

GRAVIMETRIC SORPTION: A FOUNDATION OF DRYING RESEARCH

HIDEN
ISOHEMA

Gravimetric sorption provides precise, real-time measurement of how materials gain and lose moisture. By revealing equilibrium sorption behaviors and drying rates under controlled conditions, it delivers **critical data needed by drying research**.



Relevant Applications

- **Dessicants** - moisture cycling & regeneration
- **Porous sorbent optimisation** - water uptake profiling
- **Biological and pharmaceuticals** - humidity driven transitions
- **Agriculture and food** - water activity control
- **Polymers** - diffusion limited transport
- **Cement** - moisture buffering & structural effects
- **Wood, pulp and paper** - equilibrium moisture and stability



Discover Hiden Isochema

Hiden Isochema is a world leader in the design and manufacture of advanced gas and vapor sorption analyzers for a diverse range of drying-related applications.

**Scan to watch our
company overview**

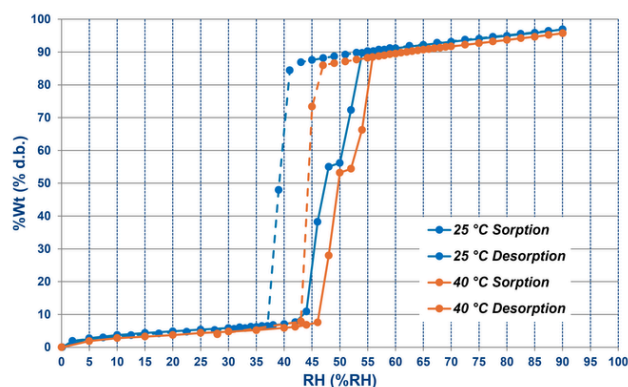
Find out more:

- ▶ See overleaf for example data sets
- ▶ See back page for more details on our class-leading gravimetric sorption analyzers.

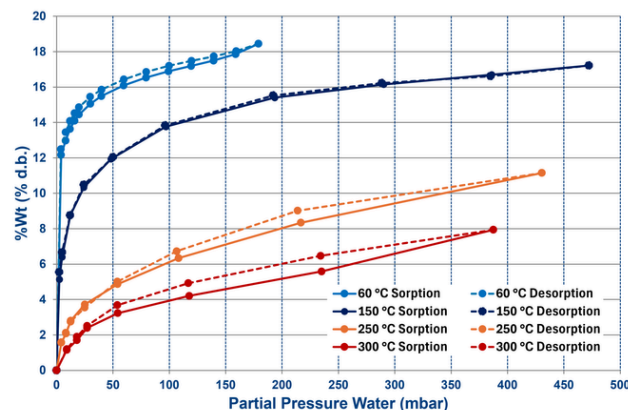


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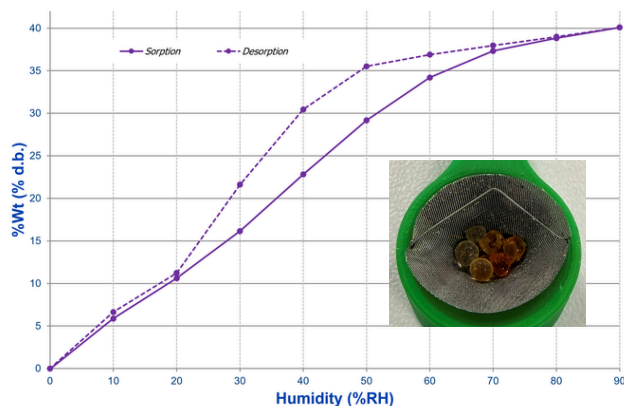
EXAMPLE DATA



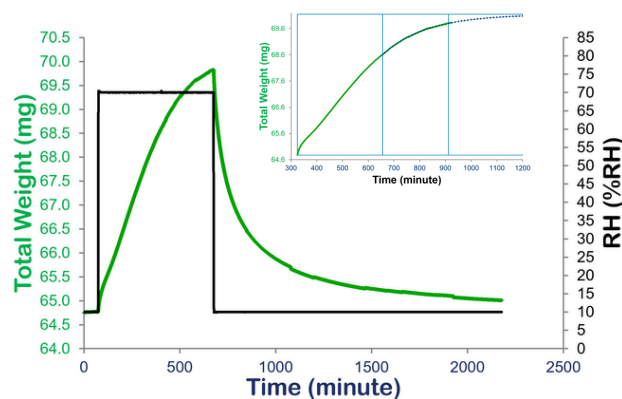
High resolution water sorption and desorption isotherms for **Metal Organic Framework MIL-101(Cr)** at 25 °C and 40 °C. Increasing temperature shifts the S-shaped uptake step to higher RH, enabling drying under mild heating. This demonstrates why MIL-101 (Cr) is highly effective in **temperature-swing water harvesting systems**.



