

Hidden Isochema HTP Series

Volumetric and Thermal Desorption
Hydrogen Storage Analysers



www.hiddenisochema.com

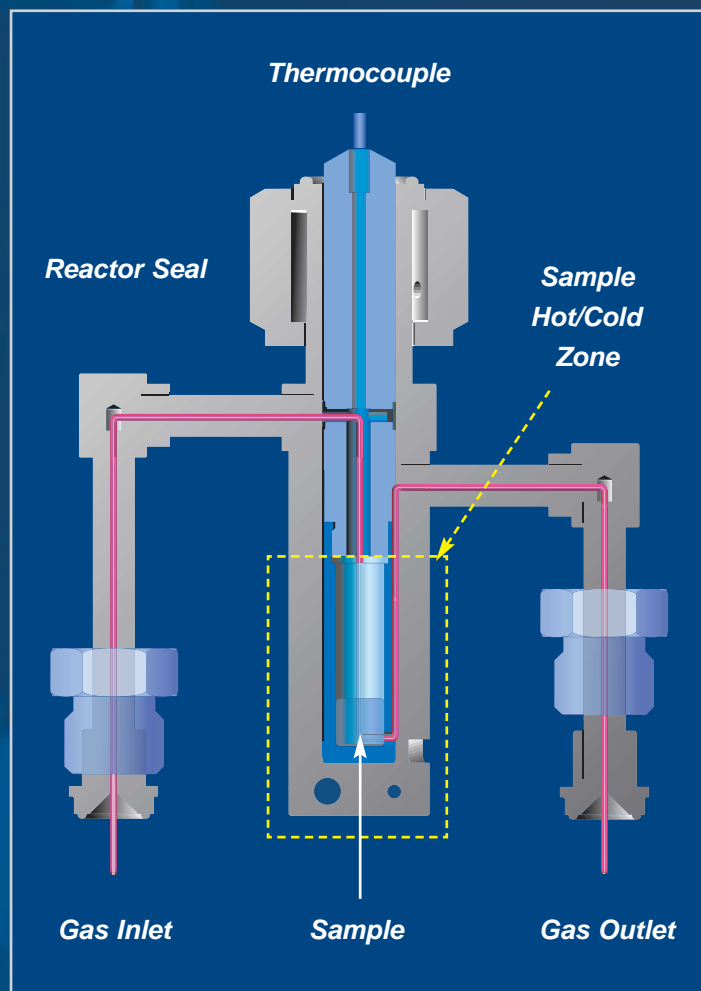
HTP

Series Overview

The HTP series provides a fully automated instrument platform for the analysis of hydrogen storage materials.

The advanced features and versatile, modular design offer a range of analysis possibilities for samples as small as a milligram. As a volumetric sorption analyser, the ultra-low dead volume and careful thermal design give unparalleled accuracy for isotherm measurement by Sieverts' Method. For Temperature-Programmed Desorption (TPD), or Thermal Desorption Spectroscopy (TDS), the optimised analysis configuration allows quantitative desorption measurements using an integrated quadrupole mass spectrometer.

HTP systems are powerful research tools that give the user complete control over the experimental parameters, allowing the study of a diverse range of materials.



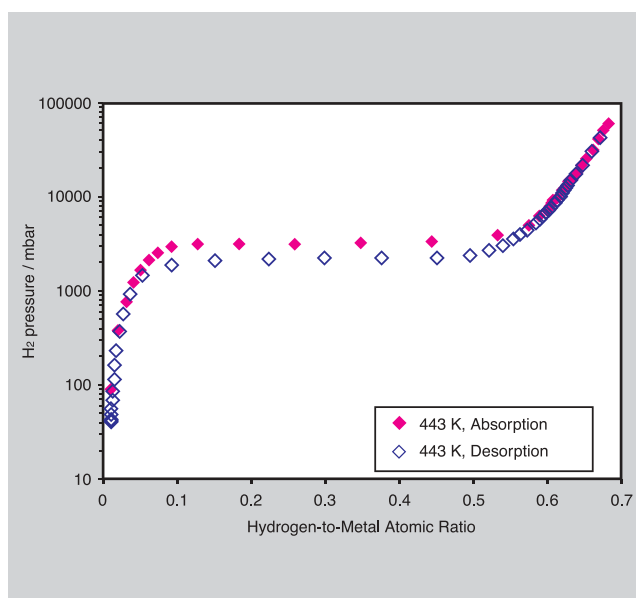
A cross-section of the HTP reactor design indicating the gas path for flowing mode operation.

