

STA 6000

Simultaneous Thermal Analyzer



insights...fast!

complementary measurements in one

QUICK GLANCE

- Acquire both DSC and TGA results in a single, small instrument
- Measure sample and reference temperature directly with our patent pending SaTurnA™ sensor
- Conduct measurements as low as 15 °C without a chiller to capture complete moisture and solvent evaporation
- Control temperature with the compact furnace, allowing you to attain reliable results
- Focus on high productivity with quick furnace cool down
- Equip your instrument with an optional 45 position, vertical loading autosampler to achieve quick, unattended productivity
- Hyphenate your system with a mass spectrometer (MS) or IR spectrometer for the ultimate in materials characterization capabilities



Measure simultaneously with ease

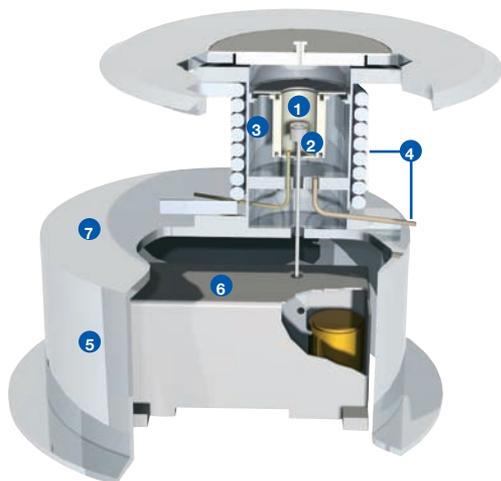
Whether you need to characterize sample materials of pharmaceutical tablets or polymers, the STA 6000 offers you simultaneous measurement and analysis of weight change and heat flow. By combining flexible differential temperature analysis (DTA or DSC) with proven thermogravimetry (TG) technology, the STA 6000 enables you to generate accurate and reliable results while simplifying data interpretation.

Designed with routine and research applications in mind, the instrument features advanced, innovative sensor technology and proven compact furnace design that together give you better temperature control, faster cool-down time and more consistent measurements. And if increased throughput is your goal, the STA 6000 with its easy-to-load vertical system can be equipped with an autosampler to run an industry-leading 45 samples unattended.

innovation and control

Innovation

The STA 6000 features the innovative SaTurnA Sensor for high quality, simultaneous TG and DTA/DSC measurements. This advanced sensor is optimized to achieve flat DTA baselines and high sensitivity. Because both sample and reference are measured simultaneously, you can be sure of the integrity of your analysis. The corrosion-resistant, pure platinum pan holder and reference ring make the instrument suitable for a wide variety of samples and applications.

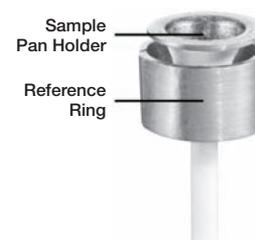


Control

While many methods call for specific gas flow rates, others may require a gas switching during the analysis. Either way, the STA 6000 with its built-in mass flow controller both monitors and controls the purge flow rates.

Within a method, the purge rate can be selected to meet your application requirement and to ensure measurement accuracy. If the specified flow rate cannot be achieved, for example due to lack of gas flow from an empty tank, a status window in the Pyris® software will alert you to the error condition. The mass flow controller also manages sample gas switching, such as that between inert and oxidizing (reducing) gas.

In addition, the mass flow controller enables you to program a fast purge-out of residual oxygen or a quick oxidizing furnace clean at the end of the run, as required for good laboratory practice (GLP).



An inside look at the STA 6000

1. The small furnace enables accurate temperature control, minimizes the time to achieve a pure gas environment and allows for the fastest cool down/turnaround times.
2. The SaTurnA sensor measures both the sample and reference temperature directly for superb performance. The vertical loading balance allows for easy operation and sample loading. For unattended operation, equip your STA 6000 with an optional 45 position autosampler.
3. The rugged alumina furnace is corrosion-resistant allowing for a wide variety of reactive gases to be used. Its large isothermal zone provides excellent temperature reproducibility.
4. Experience unsurpassed furnace cool-down speed with the chiller and integral forced air features and allow your laboratory to process more samples in less time.
5. The balance housing's thick, stainless steel walls act as a large heat sink, thermally isolating the balance from the furnace.
6. Balance purge gas maintains a constant environment for the balance and protects it from the reactive sample purge gas as well as materials evolving from the sample.
7. Sample purge gas: the integrated mass flow controller provides accurate environmental control and meets the needs of methods that call for specific gas flow rates, or for gas switching during the analysis.

