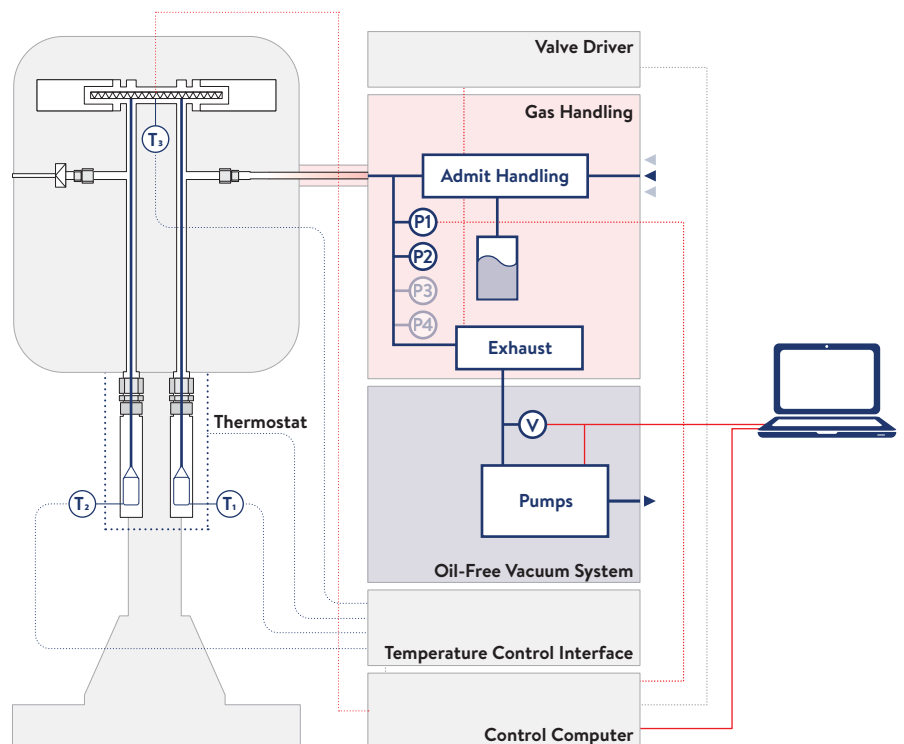
# XEMIS-002

High resolution gas and vapor sorption analyzer, with anti-condensation protection up to 40 °C.

Up to 4 pressure sensors may be selected, offering active pressure control over an unparalleled range.

## Typical application areas:

- ▶ VOC filtration
- ▶ Thermochemical energy storage
- ▶ Toxic gas storage and separation



