ANALYZER
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HIDEN ISOCHEMA

Cutting Carbon with Precision

The ECOsorp sets a new standard for high accuracy carbon capture measurement

Carbon capture is a crucial technology for mitigating climate change and accurate testing under real-world conditions is more important than ever.

In this issue, we explore how the IGA ECOsorp supports ongoing research with combined CO_2 and water vapor sorption capabilities—offering new possibilities for studying materials in direct air capture environments.

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The IGA ECOsorp combines high-resolution gravimetric water sorption with CO_2 gas sorption under dynamic flow—delivering an affordable, practical way to evaluate candidate carbon capture sorbents across a broad range of real-world conditions.

Carbon capture has a critical role to play in reducing CO_2 emissions to help mitigate climate change, and adsorption by porous materials has emerged as a key approach. Carbon capture involves the removal of CO_2 from a gas mixture, with the details defined by the specific method used. Post-combustion carbon capture (PCC) is the removal of CO_2 from point sources, typically fossil fuel power plants. In this case, CO_2 must be adsorbed from a flue gas, consisting mainly of N_2, with varying levels of other minor contaminants, and CO_2 at an approximate concentration of 15%. Direct air capture (DAC), meanwhile, is the removal of CO_2 from atmospheric air, so it requires CO_2 adsorption at low concentrations, around 400 ppm, from a complex gas mixture (air) at ambient pressure.

To support this important area of research, Hiden Isochema recently introduced the IGA ECOsorp, a dynamic gas and vapor sorption analyzer, engineered specifically for carbon capture. Our system delivers precise, independent control of carbon dioxide and water vapor concentrations, enabling accurate simulation of DAC environments. CO_2 partial pressures can be set as low as 100 ppm, while humidity is independently regulated to reflect real-world atmospheric conditions. Combined with fully programmable operation across a wide temperature range (5 to 85 °C), this system delivers comprehensive analysis.

The IGA ECOsorp combines DVS water sorption with high resolution gas sorption and has the widest controllable CO_2 partial pressure range of any dynamic sorption analyzer. Unique barometric compensation technology provides accurate CO_2 flow regulation, allowing the subtle adjustment of mass flow rates to provide constant and stable CO_2 partial pressures, independent of atmospheric pressure variations. The flexible design and operation of the ECOsorp allows the performance of various measurements including CO_2 isotherms under dry and controlled humidity conditions, high resolution water sorption isotherms and kinetics, and gravimetric response tests under controlled DAC and PCC conditions.

If you'd like to learn more about how the ECOsorp can support your research, get in touch with a Hiden Isochema specialist at **info@hidenisochema.com**

Professor Len Barbour joins the University of Lincoln


Professor Len Barbour

In March this year, Len Barbour joined the University of Lincoln as the Leverhulme International Professor of Materials Insight and Innovation.

For the past two decades, Professor Barbour was at Stellenbosch University in South Africa, where his research focused on supramolecular chemistry and the design of porous crystalline materials. He is also an Associate Editor of *Crystal Growth & Design*, an Editorial Advisory Board member for *Chemistry of Materials* and was Associate Editor of *Comprehensive Supramolecular Chemistry II*, a nine volume reference work, published by Elsevier in 2017.


Professor Barbour presenting his keynote talk at the UK Porous Materials Conference

"I've been using Hiden equipment for over 20 years and have always been impressed by the quality of their instruments, as well as their exceptional technical support...it was an easy decision to choose Hiden again."

Professor Len Barbour, University of Lincoln, UK

Back in his Stellenbosch laboratory, Professor Barbour had a series of x-ray diffractometers for in-situ characterization and different sorption instruments, including two **Hiden Isochema Intelligent Gravimetric Analyzers (IGAs)**.

We are delighted that Professor Barbour has now chosen Hiden Isochema instruments for his new sorption laboratory at the University of Lincoln. Amongst a range of characterization equipment are an **IGAsorp water sorption analyzer**, a **XEMIS high pressure microbalance**, and an **ABR automated breakthrough system**.

Professor Barbour told us ***"I've been using Hiden equipment for over 20 years and have always been impressed by the quality of their instruments, as well as their exceptional technical support, even from thousands of miles away. When setting up a new sorption lab at the University of Lincoln, it was an easy decision to choose Hiden again. I am also very pleased to become part of the UK porous materials community and I'm open to collaboration involving the use of our state-of-the-art sorption capabilities and in situ structural characterization".***

We are very much looking forward to continuing to support Professor Barbour and his group, and to seeing the progress that can be expected from this state-of-the-art sorption facility.