HTP1-V

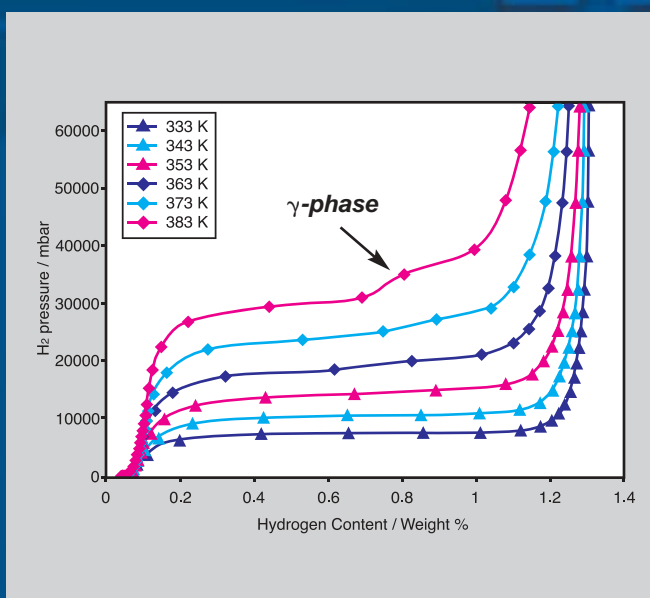
Volumetric Analyser

The HTP1-V volumetric analyser is specifically designed for high accuracy hydrogen sorption measurements on a range of potential hydrogen storage materials. The instrument offers fully automated operation for the measurement of metal hydride pressure-composition isotherms (PCIs) and excess adsorption isotherms for microporous adsorbents.

The system can operate in the temperature range from 77 K to 773 K, including stable isothermal control at intermediate temperatures, and at pressures of up to 200 bar. The incorporation of auxiliary gas inputs allowing the use of other sorbates, in addition to the helium used for dead space volume calibration, makes the HTP1-V a versatile high pressure volumetric sorption analysis system.



Pd-H absorption-desorption isotherms measured at 443 K using the HTP1-V volumetric analyser.



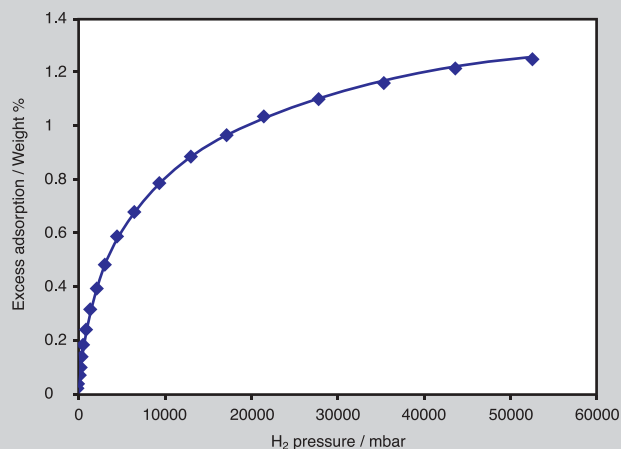
Desorption isotherms for the LaNi₅-H system, measured at 6 temperatures using the HTP1-V volumetric analyser. The appearance of an intermediate γ -phase can be seen in the higher temperature data.

HTP1-S

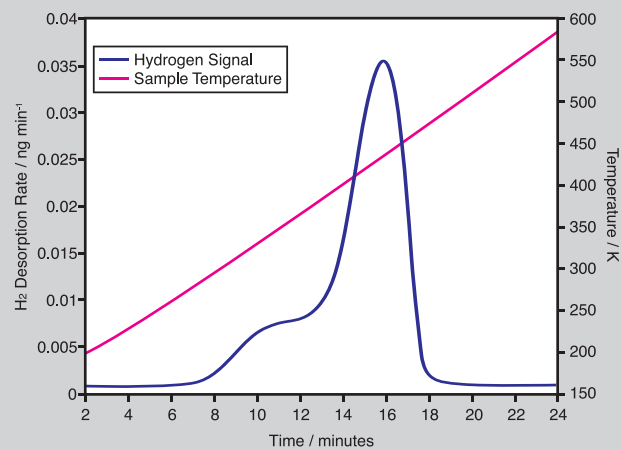
Thermal Desorption Analyser

Incorporating the full volumetric capabilities of the HTP1-V system, the HTP1-S thermal desorption analyser offers additional TPD-MS features that allow the study of hydrogen desorption behaviour and exchange reactions. The instrument can be operated in both an isothermal static uptake measurement mode or a flowing, temperature-programmed desorption (TPD) mode for total hydrogen content determination.

