

IGASORP

FOCUSING ON WATER SORPTION



The brochure is available to download on our website but please let us know if you would like a hard copy!

DOWNLOAD NOW!

hidenisochema.com
/IGAsorp



IGAsorp analyzers are used in various applications in which the interaction of water or organic vapor with a material plays a key role in its performance or stability. Examples include water harvesting using adsorbents, natural materials characterization, and water and organic vapor transport in polymers.

The IGAsorp is a fully automated compact benchtop DVS analyzer for fast and accurate vapor sorption measurements using the dynamic flow technique. It uses the unique IGA method for determining sorption kinetics and equilibrium isotherms, ensuring consistent analysis with faster analysis times. The IGAsorp is used in laboratories worldwide in both industry and academia.

In this autumn edition of Analyzer we focus on some recent examples of publications by IGAsorp customers demonstrating the flexibility of the technique and varied material types that can be studied using dynamic vapor sorption.

More on page 2...

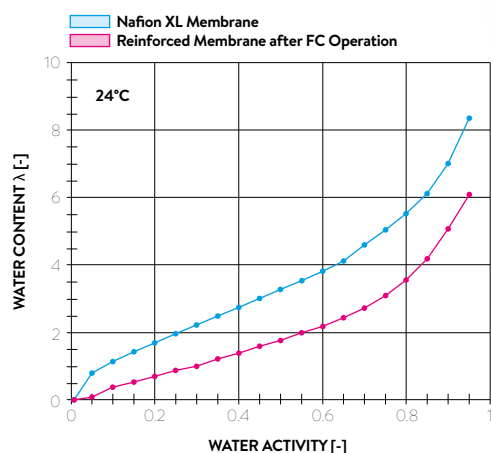
Improving the accuracy of DVS measurements

Water sorption in wood can be very slow, so choosing a sufficient equilibrium time for each isotherm point is critical. In this work, IGAsorp data recorded over long periods are analyzed to show the effects of applying different equilibration criteria [1]. Best practices are also suggested for DVS measurements made on wood and related natural materials.

FOCUSING

Degradation of proton exchange membranes

An ongoing challenge for proton exchange fuel cell membranes is performance loss due to aging and degradation. A complementary study on a modern reinforced perfluorosulfonic acid based membrane is described [4], which uses NMR to probe water mobility at a microscopic level and DVS to determine water sorption isotherms. Reduced water sorption capacity in aged membranes is then used as a fingerprint for performance loss, and is correlated with both NMR and FTIR results.



Water sorption isotherms at 24°C of Nafion XL reinforced membrane and reinforced membrane after long-term FC operation.

Reproduced under copyright: from creativecommons.org
© The Author(s), 2018. Journal of The Electrochemical Society, 165
(6) F3209-F3216 (2018), Université de Lorraine, CNRS, LEIMITA,
F-54000 Nancy, France

Long term weathering of stained glass windows

Stained glass windows can experience long term variations in both temperature and humidity, but the weathering process is not well understood. Water sorption isotherms on medieval glass samples were measured using an IGAsorp and analyzed as part of a study investigating the role of water in the weathering process [2].

Supported ionic liquid membranes for organic solvent/ water separation

Ionic liquids (IL) possess a range of unique properties and their incorporation in membranes leads to applications such as solvent separation. Water, ethanol and cyclohexane vapor sorption isotherms were measured using an IGAsorp for pure ILs, pure membranes, and supported ionic liquid membranes (SILM) [5]. Vapor transport measurements using the IGAsorp's permeation cell were also performed for the pure membranes and corresponding SILMs at different temperatures.

References

- [1] Glass et al, Wood Sci. Technol., 2018, 52, 909.
- [2] Sessegolo et al, Materials Degradation, 2018, 2:17.
- [3] Racovita et al, RSC Adv., 2018, 8, 23274.
- [4] Robert et al, J. Electrochem. Soc., 2018, 165, F3209.
- [5] Fatyeyeva et al, Reactive and Functional Polymers, 2018, 130, 16.
- [6] Sharma et al, Cellulose, 2018, 25, 3255.