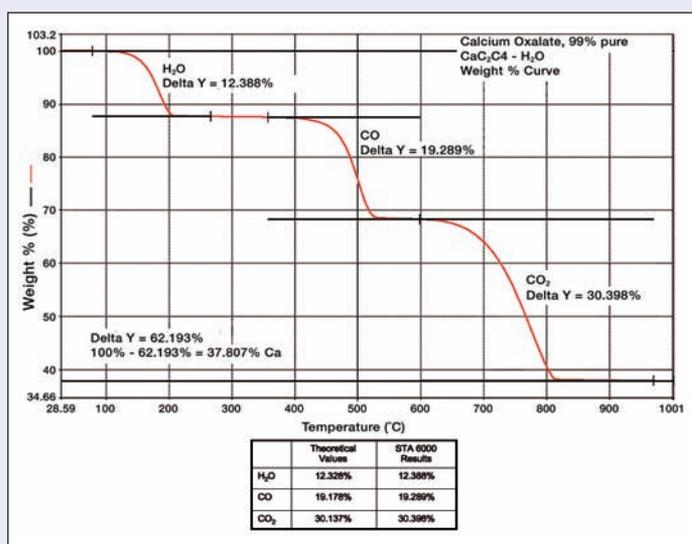
APPLICATIONS FOR SIMULTANEOUS ANALYSIS

From TGA...

- Compositional analysis – quantitative content analysis
- Decomposition temperatures
- Engine oil volatility measurements (TGA Noack test)
- Filler content
- Flammability studies
- Lifetime predictions (via TGA kinetics software)
- Measurement of volatiles (e.g., water, oil)
- Oxidative stabilities
- Thermal stabilities
- Catalyst and coking studies
- Hyphenation to identify out-gassing products

to DTA/DSC

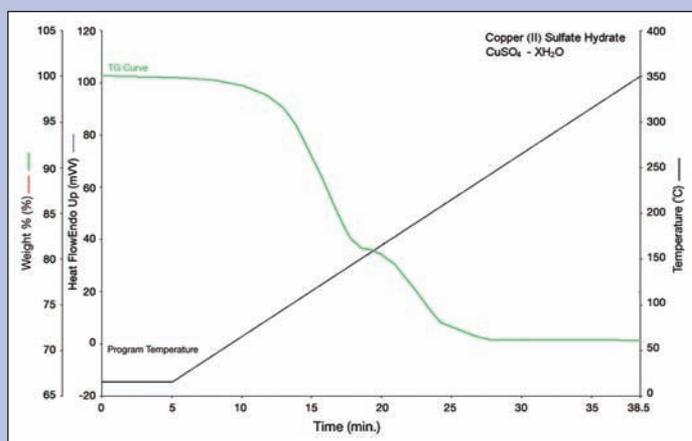
- Melting/crystallization behavior
- Glass transition temperatures
- Specific heat capacity
- Kinetic studies
- Transition and reaction enthalpies