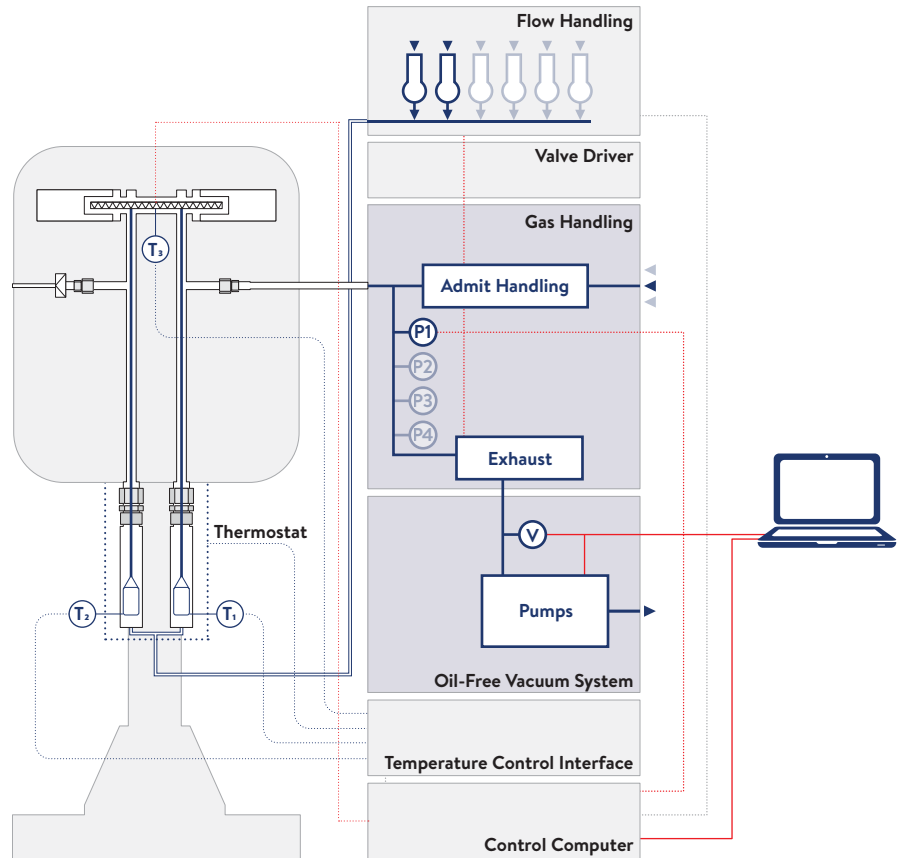
# XEMIS-003

Versatile pure and mixed gas sorption analyzer with combined control of pressure, flow and gas composition.

An optional vapor generator module allows water or organic solvent vapor to be delivered as part of the gas mixture so more complex investigations can be performed.

## Typical application areas:

- ▶ High pressure catalysis
- ▶ Flue gas desulfurization
- ▶ Gas-solid reaction kinetics



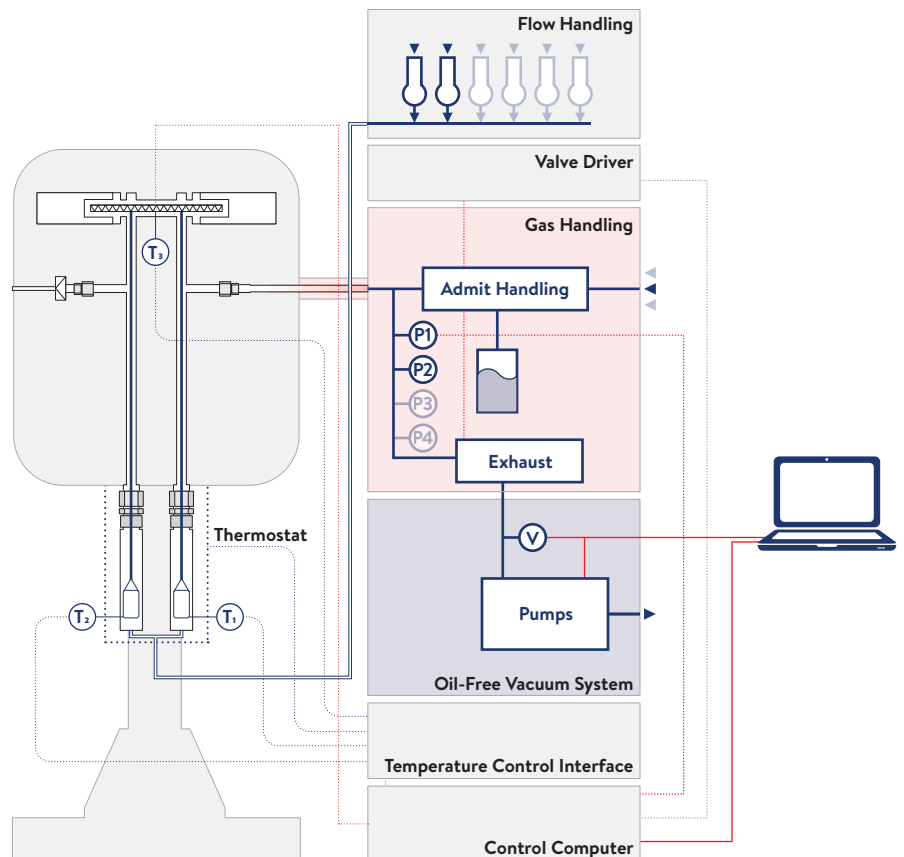
# XEMIS-100

Advanced gravimetric sorption analyzer for high resolution gas and vapor sorption combined with high pressure TGA.

Integration with Hiden Analytical's range of quadrupole mass spectrometers allows analysis of evolved gas for in-situ TGA-MS and related studies.

