



IGA

GRAVIMETRIC GAS & VAPOR SORPTION ANALYZERS

hidenisochema.com

Hiden 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

XCS

ABR

Climate Control

IGA ECOsorp Gravimetric Analyzer for Carbon Capture Applications

Next Generation Gravimetric

High Accuracy H Storage Analyzer

XEMIS

335



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.hidenisochema.com

High accuracy gravimetric gas and vapor sorption analyzers for the precise characterization of sorption equilibria and kinetics.

UNRIVALLED MEASUREMENT PRECISION, ACCURACY AND REPEATABILITY

An ultrasensitive thermostatted microbalance provides high resolution and excellent long-term stability with precise pressure and temperature control.

FAST AND ACCURATE ANALYSIS OF EQUILIBRIA AND KINETICS USING THE UNIQUE IGA METHOD

Provides consistent analysis with optimum measurement accuracy and faster overall process times.

COMPLETE ISOTHERMAL, ISOBARIC AND KINETIC ANALYSIS FROM VACUUM TO 20 BAR

Precise pressure control from sub-millibar to 20 bar allows determination of isotherms, isobars and isobaric kinetics with a wide range of gases.

A VERSATILE AUTOMATED ANALYZER SUITABLE FOR USE WITH A RANGE OF GASES, MATERIALS AND METHODS



IGA OVERVIEW



OPTIONS

- ▶ Vapor sorption with active pressure regulation from 10⁻³ mbar
- Dynamic mode with control of pressure, flow and gas composition
- Advanced functions with integrated mass spectrometer

KEY FEATURES

- Unrivalled long term microbalance stability
- Fast and accurate analysis of equilibria and kinetics
- Fully programmable for advanced method development
- Active pressure regulation from sub-millibar to 20 bar
- Modular design provides flexible upgradeability

THERMOSTATTED CABINET For optimal long term stability

IGA MICROBALANCE With sub-microgram resolution

PRESSURE VESSEL With all metal fittings

VACUUM CONNECTION For in-situ degassing

SAMPLE REACTOR Selected to suit application

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INTERCHANGEABLE THERMOSTATS



THE IGA METHOD

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



KINETIC ANALYSIS

During an experiment, weight measurements are analyzed using the Real Time Processor (RTP). Parameters defining the fitting process are set by the user, with full flexibility, and end point uptake at each isotherm point is then predicted from the weight data and RTP parameters. The predicted equilibrium is continually refined as data is collected, and displayed both graphically and numerically.

The measurement and fitting process is illustrated in the accompanying screenshots, with the calculated residuals displayed below each kinetic plot indicating the quality of the fit. RTP analysis provides both accuracy and consistency for the acquisition of high quality equilibrium sorption isotherm data and allows the simultaneous extraction of detailed kinetic information.





Screen captures from Hlsorp software showing measured data (red) and fit projection (blue). The predicted endpoint and associated uncertainty (upper plot) and fit residuals (lower plot) are also shown.

IGA MODELS



IGA-001

High accuracy gravimetric sorption analyzer, for precise characterization of gas sorption equilibria & kinetics.

The IGA-001 is a dedicated single component gas sorption analyzer for the study of gas interactions with both solids and liquids.

Typical application areas:

- Hydrogen and natural gas storage
- Gas solubility in ionic liquids
- Thermodynamic and kinetic studies



IGA-002

Single component gravimetric analyzer, for precise characterization of gas & vapor sorption equilibria & kinetics.

The IGA-002 is a high resolution vapor sorption analyzer for precisely characterizing vapor-solid interactions.

Typical application areas:

- Water and organic vapor sorption
- Diffusion coefficient determination
- Vapor sorption in polymers



IGA-003

High accuracy gravimetric analyzer, with combined pressure & flow control for precise characterization of thermodynamics & kinetics.

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:

- Temperature Programmed Desorption/ Oxidation/Reduction (TPD/TPO/TPR)
- Thermodynamic and kinetic studies
- Energy gas storage



IGA-100

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

An automated multiple inlet flow control system allows mixed gas experiments, while anti-condensation protection and active pressure regulation enable high resolution vapor measurements.

Typical application areas:

- Moisture and organic vapor sorption
- Diffusion coefficient determination
- Thermogravimetric Analysis (TGA) and Evolved Gas Analysis (EGA)
- Catalyst characterization



EXAMPLE APPLICATION DATA



Figure 1: Hydrogen adsorption by a polymer of intrinsic microporosity measured at cryogenic temperatures.

Reproduced from S. Tedds et al, Faraday Discuss., 2011, 151, 75-9 with permission from The Royal Society of Chemistry.



Figure 3: Experimentally determined CO₂ gas solubilities in ionic liquid [bmim][PF₄] compared with equation of state model.

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Figure 5: Cyclohexane, benzene and mesitylene organic vapor sorption by ZSM-5 zeolite, illustrating steric separation of vapor species.



Figure 2: Hydrogen desorption kinetics at 10 mbar and 673 K for MgH₂ showing improvement in kinetics for treated samples (i) and (iii).

Reproduced from S. R. Johnson et al, Chem. Commun., 2005, 2823-2825 with permission from The Royal Society of Chemistry.



Figure 4: CO₂ adsorption by a metal-organic framework, ZIF-7, showing adsorption-induced structural dynamics.

Reproduced from P. Zhao et al, Nat Commun 10, 999 (2019) under CC BY 4.0.



Figure 6: Kinetics of xylene isomer adsorption at 10 mbar and 323 K for pure ZSM-5 (red traces) and silicalite-coated ZSM-5 (blue traces).

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IGA TECHNICAL SPECIFICATIONS

WEIGHT

Balance capacity	1 g (standard) or 5 g (optional)
weighing range	U – 200 mg (standard)
Resolution	0.1 μ g (0.2 μ g with optional 5 gram balance)
Stability	±1µg long term (± 0.1µg short term)

PRESSURE

Design pressure	10 bar (standard), or 20 bar (optional)
Typical accuracy	± 0.05 % of range
Transducer ranges (up to 3 per system)	1, 10, 20 bar 2, 10, 100 mbar
Base vacuum	< 10 ⁻⁶ mbar
Typical setpoint regulation accuracy	± 0.02 % of range

TEMPERATURE

Measurement range	77 – 1273 K
Temperature sensors	Platinum Resistance Thermometer (Pt100) or Type-K Thermocouple
Measurement accuracy	± 0.1 K (Pt100) or ± 1 K (Type-K)
Typical setpoint regulation accuracy:	
Recirculating waterbath	± 0.05 K
Furnace options	± 0.1 – 1 K
Linear ramp TGA option	0.05 – 20 K/min programmable
Balance temperature regulation accuracy	± 0.1 K
Anti-condensation protection	50 °C (IGA-002 and IGA-100 models)

MASS SPECTROMETER OPTIONS

Atomic mass range 1–200 AMU standard (1-300 A	MU optional)	lt is Hiden Isochema's p
Detection limit0.1 to 1 ppm, subject to spectraBetter than 20 ppb (Triple Mas	al interference ss Filter option)	to continually improve product performance a therefore specification
Detector Dual Faraday/Electron Multipli	ier	are subject to change.

SUPPORT

Hiden Isochema offers unrivalled technical support free of charge, for the lifetime of the instrument. Telephone and email access to our team of highly gualified engineers with a guaranteed response within 24 hours. Full 12 month warranty as standard. A range of service contracts available.

CONTACT US

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Please refer to Hiden Isochema product specialists for detailed

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compatibility and laboratory