Thermogravimetric (TG) verification

Calcium Oxalate

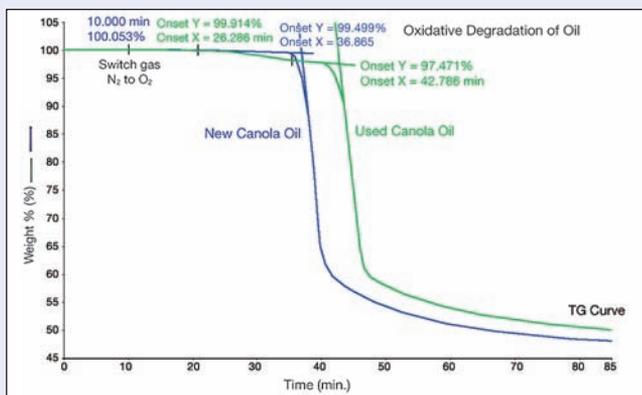
Calcium oxalate is a well characterized material that has three distinct weight loss events that occur during heating: H₂O, CO, CO₂. To verify the performance of the STA 6000, an experiment was conducted using 15 mg of calcium oxalate with a nitrogen purge gas. The samples were run using a scanning rate of 20 °C/minute. As you can see from Figure 1, the weight loss events recorded by the STA 6000 are extremely comparable with the theoretical values of calcium oxalate.



Low starting temperature

Copper Sulfate Hydrate

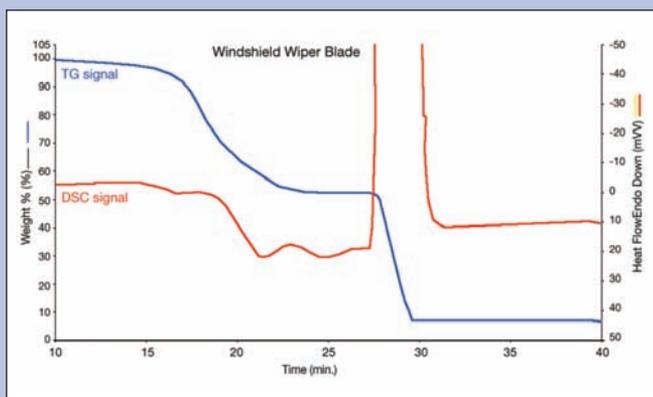
Copper Sulfate (CuSO₄) exists as a series of compounds which differ in regard to their degree of hydration. When hydrated forms are left at room temperature they begin to lose weight. In this example, the sample has been held at a starting temperature of 15 °C for 5 minutes before heating begins. Note the stability of the TG curve during this time.



Oxidative degradation

New and Used Oils

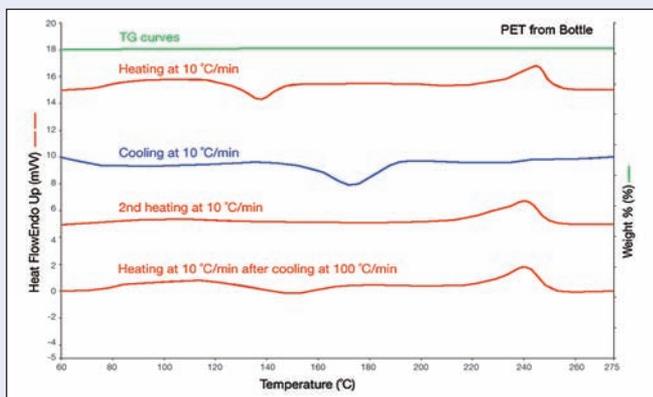
For this example, a new and used canola oil sample were held isothermally at 300 °C in an initial N₂ environment. The sample purge was switched to O₂ after 10 minutes. The new, unused canola oil shows one weight loss step after almost 37 minutes as the oil degrades whereas the used canola oil shows two weight loss steps. The initial degradation occurs at 26 minutes and the second more dramatic degradation occurs after approximately 47 minutes. With this type of test, sample results are always compared against reference oil run under the same system conditions.



