APPLICATIONS FOR ENERGY AND ENVIRONMENT

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BATTERIES

Assess thermal stability, heat transfer management, self-discharge data.

TGA, DSC and calorimetry for battery testing

Setaram thermal analysis and calorimetry equipment is widely used for battery testing such as measurements of decomposition temperature, charge/discharge heat and self-discharge power.

Assess thermal stability, heat transfer management, self-discharge data.

The quality and thermal safety of a battery are general concerns for developers and manufacturers. Our solutions provide you with electrodes, electrolytes, membranes, or even full battery characterization.

Thermal stability	Under normal or abusive conditions, batteries may be exposed to high temperatures. TGA, STA and calorimetry help you select the most resistant batteries and battery materials.
Charge-Discharge	You may need to characterize heat transfer in batteries during charging and discharging. Calorimetry provides you with the necessary heat release and heat capacity data.
Self-discharge	If you need to specify the capacity of your batteries to retain their charge for long periods, calorimetry is the solution. It directly measures a battery's self-discharge heat.

More details on Brochure
https://setaramsolutions.com/app/uploads/sites/2/2023/03/EN-BATTERIES.pdf

CATALYSTS AND ADSORBENTS

Characterize their sorption, desorption, selectivity data, coke content.

Calorimetry and gas sorption analysis for catalysts and adsorbents

Calorimetry and gas sorption analysis, alone or combined, can be used to characterize the surface properties of catalysts and adsorbents. This is essential for improving process performance or selecting the most suitable materials for energy and environmental processes.

If you need to select the best catalyst for an application, or to define the applications of a new adsorbent, we have solutions to help! They can handle gas-solid, vapor-solid, or liquid-solid interactions.

Sorption isotherms	TGA and Manometry characterize how much gas or vapor a material can capture. With these methods, you can measure and compare sorption isotherms.
Sorption kinetics	If a solid substrate adsorbs a lot of gas but the sorption takes too long, it isn't applicable. With TGA and manometry, you can measure how fast the sorption takes place between the gas and the solid.
Selectivity	If you're interested in separation processes, the best materials adsorb more of the desired gas, faster. You can compare sorption isotherms and kinetics to characterize selectivity against various gases.
Heat of sorption	To select the best catalysts, you need to understand their surface chemistry. You can measure heat of sorption by coupling calorimetry with manometry. A large amount of heat means a strong interaction between the catalyst surface and the test molecule, and vice versa.
Coke content	You can ensure your catalysts work for longer with TGA. A typical application of TGA is the quantification of the coke deposits on a catalyst's surface during its operation.

More details on Brochure
https://setaramsolutions.com/app/uploads/sites/2/2023/01/EN-CATALYSTS.pdf

RENEWABLE ENERGIES

Evaluate the thermal properties and processing behavior of materials used in renewable energy applications such as solar, wind, and biomass.

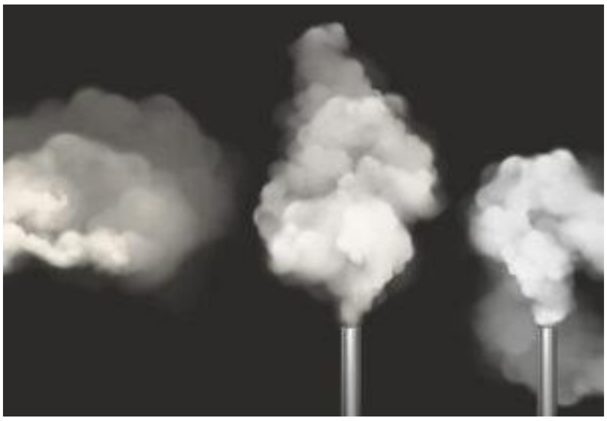
Thermal characterization of materials for renewable energy

Thermal analysis and calorimetry of organic or inorganic materials used in renewable energy technologies provide key data about their thermal stability, synthesis, processing or composition.

Solar energy	Thermal analysis and calorimetry are essential tools for evaluating the thermal stability, phase transitions, and degradation behavior of materials used in solar energy applications. These techniques provide critical insights into the performance of photovoltaic components such as complex alloys, ceramics, perovskite as thin films and / or nanostructured. They also help assess the reliability of encapsulation materials, ensuring long-term durability under varying thermal conditions.
Wind energy	Thermal analysis and calorimetry are key to evaluating the thermal stability and curing behavior of composite materials used in wind turbine blades. These are critical data for ensuring structural integrity under fluctuating environmental conditions. These methods also help assess the high-temperature performance of strong permanent magnets in generators, ensuring reliability under operational stress.
Biomass	BIOMASS Thermal analysis techniques like TGA are essential for characterizing biomass in combustion, pyrolysis, and gasification processes by determining water, ash content, reaction temperatures, and solid residues. Evolved Gas Analysis (EGA) complements this by identifying valuable gases released during pyrolysis. Additionally, calorimetry provides crucial data on heat and heat capacity, supporting energy balance and heat transfer simulations in biomass processing.

