ANALYZER
HIDEN ISOCHEMA NEWSLETTER
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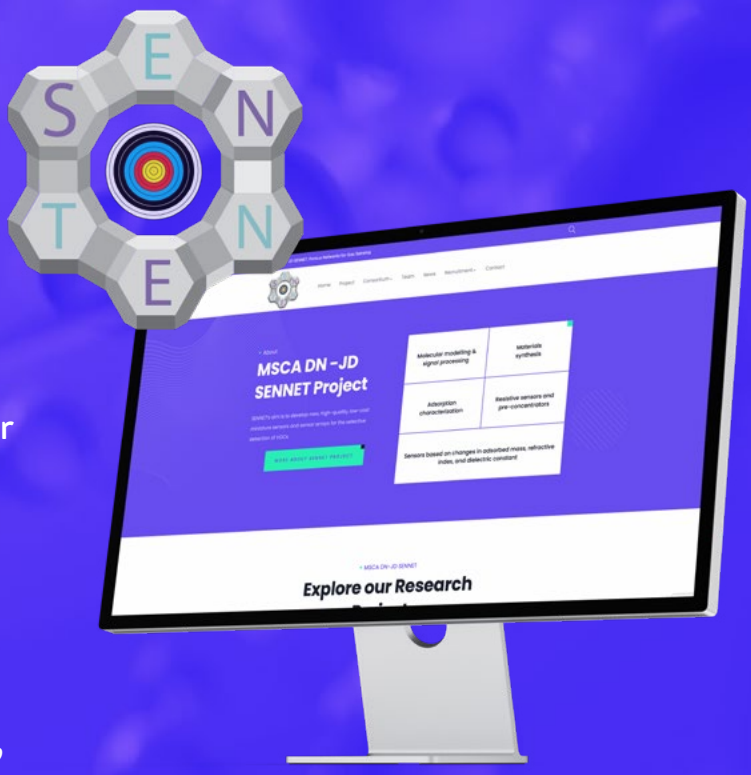
HIDEN ISOCHEMA

Making sense of MOFs with SENNET

Supporting collaborative research on MOFs, vapor adsorption and sensing technologies

Hiden Isochema is pleased to participate in the Horizon Europe MSCA Doctoral Network, SENNET (Porous Networks for Gas Sensing) as an Associated Partner.

SENNET aims to develop high-quality, low-cost miniature sensors and sensor arrays for the selective detection of volatile organic compounds (VOCs) using the adsorption properties of tunable porous materials such as metal-organic frameworks and zeolites. The project integrates expertise across materials synthesis, adsorption characterization, computational modelling, and sensor engineering, from 19 academic and industrial partners.



More on page 2...

Advancing VOC sensor research at Hiden Isochema



As part of the SENNET project, Hiden Isochema was pleased to host researchers Kavosh Karami and Iago Maye at our headquarters in Warrington. Kavosh and Iago are both working on characterization of the adsorption properties of porous materials being considered for use in VOC sensors, the main topic being tackled by SENNET. As an Associated Partner in the network, Hiden Isochema is contributing specialist expertise in adsorption science and providing project partners with access to high quality measurement capabilities.



Kavosh and Iago are PhD students in the groups of Professor Joeri Denayer at the Vrije Universiteit Brussel, Belgium, and Professor Matthias Thommes at Friedrich-Alexander-Universität (FAU) Erlangen-Nürnberg, Germany. Kavosh's research focuses on dynamic approaches to measuring multicomponent adsorption equilibria at ultra-low concentrations, a critical step for understanding how VOC mixtures interact with porous materials intended for sensing applications. Meanwhile Iago's work centres on the characterization of MOFs and zeolites using static and dynamic adsorption techniques, with the aim of linking sorption behavior to material structure and sensor functionality.

During their visit, both researchers benefited from access to our **IGAsorp** and **ECOsorp** dynamic vapor sorption (DVS) analyzers to perform vapor adsorption measurements, supported by our specialist team. Hiden Isochema engineers Harvey Manley and Maximilian Malkin provided technical training, whilst Dr. Mark Roper discussed practical measurement strategy. Sessions led by Dr. Darren Broom meanwhile covered core concepts in gas and vapor adsorption, including both volumetric and gravimetric techniques.

After a productive month in Warrington, Iago continued his SENNET placement at the Université de Caen Normandie in France in the laboratory of Professor Svetlana Mintova, while Kavosh remained for further measurements and discussions with our team. Their time here offered valuable opportunities for knowledge exchange and strengthened collaborative links across the network.