The Lincoln team in their state-of-the-art sorption laboratory

Interlaboratory update

Interlaboratory studies are critical for testing the reproducibility of measurement techniques and for certifying reference materials. Until recently, however, interlaboratory exercises on gas and vapor sorption were few and far between. This has now begun to change, with a series of papers reporting gas and vapor sorption data measured in different laboratories on a range of materials.

Following an early effort on hydrogen adsorption by porous carbon, in which significant differences were observed between data determined in different laboratories,[1] a series of exercises were organised by the National Institute for Standards and Technology (NIST) in the US.[2-4] The latest was a study of water adsorption in the reference carbon BAM-P109, published in 2023.[4]

In 2024, Hiden Isochema scientists, working with Professor Stefano Brandani and his team at the University of Edinburgh, expanded an earlier NIST study[3] to include validated high pressure methane adsorption isotherms measured at two further temperatures.[5] The isotherms were measured using a differential volumetric system at Edinburgh and a Hiden Isochema **XEMIS** in our in-house laboratories.

In the same year, a study of the stability of microbalances, coordinated by the Forest Products Laboratory of the US Forest Service, in the context of measuring water sorption by wood, was published.[6] Earlier this year, a further paper focusing on the isotherm measurements of water on wood was published,[7] and another publication is in the pipeline.

These recent papers signify a big increase in the amount of interlaboratory gas and vapor sorption data in the literature, which now includes H_2, CH_4 and CO_2 adsorption on carbons and zeolites, CH_4, CO_2 and C_2H_6 adsorption on coals and shales, and water sorption in porous carbons and wood. Further exercises are currently underway and more papers will follow in the future. Hiden Isochema is proud to have been involved in such work, as confirming the accuracy of our instruments by rigorous comparison with results produced in independent laboratories is important to us.

References

1. Zlotea et al, 2009, Int. J. Hydrogen Energy 34(7), 3044
2. Nguyen et al, 2018, Adsorption 24, 531
3. Nguyen et al, 2020, Adsorption 26, 1253
4. Nguyen et al, 2023, Adsorption 29, 113
5. Rea et al, 2024, Adsorption 30, 1529
6. Zelinka et al, 2024, Adsorption 30, 1663
7. Zelinka et al, 2025, Adsorption 31, 74

PUBLICATION ROUND-UP

CO_2 utilization

Development of a bifunctional material incorporating carbon microspheres for the intensified hydrogen production by sorption-enhanced glycerol steam reforming

A. Olivier, A. Desgagnes and M. C. Iliuta

Chemical Engineering and Processing: Process Intensification, 2024, 200, 109790.

The authors report several novel sorbents based on calcium oxide with varying quantities of stabilizing materials, using carbon microsphere templated agents, for use in the sorption-enhanced glycerol steam reforming (SEGSR) process. The CO_2 sorption performance of the resulting materials was tested using an **IGA-003**, under conditions relevant to the SEGSR process. These included pre-treatment and regeneration under nitrogen gas flow at 750 °C and sorption under controlled dry and humid CO_2 conditions in the range 600 – 700 °C. The materials' CO_2 uptake level, sorption kinetics, and stability over 15 sorption-regeneration cycles were all studied with the **IGA-003**.

Humidity sensing

Ionic covalent organic framework as a dual functional sensor for temperature and humidity

G. Das et al

Small, 2024, 20(32), 2311064

An international collaboration led by researchers at New York University Abu Dhabi (UAE) report a covalent organic framework (COF) with hydrogen bonding ionic functionalities incorporated into the structure, which exhibits clearly visible color changes due to temperature and humidity conditions. Amongst a number of complementary characterization techniques, high resolution water vapor sorption isotherms were measured using an **IGAsorp**, with the water sorption isotherm shape, hysteresis and uptake level studied over several cycles. The material was shown to act as a rapid visible sensor for changes in either temperature at constant humidity or humidity at constant temperature. Potential applications for this class of material were also discussed by the authors.

Discovering more. Seeing more.

DATE	CONFERENCE	LOCATION
9th – 11th September	UK APS PharmSci	Cardiff, UK
17th – 18th September	EPoMM Network meeting	Bath, UK
21st – 24th September	EUROMOF	Heraklion, Greece
21st – 23rd October	Hydrogen + Carbon Capture Technology Expos	Hamburg, Germany
2nd – 6th November	AICHE Annual Meeting	Boston, USA

Dates are subject to change, please confirm details with event organizers.

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