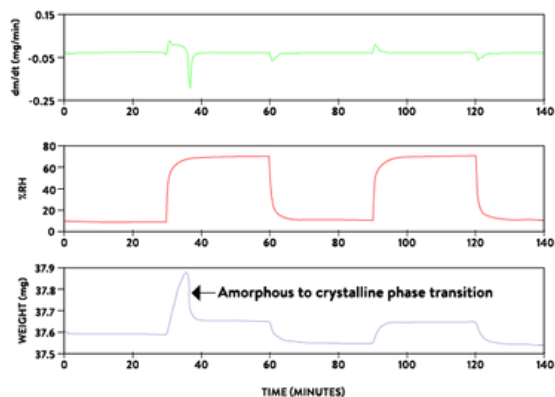
Water sorption isotherms of **zeolite 13X** at 60, 150, 250 and 300 °C. The isotherms show strong temperature dependence, with high uptake at lower temperatures and reduced capacity as temperature increases. Even at 300 °C, uptake is still sufficient for zeolite 13X to dry reaction environments of **Sorption Enhanced Reaction Processes**.



Water sorption isotherm of **silica gel indicator beads** at 25 °C. The beads show significant uptake up to 40 wt% at 90 %RH. The silica gel does return to its original dry weight during desorption, although there is some hysteresis observed and the colour indicator suggests it has not been fully regenerated. Regeneration at 150 °C for 3 hours is usually advised.



Sorption-desorption kinetics for **long grain rice** at 15 °C between 10 and 70 %RH. Characterizing moisture sorption behavior of rice and other grains in chilled environments is important for understanding relevant processes such as **chilling aeration**. (Inset) Asymptotic prediction of equilibrium uptake at 70 %RH.

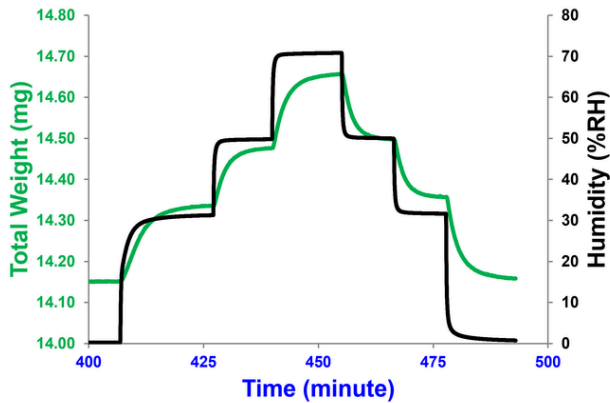


Spray drying is used in the pharmaceutical industry as a scalable means of manufacturing powders with favourable properties such as enhanced solubility and consistent particle size distribution. **Dynamic Vapor Sorption (DVS)** plays an important role in understanding the behavior of spray dried materials including hygroscopicity and amorphicity.

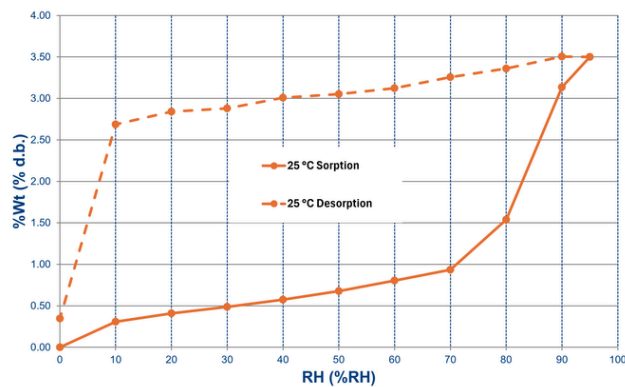
Spray-drying is a common process used for creating amorphous forms of **active ingredients and excipients such as lactose**. With DVS, very low levels of amorphous content can be detected.

Water is used as a plasticizer and upon stepping relative humidity from 10 to 70 %RH, the amorphous material shows significant moisture uptake before crystallization occurs and the sample weight reduces. The difference between the first and second cycles is indicative of amorphous content.