"The SENNET team addresses the challenges of VOC sensing by combining expertise from fundamental chemistry all the way through to sensor engineering"



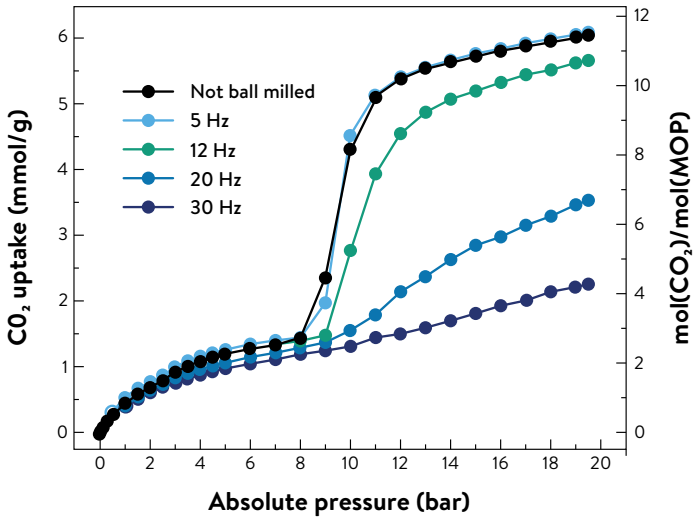
Switchable porosity in dynamic porous solids



Two recent publications from Professor Ashleigh Fletcher at the University of Strathclyde and her collaborators explore switchable porosity in dynamic solids, in both cases using IGA instruments to measure high pressure gas adsorption-desorption isotherms.

The first paper, published in Nature Chemistry, describes the synthesis and characterization of a family of flexible silver coordination polymers.[1] These materials are ostensibly non-porous but are shown to undergo a gate opening process, induced selectively by exposure to CO_2 above a threshold pressure. Adsorption-desorption isotherms for CO_2, CH_4, and CO_2-CH_4 mixtures were measured using an **IGA-003** at pressures up to 20 bar. For measurements at 273 K, CO_2 gate opening pressures between 3 and 19 bar were observed for different materials, with the threshold pressure for gate opening correlating with the linker chain length. In contrast, CH_4 isotherms were consistently IUPAC Type III, typical for non-porous materials. N_2 adsorption isotherms also showed negligible uptake, confirming the non-porous nature of the silver coordination polymers in the absence of CO_2. Measurements with mixtures of CO_2 and CH_4 showed near identical uptake for equivalent CO_2 partial pressures compared with single component isotherms. The authors also discuss the potential for further investigation and applications for this interesting family of flexible coordination polymers.

The second paper describes observation of a transition from metal-organic polyhedra to a one dimensional (1D) porous coordination polymer during solvent exchange.[2] Due to the reduced crystal size obtained for the 1D material, 3D electron diffraction – in preference to single crystal X-ray diffraction – was used to determine the material's structure. To investigate the effect of crystal size on porosity, samples of the 1D material were ball milled at different frequencies and an **IGA-001** used to measure the CO_2 sorption properties. Adsorption-desorption isotherms in the range 0-20 bar measured at 273 K showed similar moderate CO_2 uptake profiles at pressures up to 8 bar for all samples, but notable differences at higher pressures. The original material's CO_2 isotherm exhibited an abrupt step in the adsorption branch between 8 and 11 bar, with a pronounced hysteresis loop evident between 8 and 5 bar in the desorption branch. Samples ball milled at progressively higher frequencies, with correspondingly smaller crystal sizes, showed reduced CO_2 sorption capacities and flattening of the hysteresis loop. The authors discuss the potential for further complementary gas sorption and 3D electron diffraction studies.



CO_2 adsorption isotherms measured at 273 K for original and ball milled metal-organic polyhedra samples.

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"We used IGA instruments to measure high pressure sorption-desorption isotherms and study the trend in hysteresis. These results, at pressures above ambient, were absolutely essential to our conclusions."

Prof. Ashleigh Fletcher,
Department of Chemical and Process Engineering, University of Strathclyde



References

1 Selective CO_2 uptake mimics dissolution in highly fluorinated non-porous crystalline materials
Vitórica-Yrezábal et al, Nature Chemistry, 2025, 17, 1705-1711.

2 A metal-organic polyhedron-to-coordination polymer transition revealed by 3D electron diffraction
Snelgrove et al, Angew. Chem. Int. Ed., 2025, 64, e202514527.

IGAsorp supports award-winning research



Recent research from New York University Abu Dhabi has been recognised as Research Project of the Year: STEM at THE Awards Arab World 2025, highlighting advances in nature-inspired approaches to atmospheric water harvesting. Performed by Dr. Marieh Al-Handawi as part of her PhD studies under the supervision of Professor Panče Naumov, the work explores innovative ways to capture water from the air by learning from the UAE's unique desert environments.

