Hiden Isochema
Advancing Sorption Analysis

Newsletter • Spring 2015

First XEMIS Data Published!

It has certainly been a busy few months for our XEMIS gravimetric sorption analyzer. Launched just over a year ago, the XEMIS is designed for high accuracy gravimetric sorption measurements with research scale samples.

Configurations are available to allow operation up to 50 bar, 150 bar, and 200 bar pressure levels, with corrosive gases, but high precision low pressure measurements are equally possible. This combination of measurement capabilities, including the ability to perform high accuracy measurements even with small sample sizes, is achieved with Hiden Isochema's exosensing technology and is unique amongst gravimetric sorption analyzers.

Measuring the hydrogen storage capacity of carbon nanotubes with XEMIS

January saw publication of the first XEMIS data in a peer-reviewed journal. The group of Prof. Robert Mokaya in the School of Chemistry, University of Nottingham (UK) reported a method of synthesising carbon nanotubes at lower temperatures than those typically employed in standard synthesis routes [1]. The authors then characterised the nanotubes using a range of analysis methods. A Hiden Isochema IGA-003 gas sorption analyzer was used to measure CO_2 and H_2 adsorption isotherms at pressures to 20 bar at a number of different temperatures in order to evaluate the CO_2 and H_2 storage capacity of the nanotubes.The hydrogen storage capacity of the most promising nanotube material was also measured at higher pressures up to 150 bar using a XEMIS instrument. Adsorption measurements were performed at 77 and 298 K with a 22 mg sample and this is reported in Figure 13 of the publication. Additionally, comparison of the data measured at 77 K on both XEMIS and IGA-003 instruments serves as a

Where are you heading to this year?

Here is our latest conference schedule; we look forward to catching up with many of you out and about at conferences this year.

8-9 April	**ChemEngDayUK 2015,**	UK
12-17 July	**Carbon 2015**	Germany
17-23 July	**ISSHAC-9**	Poland
20-23 July	**12th International Conference on Materials Chemistry**	UK
26-31 July	**BZA Annual Meeting**	UK
6-10 Sept	**Euromembrane Conference 2015**	Germany
7-9 Sept	**The 5th APS International PharmSci 2015**	UK
11-14 Oct	**1st EuroMOF Conference**	Germany
25-29 Oct	**AAPS Annual Meeting and Exposition**	USA
8-12 Nov	**AIChE Annual Meeting**	USA
1-3 Dec	**MRS Fall Meeting**	USA

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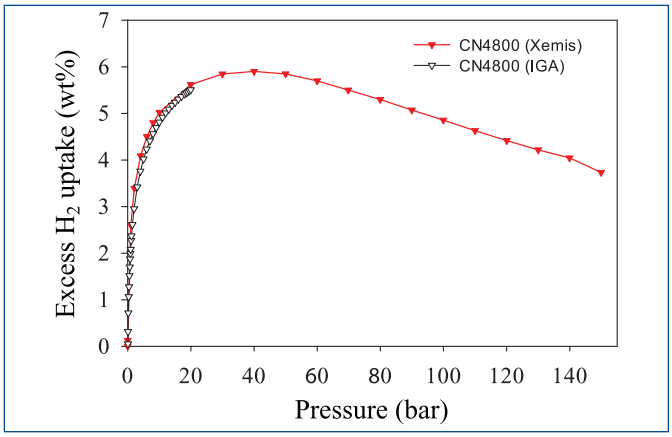
thorough validation of the XEMIS data, which the authors present in Figure S17 of the publication, which is reproduced below.

"...both the shape of the isotherm and the magnitude of the uptake shows close agreement between the two instruments."

