



IGA Provides Penetrating Insight

An article recently published in *Nature Materials* [1] reported new research into 'partially interpenetrated' metal organic frameworks (MOFs). The paper, along with its associated supplementary information [2], features a substantial amount of sorption data acquired using an **IGA** gravimetric sorption analyzer from Hiden Isochema. This data characterizes the novel MOF materials produced and demonstrates the effectiveness of the substance as a CO₂ adsorbent.

The new partially interpenetrated MOF consists of two individual structures, one dominant structure and a secondary, partially formed structure, which are held apart by intermolecular forces. The partially formed structure gives rise to a network of internal pores with different dimensions, depending upon whether or not the lattice structure is complete. By using specially selected MOF frameworks for interpenetration, the material can be designed to create pores which selectively adsorb some gas species over others. In the case of the material synthesized at the University of Nottingham, CO₂ is selectively adsorbed over CH₄, N₂, O₂, H₂, D₂ and Ar.

Static sorption capabilities at pressures up to 20 bars were proven using an **IGA-003** system with cryofurnace and waterbath thermostating. Isotherms were measured at a range of temperatures between 195 K and 303 K. The data sets were then used to determine isosteric heats of adsorption, analyze hysteretic effects and calculate the selectivity of the material

| Temperature | CO ₂ /CH ₄ | CO ₂ /N ₂ | CO ₂ /O ₂ |
|-------------|----------------------------------|---------------------------------|---------------------------------|
| 293 K | 1.4:1 | 4.3:1 | 3:1 |
| 273 K | 2.9:1 | 26.7:1 | 27.3:1 |
| 195 K | 23.7:1 | 285:1 | 145:1 |

Table 1: CO₂ selectivities for various gas mixtures



Figure 1: Intelligent Gravimetric Analyzer (IGA)

for each of the sorbate species. The study concluded that, at near-ambient temperatures, the new material selectively adsorbed CO₂ in preference to other species according to Table 1. However, at 195 K, below the triple point temperature of carbon dioxide, the selectivity for CO₂ was shown to significantly increase. This means that the new interpenetrated MOF compares favorably to other porous materials. These selectivities are then enhanced further by hysteretic desorption of CO₂, which would improve separation when using pressure-swing techniques.

This study reinforces the potential for development of custom-designed MOF materials in gas separation technologies, as well as the power and flexibility of the **IGA** to facilitate characterization of sorption capabilities, identify potential applications and validate computer simulations of the high-tech materials of the future.

References

- [1] S. Yang *et al.* (2012) *Nature Materials* 11, 710–716
- [2] <http://www.nature.com/nmat/journal/v11/n8/extref/nmat3343-s1.pdf> (free access to extensive supplementary information)



New Applications Articles:

"Ring Opened Heterocycles: Promising Ionic Liquids for Gas Separation and Capture", S. M. Mahurin *et al.* *Journal of Membrane Science* 401-402 (2012) 61-67

Researchers at Oak Ridge National Laboratory and University of Missouri-Columbia use an **IGA-001** to investigate the solubility of carbon dioxide in a new class of ionic liquids.

"Moisture Sorption in Artificially Aged Wood-Plastic Composites", B. K. Segerholm, R. E. Ibach and M. E. P. Wålinder, *Bioresources* 7 (2012) 1283-1293

A Swedish-American collaboration investigates different methods of artificially aging wood-based products using an **IGAsorp** dynamic vapour sorption system.

...Hot off the Press!



Conference Season Extended!

As part of Hidden Isochema's initiative to meet as many of our customers as possible, 2012 has provided another very busy conference schedule. So far this year, Hidden Isochema have attended:

- **24th DZT**, Magdeburg, Germany, March
- **Pittcon 2012**, Orlando, USA, March
- **28th GFZ Meeting**, Mittelwihr, France, March
- **ACS Spring Meeting**, San Diego, USA, March
- **TAC 2012**, Nottingham, UK, April
- **CPM-6**, Delray Beach, USA, May
- **IBA-1**, Recife, Brazil, May
- **PBAST-6**, Taipei, Taiwan, May
- **Carbon 2012**, Krakow, Poland, June
- **35th BZA Annual Meeting**, Chester, UK, July
- **ISSHAC-8**, Krakow, Poland, August

Upcoming conferences include:

- **PharmSci 2012**, Nottingham, UK, 12 – 14 September
- **MOF2012**, Edinburgh, UK, 16 – 19 September
- **SE@NSF**, Sydney, Australia, 17 – 20 September
- **International Pittsburgh Coal Conference**, Pittsburgh, USA, 15 – 18 October
- **MH2012**, Kyoto, Japan, 21 – 26 October
- **AICHE 2012**, Pittsburgh, USA, 28 October – 2 November

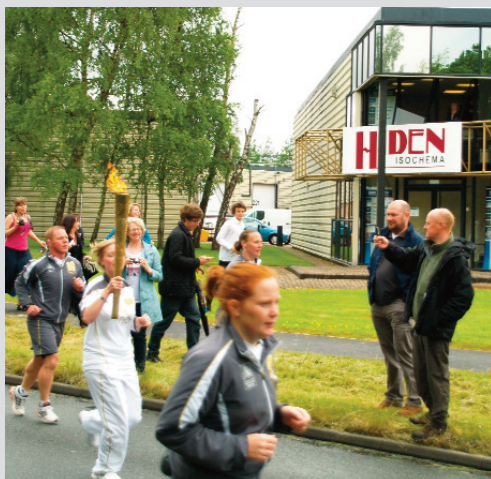
A number of other meetings are also being planned in South America and Asia through to the end of the year. We hope to see you there!



Hidden Isochema training courses

Did you know that Hidden Isochema run a range of training courses covering both theoretical and practical aspects of sorption measurements? We offer courses for new customers, refresher training for existing users, and also advanced training sessions covering areas such as material-specific measurement optimization and advanced data analysis. Training courses are delivered by our Applications Team, including five PhD qualified scientists, to a small group of delegates. This ensures a focused approach and the opportunity for practical hands-on sessions within each course.

For information on available dates, locations and the forthcoming topics, please contact us now at info@hiddenisochema.com



Olympic Torch Comes to Warrington!

Prior to the London 2012 Olympic Games, the Olympic torch was paraded across all corners of the United Kingdom of Great Britain and Northern Ireland. The torch was carried eight thousand miles around all the main towns and cities in the UK by a relay team of eight thousand runners. Finally, the torch was used to light the magnificent 212 piece ceremonial flame in the opening ceremony, one piece representing each participating country.

The Hidden Isochema staff were very proud to see the torch, carried by Tina Bye and Lauren Ashworth, pass directly past our manufacturing facility in Warrington, in the north-west of England.

We hope that everyone has enjoyed watching the Olympic Games, seeing London and the UK, and congratulate the athletes, organisers and the many thousands of volunteers who helped make the event such a success.

IF YOU REQUIRE INFORMATION OR ADVICE PLEASE CONTACT US: info@hiddenisochema.com

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