The study focuses on the desert tree Tamarix aphylla, which excretes salts capable of attracting atmospheric moisture. Observations of this natural mechanism formed the basis of the team's 2023 Proceedings of the National Academy of Sciences publication, where water vapor sorption behavior was investigated in detail. Furthermore, quantitative measurements were performed on Tamarix branch samples with and without salt excretions, to assess their influence on water uptake; these measurements were conducted using an **IGAsorp** instrument. Results from the IGAsorp dynamic vapor sorption (DVS) measurements showed a significant increase in water sorption in the presence of salts, with uptake increasing eight-fold in comparison to branch samples with salts removed, clearly demonstrating the role of salt excretions in enhancing atmospheric moisture capture.

Beyond its biological relevance, the research provides valuable insight into how adsorption phenomena can be exploited for the development of engineered water-harvesting materials. As interest grows in technologies addressing global water scarcity, this work illustrates how rigorous sorption measurement and analysis can underpin the translation of natural strategies into practical solutions for arid and water-limited regions.

Congratulations to Marieh!

References

M. B. Al-Handawi, P. Commins, R. E. Dinnebier, M. Abdellatief, L. Li and P. Naumov, Harvesting of aerial humidity with natural hygroscopic salt excretions, Proc. Natl. Acad. Sci. U.S.A. 2023, 120 (45): e23134120. DOI: 10.1073/pnas.2313134120

PUBLICATION ROUND-UP

Hydrogen Storage

Mechanochemical Dual-Metal Modification of CuBTC Metal–Organic Frameworks for Enhanced Hydrogen Storage

Q. Yu, C. D. Brewster, R. Jagpal, A. Graf, X. Hu, T. J. Mays and M. Tian

ACS Applied Materials & Interfaces, 2025, 17, 68703-68716.

CuBTC based metal organic frameworks (MOFs) were modified with nickel and magnesium using two different methods, with the aim of improving the material's hydrogen storage properties. Hydrogen sorption isotherms and kinetics were measured for all materials at 77 K and at pressures from 0 to 20 bar using an **IGA-001**. Isotherms for the best performing material were also studied using an **IMI-HTP** at higher pressures up to 150 bar, at three cryogenic temperatures. The high pressure equilibrium adsorption data was then further analyzed to obtain the isosteric enthalpy of adsorption. The authors comment that these results demonstrate tuning the electronic environment of the open metal sites can improve hydrogen storage performance.

Water Harvesting

Maximizing Porosity and Water Sorption in Covalent Organic Frameworks via β-Ketoenamine Linkages

R. G. AbdulHalim, B. Garai, J. S. De Vos, S. Borgmans, L. Gkoura, S. Varghese, F. Benyettou, M. A. Olson, S. M. J. Rogge and A. Trabolsi

Small 2025, 21, e08046

Covalent organic frameworks (COFs) with a range of mixed imine and β-ketoenamine linkers were synthesized and characterised using a range of techniques. An **IGAsorp-CT** was used to measure water adsorption-desorption isotherms for the family of COFs, and the results analyzed in terms of maximal water sorption capacity, hysteresis, onset of water interaction at low humidity and sorption kinetics. The COF with optimal water sorption properties was investigated in further detail including kinetic sorption-desorption studies over a wider range of temperatures and extended cyclic studies between 20 and 85 %RH, indicating potential application in water harvesting devices due to the increased porosity and tunable water sorption properties.

Discovering more. Seeing more.

DATE	CONFERENCE	LOCATION
22nd – 26th March	ACS Spring Meeting & Expo	Atlanta, USA
24th – 26th March	2nd French-German Adsorption Conference	Essen, Germany
4th – 6th May	12th International Symposium on the Characterization of Porous Solids (COPS XII)	Dresden, Germany
17th – 20th May	MOF2026	New Orleans, USA
18th – 23rd May	Interpore2026	Nantes, France
9th – 10th June	9th Annual UKPorMat Conference	Bristol, UK
9th – 10th June	Hydrogen Technology & Carbon Capture Technology Expos MENA	Abu Dhabi, UAE
28th June – 2nd July	10th Conference of the Federation of the European Zeolite Associations (FEZA 2026)	Naples, Italy
12th – 17th July	World Conference on Carbon (Carbon2026)	Charleston, USA
18th – 25th July	2026 International Congress on Membranes and Membrane Processes (ICOM 2026)	San Antonio, USA

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

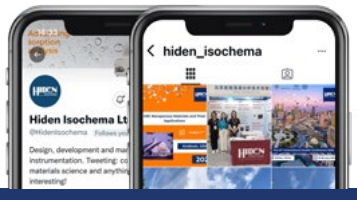
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