APPLICATIONS FOR INORGANIC MATERIALS

1) BUILDING MATERIALS

2) CERAMICS, CERMETS & COMPOSITES

3) GLASS

4) METALS & ALLOYS

5) MINERALS

6) NANOMATERIALS

BUILDING MATERIALS

Assess hydration and setting properties, burnability of raw materials, heat balance. Measure data for heat transfer simulation in buildings.

Thermal characterization of building materials

Applying thermal analyzers and calorimeters enables our customers to test the hydration properties, burnability, and heat balance of cements and plasters. For all construction materials, they measure thermal properties such as heat capacity and thermal expansion, to ensure the materials quality and performance.

Get the essential thermal properties of the building materials you manufacture, develop or use.

To produce or use the best building materials, you need information about their thermal properties. Our solutions include raw materials or final product testing, and the measurement of important data for the manufacturing process.

Cement manufacturing	You can use our solutions to understand and optimize the cement manufacturing process. It includes the reactions of the raw materials in the kiln: burnability, decarbonation, evolved gases. They are measured by DSC, TGA, STA, and EGA. Additionally, drop calorimetry can establish the thermal balance of the kiln.
Setting and Hydration	You may need to study the rate and heat of hydration or setting of your cement or plaster powders. This is data allowing a better control of the final product's strength, workability and heat release at large scale. It is measured by Calorimetry under various pressure and temperature conditions.
Thermophysical properties	Thermophysical properties of building materials are important technical specifications. You need their thermal expansion coefficient and heat capacity for heat transfer and mechanical stress simulation. TMA and calorimetry accurately measure these parameters.

More details on Brochure
https://setaramsolutions.com/app/uploads/sites/2/2020/09/Application-brochure-EN-BUILDING.pdf

CERAMICS, CERMETS & COMPOSITES

Determine phase diagrams, thermal stability. Measure data for heat transfer simulation in ceramics-based systems. Understand powders sintering.

Ceramics testing

The Setaram thermal analyzers and calorimeters, capable of operating at high temperatures, enable in-depth characterization of ceramic materials: phase diagrams, thermal stability, reactivity, and sintering behavior. Users can also evaluate the heat transfer properties of ceramics to simulate their behavior in furnaces or other high-temperature systems.

Optimize your ceramics by controlling their structure and reactivity

Ceramic users and producers are looking to precisely control the structures and reactivities of their materials to guarantee quality and performance. Effective control can improve the durability of ceramics by delaying thermal and mechanical aging, which can lead to degradation or loss of functional properties. To achieve this, it is crucial to understand the processes influencing thermal stability and structural transformations, so as to optimize the conditions under which ceramic parts are manufactured and used.

Phase diagram	Improvement of ceramics properties may come from a better control over their structure. You can benefit from phase diagrams for such a control. DTA or DSC directly measure characteristic temperatures of a phase diagram. Drop calorimetry, together with modelling, is an alternative indirect method.
Sintering	You can make some ceramics parts like those manufactured by 3D printing or injection molding using powder sintering. During sintering, the dimensions of the part changes. You can use TMA to measure powder expansion, shrinkage, and the final part’s density.
Thermophysical properties	Ceramics’ Coefficient of thermal expansion (CTE) and heat capacity (Cp) are important technical specifications. It is especially true for heat transfer and mechanical stress simulation. You can use TMA and calorimetry to accurately measure these parameters.

Heat of Formation	Interested in the long-term stability of complex ceramics? You can benefit from thermodynamics measurement. Heat of formation, measured by drop calorimetry, helps at predicting the ceramics' reactivity. It is also used for phase diagrams calculation
Oxygen ratio, stoichiometry	The properties of oxides like ceramics depend on their oxygen content. You can check the stoichiometry or oxygen to metal ratio of your ceramics using TGA.

More details on Brochure
https://setaramsolutions.com/app/uploads/sites/2/2024/02/EN-CERAMICS.pdf

GLASS

Determine phase diagrams, glass transition, thermal stability. Measure data for heat transfer simulation in furnaces.

Glass testing with calorimetry and thermal analysis

Users of our instruments determine the phase diagrams of glasses, their glass transitions and obtain valuable data for assessing their thermal stabilities. Calorimetry and dilatometry can also be used to measure important properties for simulating heat transfer in glass melting furnaces.

Optimize glass manufacturing with thermal analysis

Thermal analysis is essential to the industry, studying the properties and behavior of glass during heating and cooling. It helps determine critical parameters for optimizing manufacturing processes. Thanks to these data, manufacturers can adjust processing conditions to improve the performance and durability of glass products.

Phase diagram	If you need to determine the best thermal profile for the production of a glass, phase diagram is the right tool. It can be assessed using DSC, DTA or drop calorimetry.
Thermophysical properties	Heat capacity and thermal expansion of glass and of glass forming minerals are important process parameters. You can measure them by DSC, drop calorimetry and TMA.

METALS & ALLOYS

Assess stability against corrosion. Determine phase diagrams, data for heat transfer simulation in metals based systems. Understand powders sintering.