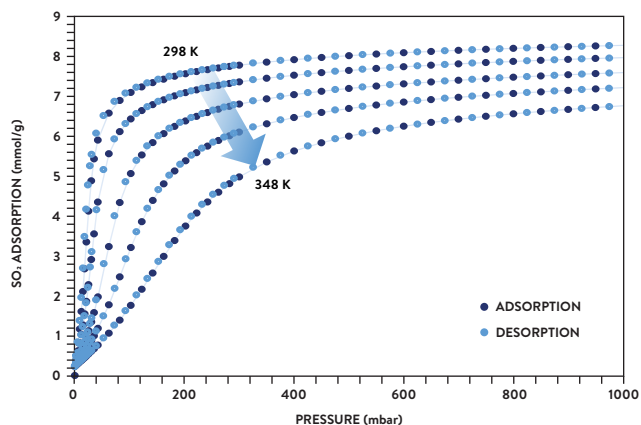
## Typical application areas:

- ▶ Energy gas storage
- ▶ High pressure TGA
- ▶ Polymer membrane characterization

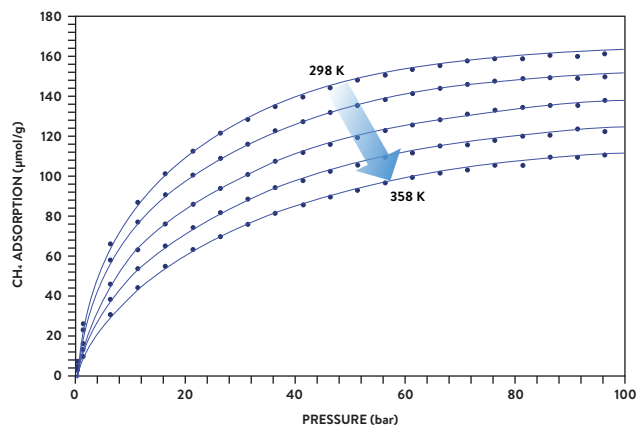




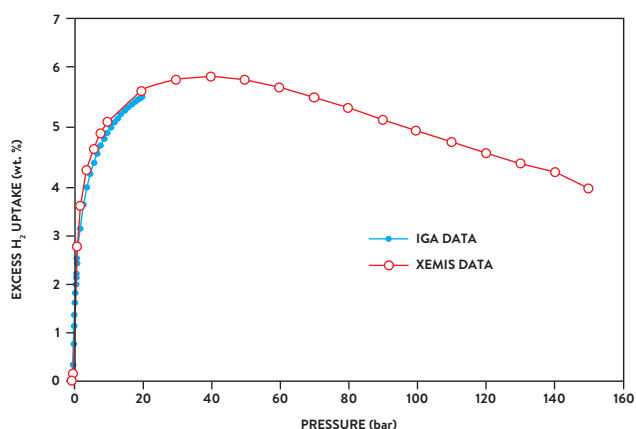
# EXAMPLE APPLICATION DATA



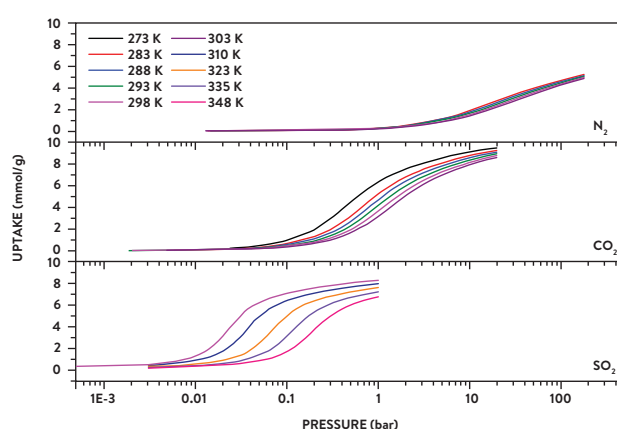
**Figure 1:** SO<sub>2</sub> adsorption by a metal-organic framework (NOTT-300), with kind permission from University of Nottingham, UK.



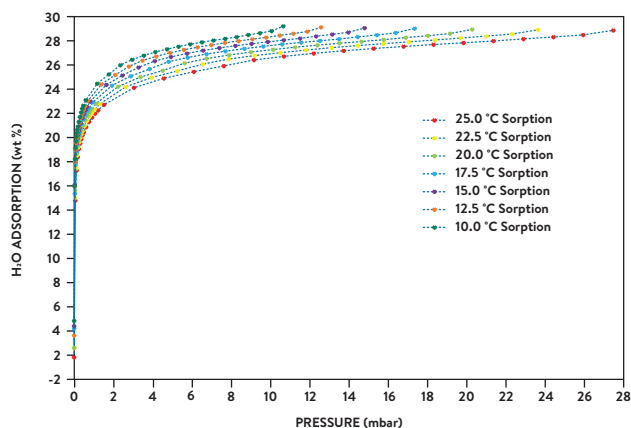
**Figure 2:** CH<sub>4</sub> adsorption by a shale over a range of temperatures.