The hydrogenation of samples can be carried out at pressures and temperatures of up to 200 bar and 773 K, and linear thermal ramps can be applied in the range 77 K to 773 K. Desorption is performed into a helium carrier gas stream and detected with a quadrupole mass spectrometer. The system design incorporates a low volume gas pathway and heated quartz capillary sampling system, for a rapid response time and maximum signal intensity. The programmable flow streams allow the study of isotopic exchange reactions (H_2/D_2) and the combination of different gas species during flowing mode experiments.



A hydrogen adsorption isotherm for a microporous material at 87 K, measured using the HTP1-V volumetric analyser.



A thermal desorption spectrum from a 3 mg Pd sample, determined using the HTP1-S thermal desorption analyser.

HTP1-V

- Dedicated volumetric hydrogen sorption analyser
- 100 bar standard upper pressure capability, with optional 200 bar configuration
- High stability isothermal control from 77 K to 773 K
- Stainless steel vacuum and pressure assembly to ultra-high vacuum standards
- High vacuum oil-free sample degassing capability, for microporous material studies
- Automated isotherm acquisition with integrated self-calibration for PCI and PCT studies
- Programmable sequences for pre-treatment, activation and cycling stability studies
- Real-time analysis of pressure relaxation kinetics
- Isobaric kinetic measurement mode using a mass flow controller (MFC) signal integration
- Auxiliary gas inputs with mass flow control for calibration and surface area/pore volume analysis using inert probe gases (e.g. Ar, N₂, CO₂, CH₄)

HTP1-S

- Versatile thermal desorption analyser with coupled quadrupole mass spectrometry, and full HTP1-V functionality
- Programmable sequences for thermal desorption studies
- Automated hydrogen signal calibration using calibrant gas mixture
- Programmable flow streams for additional flowing gas mixture studies (e.g. H₂/D₂ isotopic exchange reactions)
- Microbore custom-designed components for ultra-low dead volume gas flow path and minimal permeation errors
- Isothermal and linear thermal ramp control from 77 K to 773 K



Technical Specifications

Sample Reactor	Max. bulk sample volume: Construction material: Internal sample holder: Reactor seal:	~ 1 cm ³ (standard reactor) Stainless Steel (SS316L) Gold-plated Copper Cajon VCR-8
Pressure	Design pressure: Typical accuracy: Transducer ranges: (up to 3 per system) Base vacuum: Compressibility correction accuracy:	200 bar ± 0.05 % of range 1, 10, 100, 200 bar 2, 10, 100 mbar < 10 ⁻⁶ mbar 0.1 % (NIST Fluid Properties Database)
Gas Inlets	Up to three Mass Flow Controllers Max. flow rate:	1000 ml min ⁻¹
Temperature	Measurement range: Temperature sensors: Accuracy: Typical regulation accuracy: Cabinet regulation accuracy:	Ambient – 773 K (standard) 77 – 773 K (with optional cryocooling) Platinum Resistance Thermometer (Pt100) or Type K Thermocouple ± 1 K (Type K), ± 0.1 K (Pt100) ± 0.1 K ± 0.1 K
Mass Spectrometer	Coupling method: Atomic mass range: Detection limit: Detector:	Quartz Inert Capillary (2m) 1-200 amu 0.1 to 1 ppm, subject to spectral interference Better than 20 ppb (Triple Mass Filter option) Dual Faraday/Electron Multiplier

It is Hiden Isochema's policy to continually improve product performance and therefore specifications are subject to change.

Hiden Isochema

Advancing Sorption Analysis



Hiden Isochema Ltd.,
231 Europa Boulevard, Warrington, WA5 7TN. UK
Tel: +44 (0) 1925 244 678
Fax: +44 (0) 1925 244 664
Email: info@hidenisochema.com
Web: www.hidenisochema.com