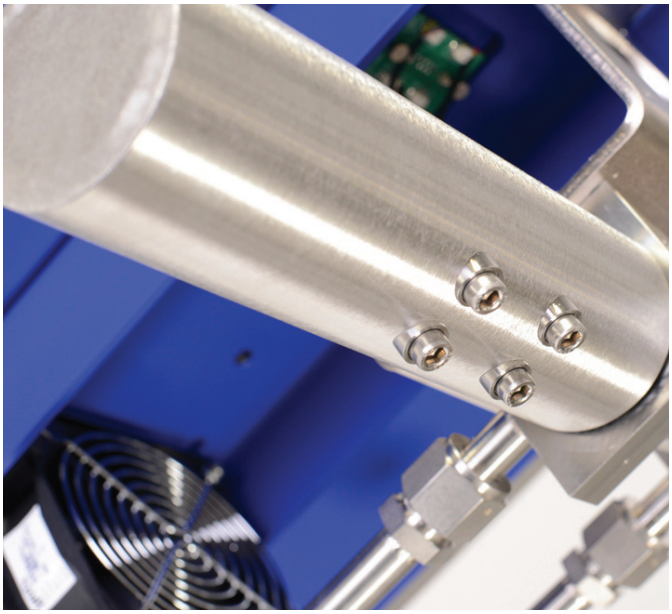


Excess hydrogen uptake data for carbon nanotube sample CN4800 at 77 K measured using both IGA-003 and XEMIS gravimetric sorption analyzers. Reproduced from [1] with permission of The Royal Society of Chemistry. We thank the University of Nottingham for the plot.

March saw the successful installation of an advanced XEMIS sorption analyzer in Germany. This configuration includes an integrated dynamic sampling mass spectrometer and allows operation in both vacuum and dynamic modes over the full pressure and temperature range (vacuum to 200 bar and 77 K to 770 K). The system includes many accessories including a humidity generator for studying materials under both dry and humid conditions and as you would expect is fully automated and offers a high degree of flexibility. We have already received very positive feedback from the instrument users as they explore the XEMIS's full range of measurement capability.

In our Applications Laboratory at Hiden Isochema headquarters we are continuing to produce demonstration data for customers, and we have also received new orders for multiple XEMIS systems already in 2015. We anticipate significant further interest in the coming months as news of the recent installations and publications spreads. If you would like to find out more, please visit our website or contact your local Hiden Isochema representative for more details!

[1] B. Adeniran and R. Mokaya, Journal of Materials Chemistry A 3, 5148-5161 (2015)



…600+ articles online…isochema.com/science…

Request an application note!

We have a series of application notes from across our range of instruments available, on subjects including:

"Measuring H_2, CH_4 and SO_2 sorption by porous materials using the XEMIS microbalance"

"A study of the solubility and diffusion kinetics of CO_2 in a polyimide film at various temperatures"

"The determination of the pore size distribution of an activated carbon using Dubinin-Astakhov analysis of CO_2 adsorption at 273 K"

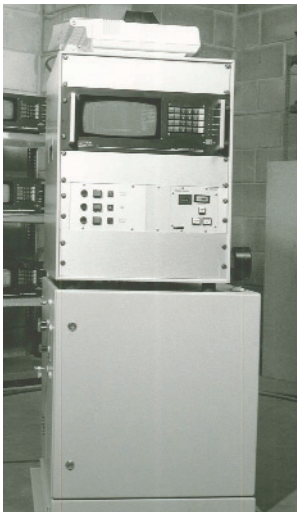
The full listing of application notes is in the library section of our website and copies can be requested by emailing info@hidenisochema.com

Hiden Instruments named as one of the "1000 Companies to Inspire Britain"

Hiden Isochema headquarters (opened 2013)

Hiden Instruments has been named in the London Stock Exchange's 1000 Companies to Inspire Britain report 2015. The report identifies the fastest-growing and most dynamic small and medium sized businesses in the UK. To be included in the list companies needed to show consistent revenue growth over a minimum of three years, significantly outperforming their industry peers.

2015 marks Hiden's 33rd year of operation and it continues to be an industry leader in mass spectrometry and gas sorption science. Hiden has an ever expanding product range which includes instrumentation for gas analysis, catalyst characterization, for plasma diagnostics, for SIMS measurement and for sorption science. As well as the head offices in Warrington, UK, Hiden has offices in North America and China and worldwide representation. This award confirms that Hiden continues to go from strength to strength.



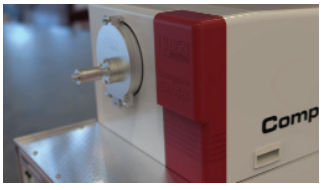
Hiden Analytical dynamic sampling mass spectrometer (1984 model)

For more information about either company visit: hideninstruments.com

Hiden Analytical headquarters (opened 1996)