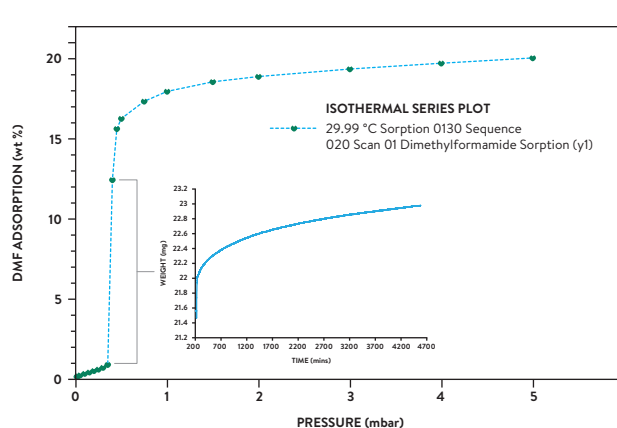
**Figure 3:** Excess H<sub>2</sub> uptake for a 22 mg carbon nanotube, CN4800, using both IGA-003 and XEMIS gravimetric sorption analyzers. Reproduced with permission of The Royal Society of Chemistry.



**Figure 4:** N<sub>2</sub>, CO<sub>2</sub> and SO<sub>2</sub> adsorption isotherms on MFM-300(In) over a range of temperatures and pressures. Reproduced with permission from John Wiley and Sons.



**Figure 5:** H<sub>2</sub>O adsorption on zeolite 13X powder.



**Figure 6:** Dimethylformamide (DMF) adsorption by a metal-organic framework (MOF), with an inset showing a single step kinetic. Data courtesy of Newcastle University, UK.

# XEMIS TECHNICAL SPECIFICATIONS

## WEIGHT

Balance capacity	5 g
Weighing range	100 mg / 200 mg
Resolution	0.1 µg / 0.2 µg
Stability	±1 µg short term (± 5 µg long term)

## PRESSURE

Design pressure	170 bar (standard), or 200 bar (optional)
Accuracy	± 0.04 % of range
Transducer ranges (up to 4)	1, 10, 20, 50, 200 bar 2, 10, 100 mbar
Base vacuum at sample	< 10 <sup>-6</sup> mbar
Typical setpoint regulation accuracy	± 0.02 % of range
Programmable gas inlets	Up to 6
Dynamic pressure / flow control	Optional (XEMIS-003 and XEMIS-100 models)
Full scale flow rate	3-1000 ml/min (as defined by order option)

## TEMPERATURE

Measurement range	77 – 773 K
Temperature sensors	Platinum Resistance Thermometer (Pt100)
Measurement accuracy	± 0.1 K
Typical setpoint regulation accuracy:	
Recirculating waterbath	± 0.05 K
Furnace options	± 0.1 K
Linear ramp TGA option	0.05 – 20 K/min programmable
Cabinet (balance) temperature stability	± 0.1 K
Anti-condensation protection	40 °C (XEMIS-002 and XEMIS-100 models)

## MASS SPECTROMETER OPTIONS

Coupling method	Heated Quartz Inert Capillary (QIC) Inlet
Atomic mass range	1–200 AMU standard (1–300 AMU optional)
Detection limit	0.1 to 1 ppm, subject to spectral interference Better than 20 ppb (Triple Mass Filter option)
Detector	Dual Faraday/Electron Multiplier

## SYSTEM CONSTRUCTION

Wetted components	All metal
Pressure vessel	Stainless steel (316L grade)
Pressure seals	Cajon VCR stainless steel
Pressure transducer diaphragms	Hastelloy C276 / Inconel 600
Overpressure bursting disc	Laser welded stainless steel
Corrosive species compatibility	Included <sup>1</sup>
Vapor species compatibility	Included for XEMIS-002 and XEMIS-100 models

<sup>1</sup>Please refer to Hidden Isochema product specialists for detailed compatibility and laboratory safety advice.

It is Hidden Isochema's policy to continually improve product performance and therefore specifications are subject to change.

## SUPPORT

Hidden Isochema offers unrivalled technical support free of charge, for the lifetime of the instrument.

Telephone and email access to our team of highly qualified engineers with a guaranteed response within 24 hours.

Full 12 month warranty as standard.

A range of service contracts available.

## CONTACT US

If you have any questions about XEMIS or any of Hidden Isochema products or services, please give us a call, we will be happy to help.

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