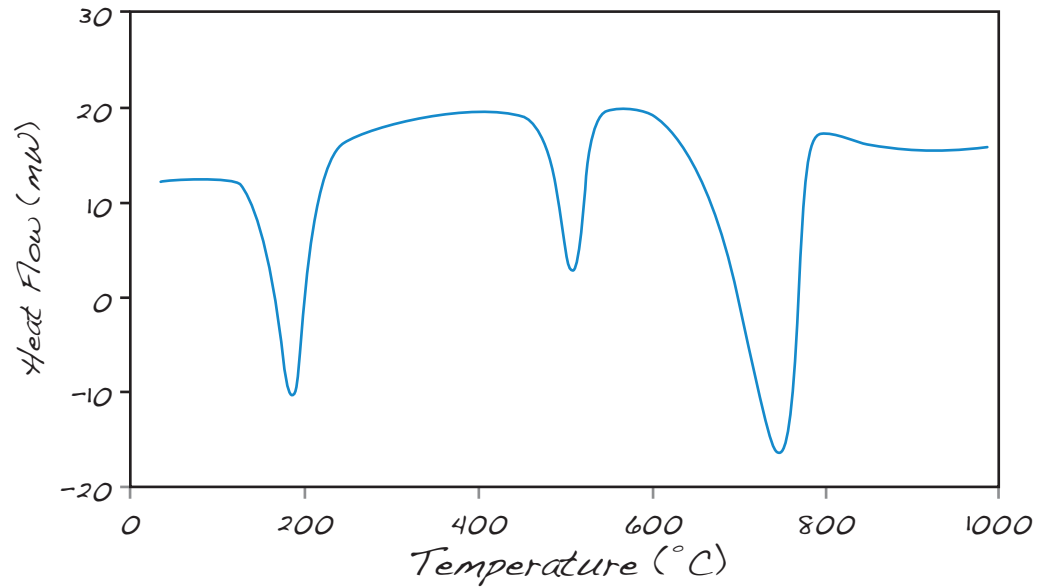Waters™ | TA Instruments

DISCOVER the **WORLD'S FINEST**
SIMULTANEOUS THERMAL ANALYZER

Discover a **New SDT System** that **delivers** the