Hiden Isochema IGA gravimetric gas and vapour sorption analyzer

Hiden Isochema IMI manometric gas sorption analyzer



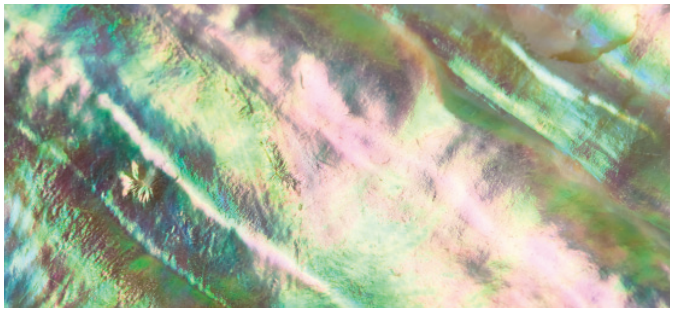
Hiden Analytical Compact SIMS surface analyzer

Recent Publications

Nacre-mimetics with synthetic nanoclays up to ultrahigh aspect ratios

P. Das et al, Nature Communications 6, 5967 (2015) doi:10.1038/ncomms6967

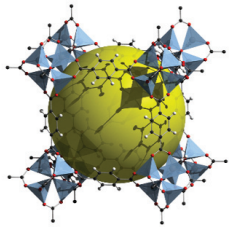
Researchers in Aachen, Germany and their collaborators report the synthesis and characterisation self-assembled polymer/nanoclay of nacre-mimetics. The effects of humidity on the mechanical and functional properties of these exciting materials are studied and an IGAsorp was used to simultaneously measure the equilibrium moisture content and the kinetics of the water sorption process.



Side-chain control of porosity closure in single- and multiple-peptide-based porous materials by cooperative folding

C. Marti-Gastaldo et al, Nature Chemistry 6, 343–351 (2014) doi:10.1038/nchem.1871

Metal-organic frameworks (MOFs) with dipeptide linkers are described by chemists at the University of Liverpool, who use an IGA-001 to study the CO_2 gas sorption properties in order to evaluate the porosity of the MOF. CO_2 adsorption-desorption isotherms and kinetics at a number of temperatures are reported, and the structure is shown to be complex and dynamic.



Polymeric molecular sieve membranes via in situ cross-linking of non-porous polymer membrane templates

Z.-A. Qiao et al, Nature Communications 5, 3705 (2014) doi: 10.1038/ncomms4705

A collaboration between Oak Ridge National Laboratory (ORNL) and the University of Tennessee, USA, reports the synthesis of hypercrosslinked porous polymeric membranes for gas separation. An IGA-001 was used to measure CO_2 and N_2 sorption uptake by the membranes at various temperatures, and subsequently determine the isosteric enthalpy of adsorption, in order to help assess their potential for practical applications.

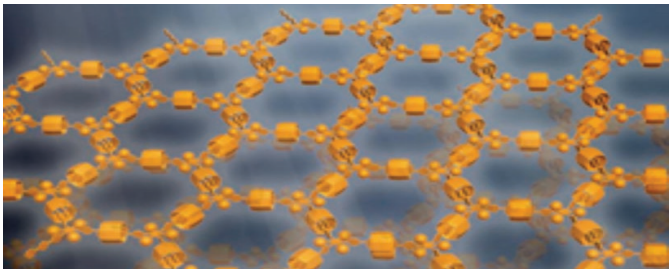
A robust binary Supramolecular Organic Framework (SOF) with high CO_2 adsorption and selectivity

J. Lü et al, Journal of the American Chemical Society 136, 12828-12831 (2014) doi: 10.1021/ja506577g

Collaborators from the University of Nottingham, UK and the Chinese Academy of Sciences report a supramolecular-organic framework (SOF) that exhibits a range of favourable properties, including excellent thermal stability, and solvent and moisture durability. An IGA-003 was used to measure N_2, H_2, CO_2 and CH_4 adsorption isotherms to 20 bar at 273 and 298 K. The material was found to have a high carbon dioxide adsorption capacity and to exhibit a high selectivity for carbon dioxide over methane.

Separation of rare gases and chiral molecules by selective binding in porous organic cages

L. Chen et al, Nature Materials 13, 954-960 (2014)



The gas separation properties of porous organic cages are demonstrated by xenon and krypton gas adsorption isotherms measured with an IGA-001 and breakthrough measurements measured with an ABR. This complementary approach involving research groups at Pacific Northwest National Laboratory (PNNL) in the USA, Aix-Marseilles University in France, and the Universities of Liverpool and Newcastle in the UK, includes kinetic and thermodynamic analysis of the gas adsorption isotherms as well as breakthrough analysis.

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