

## Unique Features of the IGA-001 Analyser

The IGA-001 is a commercial gravimetric system that is able to perform automatic gravimetric isothermal and temperature programmed sorption analyses. This system enables fundamental research and also includes a suite of in situ physical property measurements such as densitometry, surface area, porosity and outgassing behaviour only previously possible using separate instruments. The IGA-001 is the only analyser to be designed with Conflat flanges for ultra high vacuum compatibility whilst also providing high gas pressure operation.

The IGA-001 uniquely provides simultaneous determination of equilibrium interactions and kinetic (non-equilibrium) properties as a function of concentration or temperature. The IGA real-time kinetic analysis is the only commercial software capable of this simultaneous study providing a complete thermodynamic characterization (rate constants and equilibrium uptakes) of the interaction of different species.

In order to measure the kinetic response of the sample it is necessary to have a high frequency of mass, temperature and pressure measurements. The unique IGA balance with its custom control electronics is inherently stable and requires no acquisition delay for re-taring. The measurement of mass is continuous, with logging rates up to 10 times per second. This combination of fast data acquisition and processing, high resolution and high stability is essential for the analysis of fast sorption kinetics and is unique in the market place.

The IGA is the only system available with a diffusion coefficient calculator based on Crank's models for samples with either plate- or sphere-like geometry. The calculator fits the full equation for Fickian diffusion, calculating the diffusion coefficient from the whole kinetic (mass versus time data after a step in pressure). This allows the characterization of diffusion coefficient as a function of composition.

The system is also uniquely flexible and can be upgraded to enable pure vapour, multi-component and flowing sorption measurements. Additionally, the IGA is the only commercial gravimetric instrument that can be fitted with a fully integrated mass spectrometer, allowing synchronous control and tracking of specific evolved species with sample changes.

The automation offered with the IGA is unrivaled. Total control of pressure, temperature and flow and the ability to automatically run sequences and cycles at any time during the experiment; before or after any isotherm or series of isotherms or after each point within an isotherm. Isotherms can also be programmed to run at a series of different temperatures all without need of user intervention.

## **IGA Specifications to Note:**

### **Balance:**

Capacity: 5g

Resolution: 0.2 micrograms as standard (0.1 micrograms available as an option)

Stability (in an inert atmosphere at 25°C): Long term +/-1 micrograms (1 week)

Short term: +/- 0.2µg (1 hr)

Independently thermostatted balance, controlled to +/-0.1°C

### **Temperature:**

Measurement:

PT-100 sensor (platinum resistance thermometer) -196°C to 500°C

Accuracy: 0.1°C

### **Control:**

Integrated furnace temperature controlled between 50°C to 500°C.

Control accuracy: +/- 0.1-1°C

Dewar for operation at 77K with liquid nitrogen

Upgradeable temperature options (from -196°C to 1000°C).

### **Pressure:**

$10^{-8}$  mb to 20 bar

Two pressure sensors: 20 bar and 1 bar (upgradable to a maximum of three)

Minimum control increment: 0.05% of range

Control Accuracy (set-point regulation): +/- 0.02% of range

Leak rate  $<10^{-9}$  mbar l/sec

SS 316-L reactor with all metal CF seals

Maximum rate of pressure change (admittance): 1% range / sec

### **Kinetic Measurement:**

Frequency of measurement of mass, temperature and pressure up to once every 0.1 sec.

Real-time trend analysis of mass relaxation to allow measurement time to be adjusted automatically according to the sorption kinetics. The rate constant of uptake is also automatically determined.

### **Software and Safety Features:**

Over-pressure protection: in main system and for the vacuum pumps.

Safety Interlocks :- for integration with temperature control.

Buoyancy calculator to correct weight change readings

Densitometry calculator

Gas compressibility calculator

BET analysis routines

Diffusion Coefficient Calculator