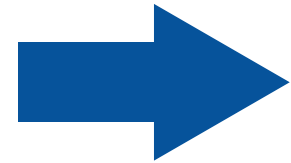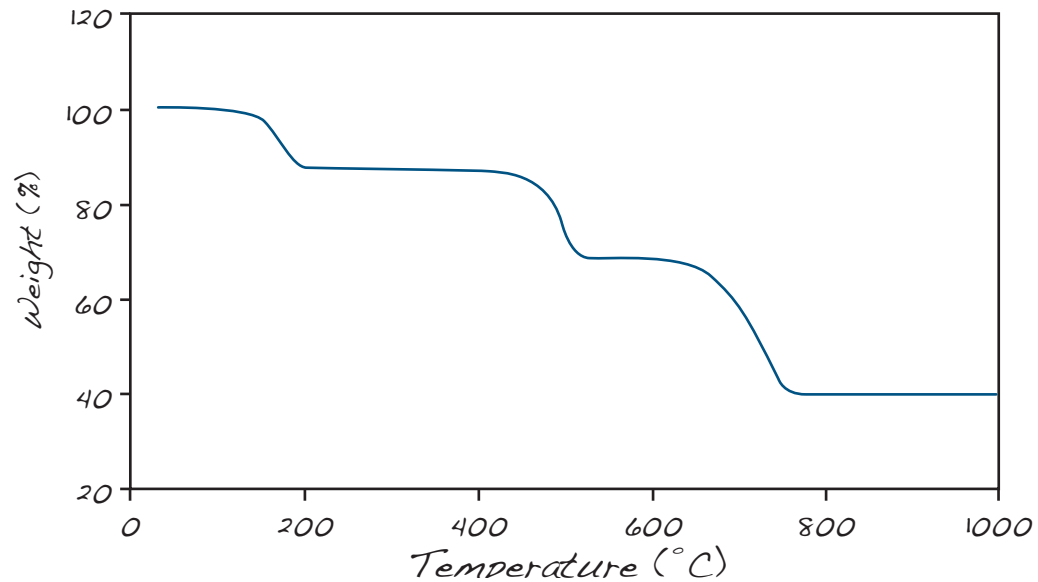**Purest real-time Simultaneous Heat flow** and **Weight Data Possible**
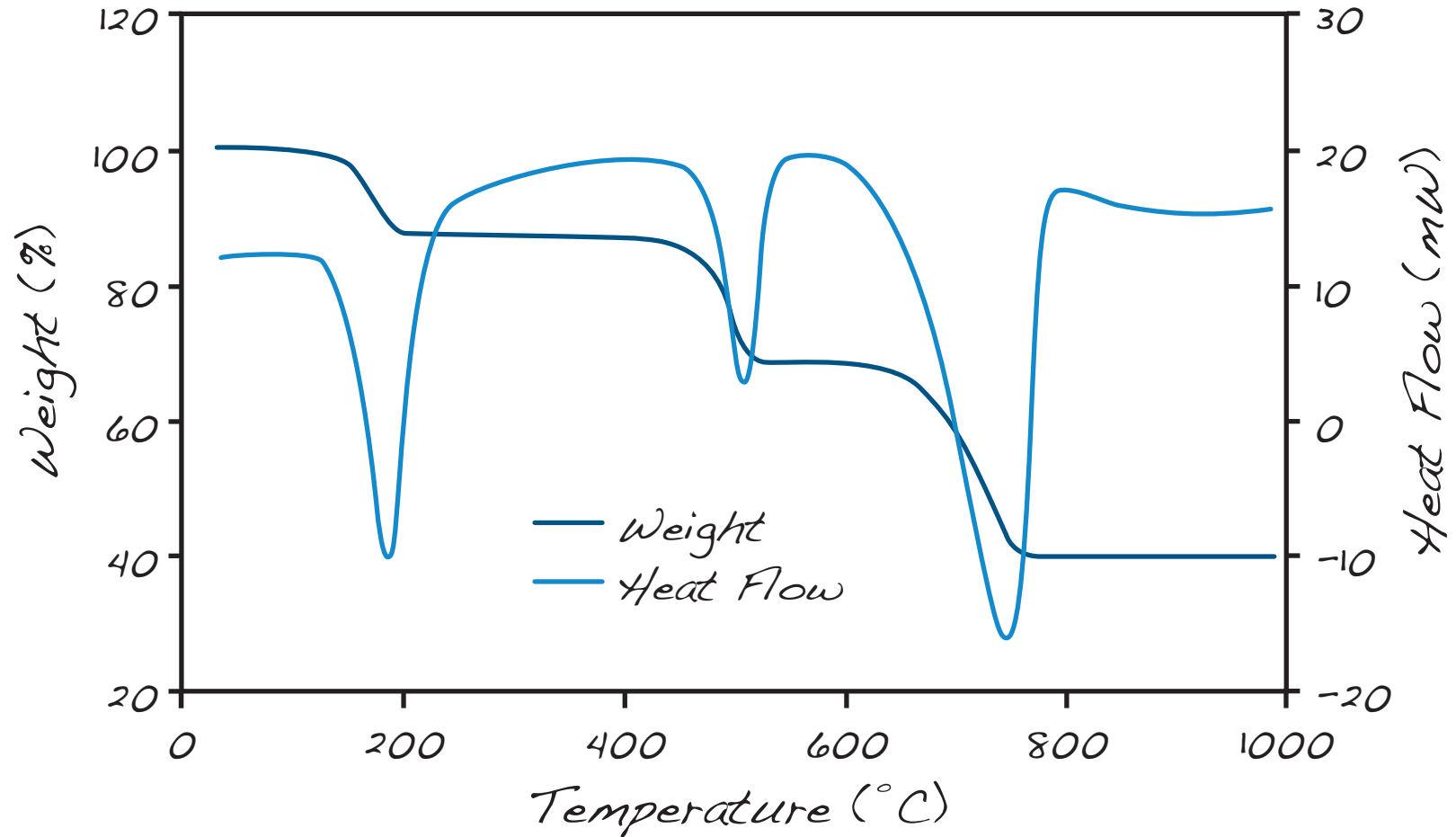
TWO SUPERIOR MEASUREMENTS

ONE GREAT INSTRUMENT!