CO2 CAPTURE AND SEQUESTRATION

Gas sorption, desorption, selectivity and regeneration data of capture materials.



Get data on CO2 sorption, desorption, selectivity and regeneration using thermogravimetry, gas sorption analysis and calorimetry, alone or combined.

Measure key material properties for CCS processes.

Carbon Capture & Sequestration processes aim at releasing less carbon dioxide into the environment. Most processes are based on the reversible sorption between the gas and a substrate. Characterizing the subtrate, which can be a solid or a liquid, is very important.

Sorption isotherms	An efficient substrate needs to capture large amounts of gas at a given temperature. You can use manometry or TGA to determine sorption isotherms, or the amount of sorbed CO2 per quantity of substrate.
Sorption kinetics	If the substrate adsorbs a lot of CO2 but the sorption takes too long, it doesn't work. With TGA and manometry, you can measure how fast the sorption takes place between the gas and the substrate.
Selectivity	The substrate used must be selective, i.e. capture more CO2 than other gases. You can compare sorption isotherms and kinetics to characterize selectivity of the substrate against various gases.
Heat of sorption	Is high heat released in the process during adsorption? How much heat is necessary to regenerate the substrate after saturation with CO2? To help answer these questions, measure heat of sorption with calorimetry coupled to manometry.

HEAT STORAGE MATERIALS

Measure sensible and latent heat of PCM, heat transfer fluids, reversible sorption material.

Characterization of materials for thermal energy storage

Setaram calorimeters measure a wide range of thermal and thermodynamic properties. We offer solutions for samples from a few miligrams to a few grams, on solids, liquids or gases. These may include for example phase change materials or heat transfer fluids.

Measure sensible and latent heat of solids, liquids or gases for thermal energy storage.

As a developer of materials for heat storage systems, you need to establish their thermal specifications. As a user of such materials, you need to check their specifications against your application.

Phase Change Materials	Phase Change Materials (PCM) store heat through their phase transitions over a temperature range. This means you need a means to measure their temperatures and heats of transition. DSC and calorimetry not only measure these, but also provide PCM's thermal ageing data.
Heat Transfer Fluids	You can characterize a heat transfer fluid by its heat capacity. It corresponds to the amount of heat that the fluid can absorb and thus transport. DSC and calorimetry measure accurate heat capacity of most fluids including under pressure.
Reversible Sorption	Adsorbents used for thermal energy storage must have a high and stable heat of adsorption and desorption. You can use a coupled TGA and DSC to simultaneously measure the capacity and heat of sorption.

FOSSIL ENERGIES

Assess composition, reactivity, combustion and sorption properties of materials such as coal or shale.

Fossil Fuels Characterization

Thermogravimetric analysis (TGA), gas sorption analysis or DSC enable our customers to assess the composition, reactivity, combustion and sorption properties of coals or shales.

Get essential properties of fossil fuels used in power generation processes.

The thermal properties and composition of fossil fuels play a key role in controlling industrial power generation processes. Our solutions meet the characterization needs of these fuels.

Coal composition	You can use a simple TGA test procedure to get information about coal composition. One single measurement gives its moisture, volatile matter, fixed carbon, and ash content. All are important coal quality specifications.
Coal combustion	The most obvious use of coal is heat production in a boiler by high temperature combustion. You can use DSC under air for information about the combustion steps, their temperature ranges and the heat released.
Oil & gas shale	Understanding gas shale formation and extraction benefit from gas sorption characterization. You can test oil shale using STA to better understand their use in energy production processes.

HYDROGEN

Material Characterization for Hydrogen : production, storage, distribution and conversion.

Materials used in the hydrogen cycle

Thermal analyzers, calorimeters and gas sorption analyzers offer unique solutions for characterizing materials used in the hydrogen cycle. They contribute to improving their sorption and desorption properties, their efficiency or their thermal stability.

The hydrogen cycle represents a major challenge for the development of sustainable energies, requiring efficient solutions for production, storage and conversion. The development of materials adapted to these uses is also essential to guarantee the performance and durability of hydrogen-related technologies. Our solutions give you a chance to contribute to this development effort.