Metal testing solutions using calorimetry and thermal analysis

Thermal analysis is used to assess the stability of alloys against corrosion and to determine their phase diagrams. By measuring specific thermal properties, it also facilitates the simulation of heat transfer within systems using these materials.

Characterize metals under real-life conditions

Metallurgy researchers face challenges in understanding the structure and reactivity of metals and alloys. We offer thermal analysis solutions that enable these materials to be evaluated under temperature and atmospheric conditions close to their actual use. This helps you to overcome these challenges and ensure optimum performance and durability of these materials in a variety of industrial applications.

Oxidation & corrosion	The stability against corrosion and oxidation is an important criterion. You can study high temperature oxidation of metals and alloys using TGA. You can even simulate harsh conditions involving humidity, pressure, acidic vapors, etc.
Phase diagram	Improvement of metal and alloy properties may come from a better control over their structure. For this you can benefit from phase diagrams. DTA or DSC directly measure characteristic temperatures of a phase diagram. Drop calorimetry, together with modelling, is an alternative indirect method.
Sintering	You can make some metallic parts like those manufactured by 3D printing using powder sintering. During sintering, the dimensions of the part changes. You can use TMA to measure powder expansion, shrinkage, and the final part’s density.

Thermophysical properties	A metals' Coefficient of thermal expansion (CTE) and heat capacity (Cp) are important technical specifications. It is especially true for heat transfer and mechanical stress simulation. You can use TMA and calorimetry to accurately measure these parameters.
Heat of Formation	Interested in the stability of complex alloys? You can benefit from thermodynamics measurement. Heat of formation measured by drop calorimetry helps predict the alloys' reactivity. It is also used for phase diagrams calculation.
Magnetic phases	Residual austenite in hardened steel affects its mechanical properties and must be measured using techniques such as magnetic saturation testing. The same applies to cemented carbides, made of hard particles and binders such as magnetic cobalt or nickel.

More details on Brochure
https://setaramsolutions.com/app/uploads/sites/2/2023/07/EN-METALS.pdf

MINERALS

Measure thermal stability data, determine composition.

Minerals characterization

Setaram thermal analyzers and calorimeters enable in-depth study of mineral materials, assessing their composition, crystalline structure and the phase changes they undergo. These techniques are essential for understanding the properties of materials, identifying their transformation points and assessing their stability.

Thermal analysis for mineral materials

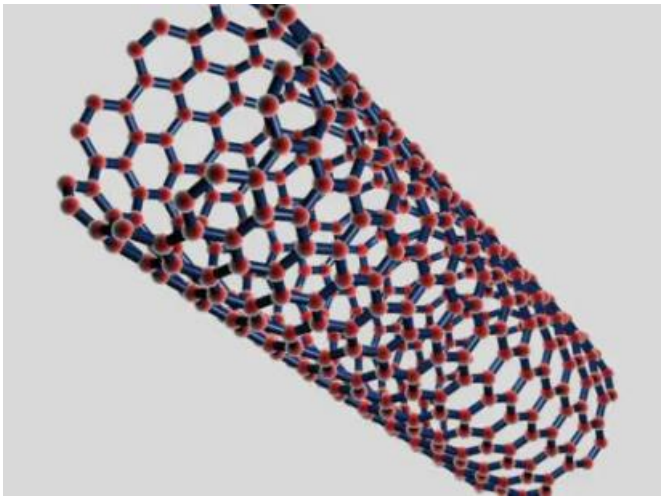
If you're studying mineral materials, your main objective may be to identify their added value or determine their best applications, such as in the field of building materials. By better understanding the characteristics of materials through thermal analysis, you can maximize their potential and adapt them to specific industrial applications.

Compositional analysis	You can use a simple TGA, STA or DSC test procedure to get information about the composition of minerals. This helps determine a mineral's economic value (carbonates, silicates or clays). It can also identify components that can affect the end products' processing or marketability.

NANOMATERIALS

Determine thermal stability data, composition.

Nanomaterials characterization



Thermogravimetric analysis (TGA) combined with evolved gas analysis (EGA) provides valuable insights into nanomaterials' composition and stability. Calorimetry helps determine thermodynamic properties, such as surface energy and reactivity, essential for understanding synthesis and optimizing conditions for applications like catalysis and energy storage.

Nanomaterials: composition and reactivity

If you're involved in the development or use of nanomaterials, it's crucial to specify or check their properties and composition. Our solutions are designed to help you meet these challenges. They allow you to optimize manufacturing processes and adapt materials to the specific requirements of various applications.

Thermal Stability	Are you using nanomaterials at high temperature? You can use TGA or STA to determine the thermal stability of your nanomaterials. It provides the temperature and steps of decomposition or transition, under different atmospheres.
Composition analysis	Do you need to guarantee or check your material's composition? Using TGA, you can characterize solids containing nanomaterials. It includes the material's volatiles, organic, inorganic content, and nanomaterials content. Evolved Gas Analysis (EGA) helps with more detailed information.