KEP Technologies

2020 Catalogue Laboratory Services

Thermal Analysis at your service

DSC, Calorimetry, TGA, TG-DTA, TG-DSC,
TMA, Evolved Gas Analysis, Sorption

setaram
KEP TECHNOLOGIES

CHALLENGES

We listen to your needs to help you meet your challenges such as:

- Limited investment capabilities and resources
- The need to develop your knowledge of analysis techniques
- The qualification of processes
- Access to new markets
- Development of new products/methodology
- Quality Control

SOLUTIONS

As there are many different needs, we offer:

- A versatile laboratory with a wide range of instruments, techniques and operational conditions:
  - DSC, DTA, TGA, TMA, Evolved gas analysis, Dilatometry, Manometry, Thermal Conductivity
  - Temperature from -196°C to 2400°C, from vacuum up to 500 bar, a broad range of atmospheres

- Support from an experienced team:
  - Training
  - Analysis and Application support
  - Contract testing
  - Demonstrations

BENEFITS

Our solutions come from our vast experience and deliver real added value:

- Increased autonomy/technical operational skills
- Forward planning on operational expenses
- Reduced time to market
- Reduced risk on capital investment – try before you buy
- Access to new techniques
- Qualification by an independent laboratory
- Increase your brand image

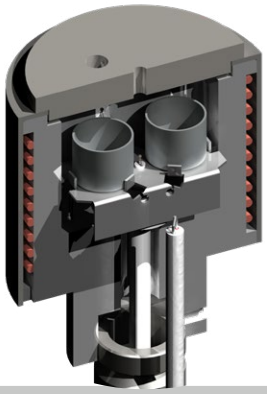
Temperature variation and heat flow measurement

DTA – Differential Thermal Analysis – & DSC – Differential Scanning Calorimetry – measure respectively the temperature difference and the heat flow difference between a sample and a reference material (subjected to the same temperature variation in a controlled atmosphere).

DTA measures the transformation temperature in all categories of materials; DSC determines the temperature and heat of transformation.

SETARAM offers:

- The widest temperature range of all DTA systems (from –150°C to 2400°C°) using high-precision tri-couple probes
- The most complete choice of DSCs (from QC systems to the highest sensitivity DSC, and 3D DSC Sensor inside)



Properties measured by DTA / DSC include phase changes, glass transition, melting, purity, evaporation, sublimation, crystallization, pyrolysis, heat capacity, polymerization, denaturation / aggregation, compatibility, mixtures, reactions, etc.

Mass variation

Thermogravimetry (TGA) measures weight changes in a material (subjected to temperature variation in a controlled atmosphere).

All SETARAM balances satisfy the highest accuracy and stability criteria.

Properties measured by thermogravimetry (TGA) include corrosion, pyrolysis, adsorption / desorption, loss of solvent, oxidation / reduction, hydration / dehydration, decomposition, carbon black etc.

Dimension variation

Thermomechanical analysis (TMA) measures the deformation of a sample under non-oscillating stress against time or temperature, with a programmed temperature.

The vertical design of SETARAM's TMA systems makes it possible to work with very low loads applying only negligible force to the sample.

Properties measured by thermomechanical analysis (TMA) include thermal expansion coefficients, softening, sintering, glass transition etc

Evolved gas analysis

Thermogravimetry (TG) or Thermogravimetric Analysis (TGA) measure the mass loss or gain of a sample of material as a function of time or temperature when it is heated or cooled under a certain temperature profile in a controlled atmosphere. Simultaneous thermal analysis (TG-DTA or TG-DSC) additionally allows the corresponding heat effects to be qualified or quantified.

The contribution of hyphenated techniques, also known as Evolved Gas Analysis (EGA) have proved particularly interesting for the investigation of the chemistry of a reaction or thermal decomposition owing to the identification of the evolved species.

TGA/STA-MS

Mass spectrometry identifies the evolved molecules after their ionization based on the m/z ratio of the main ions and their fragments. Coupling can be achieved thanks to the heated capillary or supersonic methods.