Decomposition

Butyl Rubber From a Windshield Wiper Blade

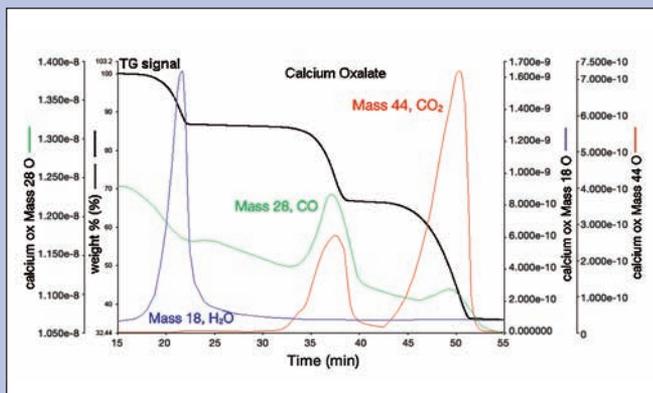
Impermeability, weather and ozone resistance, flexibility, vibration dampening and stability properties make butyl rubber a desirable selection for many applications. Numerous grades of butyl rubbers have been established to meet processing and functionality needs. Selections and ratios of the appropriate fillers, stabilizers and curatives are crucial to how a compound will process and how the end product will perform. Quantitative analysis of rubber formulation using TG analysis can be applied for reverse engineering or in a QC environment.



Crystallization

Polyethylene Terephthalate (PET)

In this example taken from a soda bottle, the initial heating at 10 °C/min shows a Tg at approximately 80 °C followed by a cold crystallization and a melt. During cooling at 10 °C/min, a recrystallization occurs. When heated a second time at 10 °C/min, there is no longer a visible Tg. The sample was then cooled at a faster rate, 100 °C/min, to suppress the recrystallization. When heated again at 10 °C/min, the Tg can be seen again at approximately 80 °C, confirming the suppression of the recrystallization. Note, during all of the heating and cooling cycles, the TG curve was not influenced.



Hyphenated techniques

Calcium Oxalate

When studying the thermal degradation of polymers, coupling a thermogravimetric analyzer (TGA) with a mass spectrometer (MS) proves to be a valuable tool. Gases evolving from the sample as it is heated in a TGA can be identified by the MS. In this example, MS measurements are used to show the components of calcium oxalate eluting during the weight loss steps. Notice the order of magnitude difference between the H₂O and CO₂ results compared to the CO results (x10²). This collection of MS data was captured using the Pyris software.

Flexibility and support

Increased productivity

For ultimate productivity, the STA 6000 can be fitted with an easy-to-load vertical autosampler that is capable of running an unprecedented 45 samples unattended. A unique split-carousel design means you can prepare and load up to 45 samples at the place of preparation and before loading them into the instrument. A patented bimetallic gripper element that actuates the fingers enables the sample to be placed very precisely into the detector compartment.

The Pyris software automatically monitors the temperature of the low-mass furnace and loads the next sample as soon as the furnace is ready. For continuous operation and analysis, you can create a Play List in Pyris Player, a standard module of the software operating system.

The combination of autosampler and Pyris software allows seasoned scientist and beginner alike to run thermal analyses faster and easier while achieving accurate and reliable results every time.

Hyphenated techniques

Data interpretation can often be simplified and laboratory productivity increased by the application of hyphenated analytical techniques. As a world-leader in instruments for chemical analysis, PerkinElmer can offer a wide choice of techniques that can be combined with the STA 6000, including infrared and mass spectrometry.

Service and support: where ever and when ever you need us

Knowledgeable, experienced and responsive global service and support keeps your laboratory running smoothly and efficiently.

- Expert service ensures your laboratory is backed by the most highly qualified engineers in the industry
- Support can extend to all of your laboratory's maintenance, validation and qualification needs
- A complete range of training, technical support and certification services are available, and can be tailored to the specific needs of your laboratory



Figure 7. STA 6000 with 45-position autosampler.