Hydrogen Production	The production of hydrogen from water or biomass requires a catalyst. The high cost of current catalysts requires optimization of these materials. Thermal analysis and calorimetry can be used to characterize the efficiency of new potential catalysts and thus achieve savings.
Hydrogen Storage	The cost and strength of materials used in hydrogen storage components and systems can be improved by characterizing their resistance to aging. Storage in liquid or solid sorbents is a promising alternative but materials need to store more hydrogen and be faster to charge and discharge the gas. Setaram helps you characterize the capacity and speed of your materials.
Hydrogen Distribution	When hydrogen is transported in gaseous or liquid form, it has a significant maintenance cost due to the short life time of materials at high pressure and/or low temperature. You may therefore have to characterize the stability of potential materials under these conditions.
Hydrogen Conversion	By combustion: turbines operating with hydrogen are subjected to higher temperatures. Setaram solutions support you with the characterization of new, more resistant alloys. By conversion in a fuel cell: the development of less expensive materials, which can resist higher temperatures, is driven by thermal stability characterization using Setaram instruments.

More details on Brochure
https://setaramsolutions.com/app/uploads/sites/2/2022/03/EN-HYDROGEN.pdf

GAS HYDRATES & FLOW ASSURANCE

Measure gas hydrate stability, wax appearance data to anticipate oil and gas transportation issues.

High pressure calorimetry for flow assurance and gas hydrates

Setaram's high pressure calorimetry has become a gold standard for mesasuring thermodynamic data such as gas hydrate stability and wax appearance temperature in order to anticipate oil and gas transportation issues.

Measure data to anticipate oil and gas transportation issues.

When you're in the oil & gas business, you know that the preservation of the flow of oil and gas in pipelines is critical. Flow assurance laboratories need solutions like high pressure calorimetry to simulate and predict flow properties in pipelines.

Gas hydrates stability	Gas hydrates affect gas flow in pipelines at high pressure and low temperature. You can determine the stability of different gas hydrate + inhibitor systems thanks to DSC or calorimetry. High pressure and low temperature conditions are achievable with these techniques.
Wax appearance	Waxes affect gas flow in pipelines at high pressure and low temperature. You can determine the conditions of the appearance of waxes in these oils with DSC or calorimetry. Real-life high pressure and low temperature conditions are achievable with these techniques.

More details on Brochure
https://setaramsolutions.com/app/uploads/sites/2/2022/11/EN-OIL-AND-GAS.pdf

WASTE MATERIALS

Determine composition, combustion behavior, recycling process data.

Waste materials characterization

Thermal analysis of waste using thermogravimetry and evolved gas analysis gives access to parameters such as composition, combustion behavior, or useful data for studying recycling processes.

Get valuable data to study their recycling processes.

If you're involved in the processing of waste, we have some solutions for you. They concern thermal processes for waste recycling or transformation into fuel or chemicals.

Waste plastics	TGA and evolved gas analysis help you with the characterization of waste plastic for the production of fuel or chemicals. They provide: – the temperature range, the steps of waste pyrolysis or combustion, – the residual solid content, – the identification of evolved gases.
Sewage sludge	Pyrolysis, combustion or gasification of sewage sludge help reduce waste volume. TGA and STA are appropriate methods to study these processes. They can determine decomposition temperatures, reaction steps, and kinetic models.

NUCLEAR MATERIALS

Assess materials thermal and thermophysical properties, quantify nuclear materials in waste.

Thermal characterization of nuclear materials

Setaram thermal analysis and calorimetry equipment is widely used to characterize materials used in the nuclear fuel cycle.

Assess the thermal or thermophysical properties, stability or composition of nuclear materials.

We offer standard systems for measuring thermal properties at very high and very low temperatures, as well as at high and low pressures. If you have specific challenges related to the handling of nuclear fuel and waste, we also have custom solutions for glove boxes or hot cells to meet these requirements.

Oxygen stoichiometry	The oxygen-to-metal (O/M) ratio, or stoichiometry, is one of the most critical parameters of nuclear fuel fabrication. Thermogravimetry (TGA) is the main solution for controlling this ratio.
Phase diagram	You need to determine how the ageing of nuclear fuel may impact its physical state. Phase diagrams are perfect tools for that purpose, and can be assessed using DSC, DTA or drop calorimetry.
In-pile behavior	You can use our solutions to predict a new fuel's behavior in the reactor, i.e. the in-pile behavior. It consists of measuring thermophysical parameters, including thermal expansion with TMA, and heat capacity with high temperature calorimetry.
Quantification of radioactive materials	The amount of radioactive material in a waste or fuel is not always known. You can use calorimetry as a non-destructive method to quantify the radioactive material. The technique does not depend on the material's matrix or geometry.

More details on Brochure
https://setaramsolutions.com/app/uploads/sites/2/2023/06/EN-NUCLEAR.pdf