- Features: best detection limit, fast transfer time
- Benefits: applicable to small mass variations, easy to set-up, detection of heavy molecules (with Supersonic System)

TGA/STA-FTIR

Chemical functions of the evolved molecules are identified according to their specific absorption of IR light wavelengths.

- Features: Signals specific to a given chemical function
- Benefits: Applicable to the detection of families of substances in complex gas blends evolved from decomposition of organic samples

TGA/STA-GC/MS

TG-GC/MS is becoming increasingly popular, as gas chromatography allows a first separation of the evolved species, before their identification by the mass spectrometer.

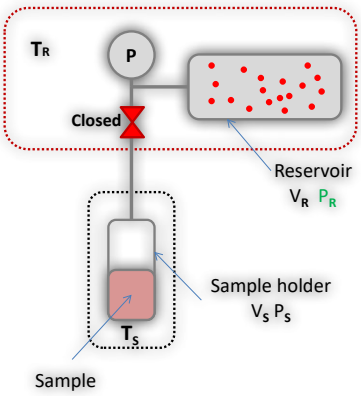
- Features: Most effective gaseous molecules' separation and identification
- Benefits: Applicable to the identification of substances in complex gas blends evolved from decomposition of organic samples

Setaram instruments can be coupled with any FTIR, MS and GCMS instruments

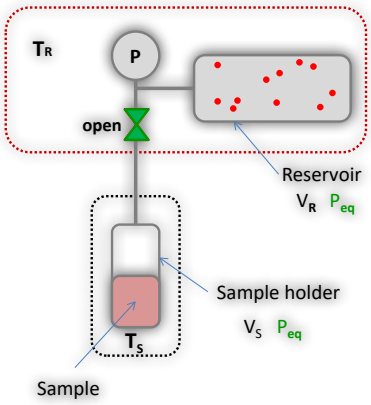
Manometry

The GASPRO is based on the Sievert's method. A sample at known pressure and volume is connected to a reservoir of known volume and pressure through an isolation valve. Opening the isolation valve allows new equilibrium to be established. Gas sorption is determined by the difference in actual measured pressure (Pf) versus calculated pressure (Pc).

GASPRO is designed for the measurements of gas sorption on a single sample with a wide range of multiple dosing volumes combined with PID Pressure and PID Temperature control systems.



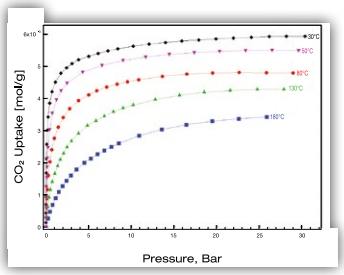
Gas is injected in a reservoir of known volume (VR) at a controlled Temperature (TR) at a set pressure (PR).
The quantity of gas in the reservoir is known from these parameters and its equation of state (EOS).
The sample is contained in a sample holder at a set temperature (TS) whose free volume is determined (VS).



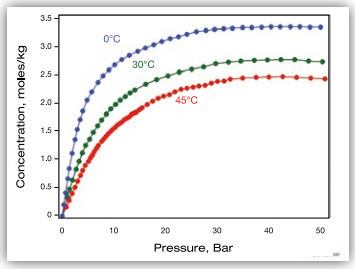
The isolation valve is opened.
The gas expands in the new volume (reservoir volume + free volume above the sample). The pressure is measured in this new volume until equilibrium.
The real equilibrium pressure and the EOS allows the absorbed Quantity to be calculated.

Types of measurements include:

- Temperature programmed desorption (TPD) dynamic measurements
- True kinetics and rate constants over the full sorption or desorption range as a function of pressure and temperature
- Pressure-Composition Isotherms (PCT, PCI) for determination of equilibrium temperatures, pressures and thermodynamics (figure below).
- Charge and discharge cycling with repeated kinetic measurements to study long-term cycling effects on capacity and kinetics



CO_2 PCT- isotherms for zeolite 13X at 30, 50, 80, 120 and 180˚C



CH_4 PCT- isotherms for zeolite 13X at 0,30 and 45˚C

CONTRACT TESTING

Our resources and experience allow us to characterize all the thermal properties of your materials. We can also combine the techniques for an optimal analysis.