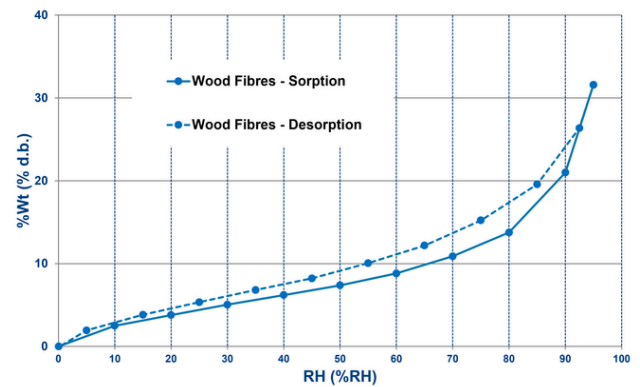
EXAMPLE DATA



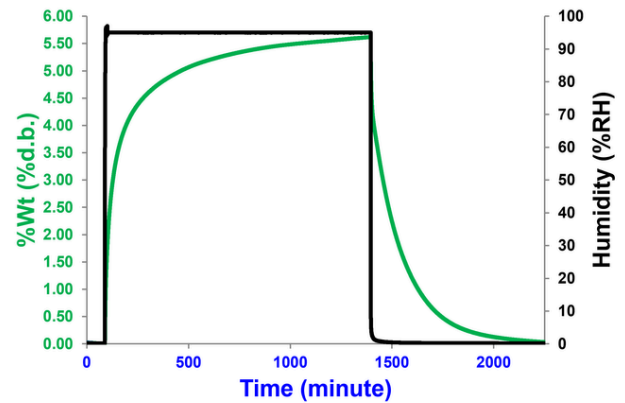
Sorption-desorption kinetics data for a **cellulose acetate film** at 40 °C. The weight-time curves allow Fickian diffusion coefficients to be calculated, providing quantitative insight into moisture-transport rates relevant to industrial drying processes such as **membrane conditioning** and **polymer processing**.



Sorption-desorption isotherms measured at 25 °C for **Portland cement** sample. Significant hysteresis is observed with substantial moisture retained during desorption until %RH is reduced to 0 %. The hysteresis is consistent with established models in which water exchange with C-S-H interlayer spaces dominates over contributions from gel and capillary pores.



Water sorption isotherms of a **fibrous wood insulation material** showing ~30 wt% uptake at 95 %RH. The pronounced hysteresis loop indicates delayed drying as moisture is retained in the fibrous structure. This is beneficial for **humidity buffering** but a potential risk for mould development if drying is too slow.

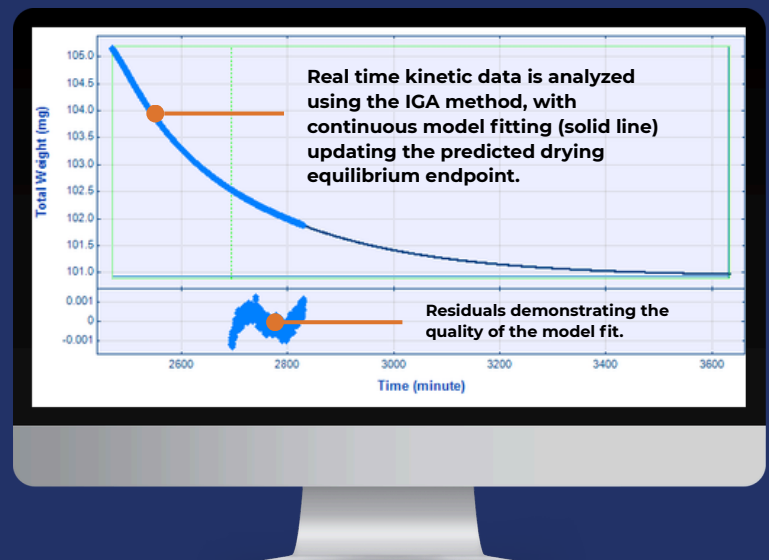


Sorption-desorption kinetics for a **Portland cement** sample at 25 °C during a 30 - 95 - 30 %RH cycle showing the material's moisture uptake and subsequent drying behavior. Characterizing moisture uptake and rate of drying is important for understanding material durability in response to processes such as C-S-H swelling and drying related cracking.

Unique methodology for accurate drying end-point determination

All Hiden Isochema gravimetric sorption analyzers use the unique **IGA method** to predict true drying end-points. Optimized equilibrium detection shortens experiment times while maintaining consistency.

Real-time modeling of weight-time data predicts equilibrium and applies objective criteria automatically, ensuring reliable, repeatable results.



Hidden Isochema offers a diverse portfolio of gravimetric analyzers to provide complete sorption solutions for drying.



IGA SORP Core

IGA SORP Core is a compact, automated dynamic vapor sorption analyzer designed for routine water sorption measurements.

- Temperature range of 5 to 40 °C
- Humidity range of 0 - 98 %RH



IGA SORP

IGA SORP is a compact, automated dynamic vapor sorption analyzer for more in depth studies of water and organic vapor sorption.

- Select from three temperature ranges: 5 to 50 °C, 5 to 85 °C or 5 to 300 °C
- Integrated heater for in-situ drying and regeneration



IGA ECOSORP

The IGA ECOSORP delivers high resolution gravimetric measurements of water and CO₂ sorption - ideal for carbon capture research.

- Temperature range of 5 °C to 85 °C
- Widest controllable CO₂ partial pressure range - down to 100 ppm without pre-mixed cylinders



IGA & XEMIS series

The IGA and XEMIS series are advanced high accuracy, fully automated gravimetric sorption analyzers, designed for sorption analysis under extreme conditions.

- Temperature range of - 196 °C to 500 °C
- High vacuum to 200 bar
- Compatible with a wide range of gases and vapors, including corrosive species