Specifications

Sensor	Pure platinum pan holder and reference ring	Corrosion-resistant, making the instrument suitable for a wide variety of samples and applications
Furnace design	Vertical	Optimized for performance, user exchangeable SaTurnA sensor. Ensures even purge gas flow.
Balance design	Top loading, single beam	Easy loading and unloading in manual and automated mode
Balance resolution	0.1 ug	
Balance measurement range	Up to 1500 mg	
Temperature range	15 °C to 1000 °C	Start experiments below room temperature to capture complete moisture and solvent evaporation
Heating rate	Ambient to 1000 °C	0.1 to 100 °C/min
Cooling rates	From 1000 °C to 30 °C	Under 10 minutes
Temperature calibration	Metal standards such as Indium and Silver	Forced air and chiller to achieve fastest cool down for higher productivity
Temperature accuracy	< ±0.5 °C	
Temperature reproducibility	< ±0.5 °C	
Calorimetric data	Accuracy/precision	±2% based on metal standards
Thermocouples	PT-PT/Rh (Type R)	
Sample pans	Alumina 180 µl	
Dimensions	(HxWxD) 17 / 38 / 41 cm 6.7 / 15 / 16.5 in	Small footprint allows for the best use of your laboratory space
Weight	12-16 kg	
Instrument control	Pyris software	Benchmark software in Thermal Analysis
Accessories	Mass flow control and switch	Included
	Autosampler	Optional, 45-position
	Transparent cover	Included in autosampler configurations Optional for standard configurations
Hyphenated techniques	Combine with MS or IR analyzers	MS or IR connectivity capabilities allow the analysis of evolved gases
Certificates/Compliance/Quality Assurance	Developed under ISO 9001. Designed and tested to be in compliance with the legal requirements for laboratory analytical instruments	

The data presented in this data sheet are for actual performance and the results are dependent upon the exact methodology used and exact laboratory conditions. This data should only be used to demonstrate the applicability of an instrument for a particular analysis and is not intended to serve as a guarantee of performance.

thermal analysis **solutions**

for material property analysis

PerkinElmer is the **leader** in high sensitivity thermal analysis instrumentation, providing you the confidence to achieve fast, accurate, reproducible results.

Differential Scanning Calorimetry (DSC)

DSC measures the amount of energy absorbed or released by a sample as it is heated, cooled or held at a constant temperature. This technique is used for polymer and pharmaceutical applications. PerkinElmer offers the best of both worlds – the Diamond DSC for highest resolution and sensitivity, and the Jade DSC for ease-of-use and robustness.

Thermogravimetric Analysis (TGA)

TGA measures the change in weight of a sample as it is heated, cooled or held at a constant temperature. The PerkinElmer Pyris 1 TGA instrument provides robustness and reliability for quality control and the answers researchers need to solve even the toughest problems.

Simultaneous Thermal Analysis (STA)

STA is a simultaneous technique that determines the weight change of a sample (TG) and measures the change in temperature between a sample and the reference as a function of temperature and/or time (DTA). The STA 6000 combines the high flexibility of the differential analysis feature (DTA, DSC) with the proven capabilities of the thermogravimetric (TG) measurement technology to provide highly reliable characterization information.

Dynamic Mechanical Analysis (DMA)

DMA measures changes in mechanical behavior, such as modulus, compliance and dampening, as a function of temperature, time, frequency, stress or a combination of these parameters. The DMA 8000, with its innovative

design, high functionality, and flexible operation, is ideal for advanced research and routine quality testing.

Thermogravimetric Analyzer coupled to an Infrared Spectrometer (TG-IR) or Mass Spectrometer (TG-MS)

Coupling a TGA analyzer, either the Pyris 1 TGA or the STA 6000, to an FT-IR spectrometer or Mass Spectrometer is ideal for applications where it is important to identify the species evolved from a material when it is heated. These include investigation of decomposition mechanisms, looking at residual solvents in drug preparations, and safety and thermal stability in polymers and materials as well as investigations into outgassing and stability of packaging. These hyphenated techniques offer meaningful sample characterization information in both quality control and research environments.

Laboratory Services – comprehensive service and support for today’s results-driven lab

With over 60 years of experience, and as a world leader in analytical instrumentation, PerkinElmer is the right partner for your application needs. In concert with global distribution of instruments, turnkey systems, and consumables, we provide factory-trained global service and support. PerkinElmer’s Laboratory Services provides you with a comprehensive worldwide service offering that allows you to take care of business and set your sights on what matters most – results. With over 1,000 professionals serving more than 125 countries worldwide, PerkinElmer is your single source for instrument care and repair, validation services, software and hardware upgrades, education, and more.

For additional information, visit our website at www.perkinelmer.com/sta6000.

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