✔ TO BE USED ✓ CAN BE USED • NOT USED

Contact us for the prices of our services by providing the following information:

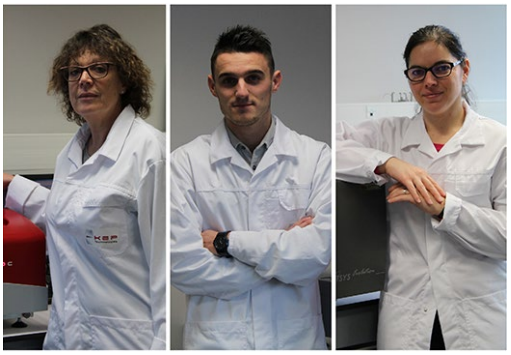
- Temperature and speed range
- Isothermal time
- Atmosphere
- Sample type / Nb / Quantity

PROPERTIES	THERMAL EVENT T°	THERMAL EVENT T° & HEAT	MASS CHANGE	DIMENSION CHANGE	GAS ANALYSIS	SORBED GAS CONCENTRATION	CONDUCTIVITY
Activation energy / Pre-exponential factor	•	✔	✓	•	•	•	•
Adsorption	✓	✓	✔	•	•	✔	•
Aggregation	•	✔	•	•	•	•	•
Carbon black content	•	•	✔	•	✓	•	•
Combustion	✓	✓	✔	•	✓	•	•
Compatibility	•	✔	•	•	•	•	•
Corrosion	•	✔	✔	•	•	•	•
Crystallization	✓	✔	•	•	•	•	•
Crystallinity rate	✓	✔	•	•	•	•	•
Curie point	✓	✓	•	•	•	•	•
Decomposition	✓	✓	✔	•	✓	•	•
Denaturation	•	✔	•	•	•	•	•
Desorption	•	✓	✔	•	✓	✔	•
Evaporation	✓	✓	✔	•	✓	•	•
Gelatinization	•	✔	•	•	•	•	•
Glass transition	✓	✔	•	✓	•	•	•
Hazard evaluation	✓	✔	✓	•	✓	•	•
Heat Capacity	•	✔	•	•	•	•	•
Heat of mixing	•	✔	•	•	•	•	•
Hydration / dehydration	✓	✓	✔	•	•	•	•
Loss of solvent	•	✓	✔	•	✓	•	•
Melting	✔	✔	•	✓	•	•	•
Oxidation Induction Time (O.I.T.)	•	✔	✓	•	•	•	•
Oxidation	✓	✓	✔	•	•	•	•
Phase transition	✔	✔	•	•	•	•	•
Polymerization	•	✔	•	•	•	•	•
Purity	•	✔	•	•	•	•	•
Pyrolysis	✓	✓	✔	•	✓	•	•
Reduction	✓	✓	✔	•	✓	•	•
Sintering	•	•	•	✔	•	•	•
Softening	•	•	•	✔	•	•	•
Solid Fat Index (SFI)	•	✔	•	•	•	•	•
Sublimation	✓	✔	✓	•	•	•	•
Thermal conductivity	•	•	•	•	•	•	✔
Thermal expansion coefficient	•	•	•	✔	•	•	•
Thermal stability	✓	✔	✓	✓	•	•	•
Wax Appearance Temperature (WAT)	•	✔	•	•	•	•	•
Young's modulus	•	•	•	✔	•	•	•
TECHNIQUES	**DTA**	**DSC** OR CALVET TYPE CALORIMETRY	**TGA**	**TMA**	**EGA** MS FTIR OR GC/MS	**MANO-METRY**	**MODIFIED TPS**

The table is not exhaustive, please contact us to discuss your needs.

TRAINING

We can provide standard training sessions on the use of our Thermal Analyzers and Calorimeters, as well as customized training sessions to address your specific needs.
You can download our training catalogue from our website : www.setaram.com



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