IGASORP

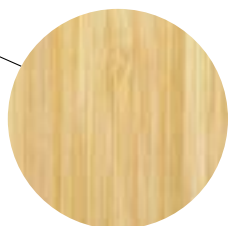
ON WATER SORPTION

Here are a few recent publications from IGAsorp customers.



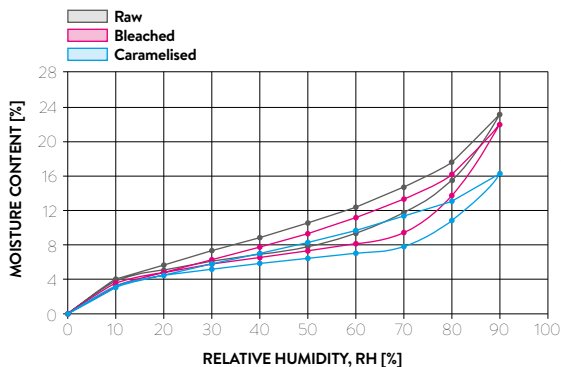
Drug release from composite polymer microparticles

Controlled drug delivery using polymer-based carrier systems is a rapidly advancing field. In this study, a calcium carbonate/polymer composite is tested for delivering antibiotics using various analytical techniques. Water sorption isotherm data measured on an IGAsorp were used to determine surface area, while chemical diffusion coefficients were calculated from water sorption kinetics [3].



Raw and processed bamboo for structural applications

As an alternative to synthetic fibre reinforced composites there is a growing interest in natural renewable materials. Laminated bamboo is a commercial product that is currently being explored for structural applications. In this study bleaching and caramelisation methods of processing raw bamboo for structural applications are compared using a range of techniques [6]. IGAsorp DVS isotherms show reduced water uptake and increased hysteresis for both processing techniques compared to the raw material, with caramelisation appearing to offer greater durability.



Moisture adsorption behaviour of the different bamboo materials.

Reproduced under copyright from https://doi.org/10.1007/978-94-007-9105-7_0
© The Author(s) 2018. Chemical composition of processed bamboo for structural applications. Cellulose 2018; 25:325-326. https://doi.org/10.1007/978-94-007-9105-7_0

Studying NO₂ adsorption in a MOF using XEMIS

A research article recently published in Nature Materials [1] reported the selective, reversible adsorption of NO₂ by a metal-organic framework, MFM-300(Al), measured with a Hiden Isochema XEMIS-001 gravimetric sorption analyzer.

Nitrogen dioxide, NO₂ is produced and released by burning fossil fuels in internal combustion engines and other industrial processes, and is a significant atmospheric pollutant. Adsorption of nitrogen dioxide offers a potential route to NO₂ removal, but previously studied sorbents have shown relatively low NO₂ adsorption capacity and often also irreversible uptake.



The authors used a XEMIS-001 gravimetric sorption analyzer to measure the interaction of nitrogen dioxide with a metal-organic framework (MOF) developed at the University of Manchester, UK. The material showed high and selective uptake for NO₂, which was shown to be fully reversible over several adsorption-desorption cycles.

Dr. Mark Roper, Hiden Isochema, said:

“We are delighted to read this publication from our customers and to learn more about how XEMIS sorption analysers are being used in such an important research area with an environmentally beneficial application”

DOWNLOAD NOW!

[hidenisochema.com/getbrochure](https://www.hidenisochema.com/getbrochure)



References

[1] Han et al, Nature Materials 2018, 17, 691-696.

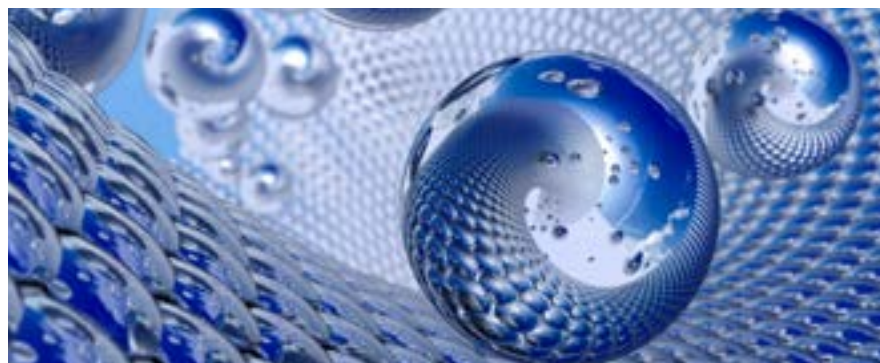
New study reports first high pressure gas adsorption reference data for a NIST RM zeolite

A new study, published in the Springer Nature journal *Adsorption*, reports the first high pressure gas adsorption reference data for a NIST Reference Material™.

Eleven laboratories, including Hiden Isochema, participated in the study of CO₂ adsorption by RM 8852, a synthetic ammonium ZSM-5 zeolite, up to a pressure of 4.5 MPa at 20 °C. Excellent agreement between the results from different laboratories was found, although resubmission of some of the reported isotherms was required, following an initial evaluation of the data. Both the reference material and the data will provide a valuable means

for laboratories to test and validate high pressure adsorption equipment and measurements.

The study was coordinated by the Facility for Adsorbent Characterization and Testing ('FACT Lab'), which was established at the US National Institute for Standards and Technology (NIST), in conjunction with the US Advanced Research Projects Agency-Energy (ARPA-E)^[1].



References

[1] Nguyen et al, *Adsorption* 2018, 24, 6, 531-539.

REACH OUT TO US:

DATE	CONFERENCE	LOCATION
3-6 Sept	PBAST 2018	Sapporo, Japan
5-7 Sept	3rd Iberoamerican Adsorption Symposium	Gijon, Spain
7 Sept	APS@FIP 2018	Glasgow, UK
11 Sept	38th Cement and Concrete Science Conference	Coventry, UK
19-21 Sept	EuroFoodWater 2018	Prague, Czech Republic
28 Oct - 2 Nov	MH2018	Guangzhou, China
28 Oct - 2 Nov	AICHE Annual Meeting	Pittsburgh, USA
19-23 Nov	Materiaux 2018	Strasbourg, France
9-13 Dec	MOF 2018	Auckland, New Zealand

Hiden Isochema Limited
422 Europa Boulevard, Warrington WA5 7TS
Tel: +44 (0) 1925 244 678 info@hidenisochema.com

PUBLICATION ROUND-UP

Porous Materials

Guest-induced structural transformations in a porous halogen bonded framework.

V. I. Nikolayenko, D. C. Castell, D. P. van Heerden and L. J. Barbour.

Angewandte Chemie (2018)
DOI:10.1002/ange.201806399

Researchers from the University of Stellenbosch, South Africa, studied the dynamic behaviour of a porous halogen bonded framework using gas sorption, in-situ single crystal x-ray diffraction and P-DSC experiments. An IGA-002 was used to measure the volumetric gas uptake capacity. The material was shown to undergo reversible switching of its pore volume by activation or by exposure to a series of gases and is the first example of a porous halogen bonded framework that can be activated.

MOFs

Bottom-Up Fabrication of Ultrathin 2D Zr Metal-Organic Framework Nanosheets through a Facile Continuous Microdroplet Flow Reaction.

Y. Wang, L. Li, L. Yan, X. Gu, P. Dai, D. Liu, J. G. Bell, G. Zhao, X. Zhao and K. M. Thomas.

Chemistry of Materials (2018)
30:3048-3059

Using microdot flow reaction technique, ultra-thin 2D MOF nanosheets were synthesised by collaborators from China and the UK. The 2D nanosheets were characterized using a range of techniques including x-ray diffraction, electron microscopy, TGA and high pressure CO₂/CH₄ adsorption using a XEMIS-001. The 2D nanosheet was compared to the corresponding MOF prepared by solvothermal methods, and exhibited superior gas adsorption performance.

hidenisochema.com

FOLLOW US:  @HidenIsochema