PLUS...

ADVANCED MODES

Modulated Techniques
MDSC® & MTGA™

Modulated Temperature (°C) vs Temperature (°C)

FOR

Heat Capacity

Rev Cp J/g °C vs Temperature (°C)

Activation Energy

Weight (%) and Activation Energy (kJ/mol) vs Temperature (°C)

Hi-Res TGA™

Hi-Res TGA @ 50 °C/min, Res 5

FOR
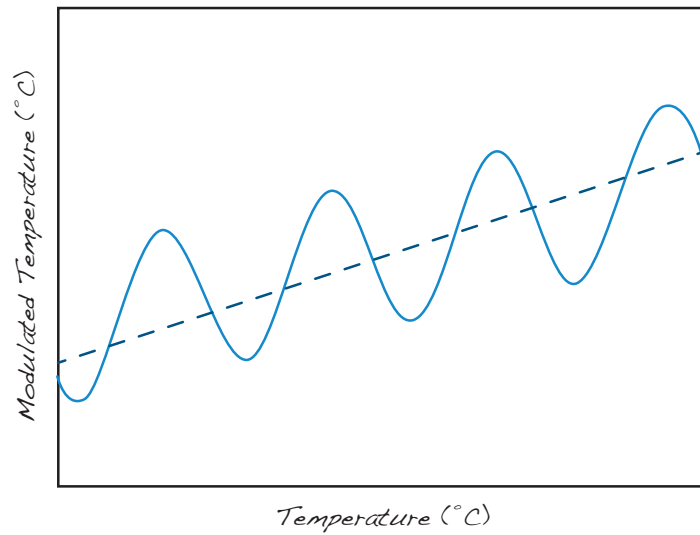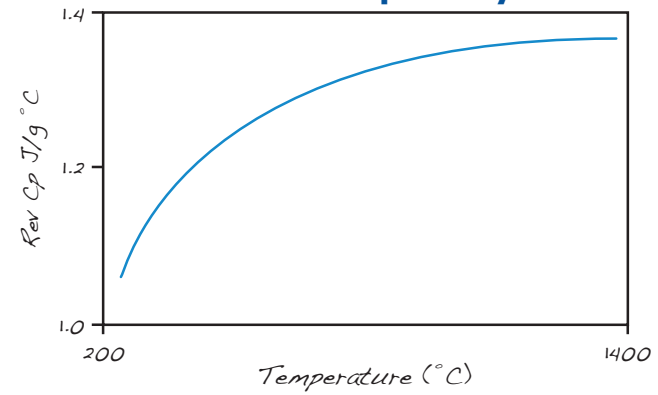
Better Resolution
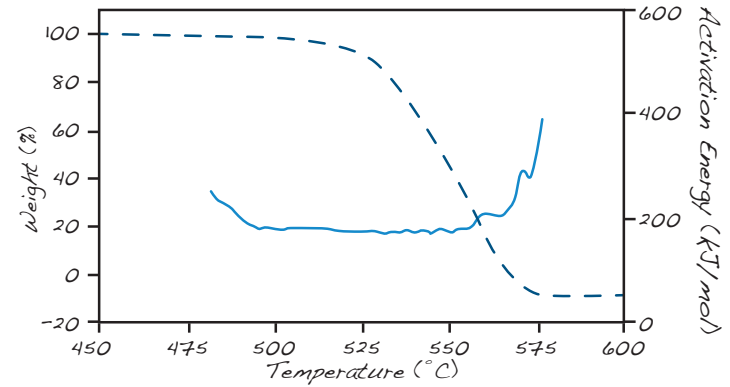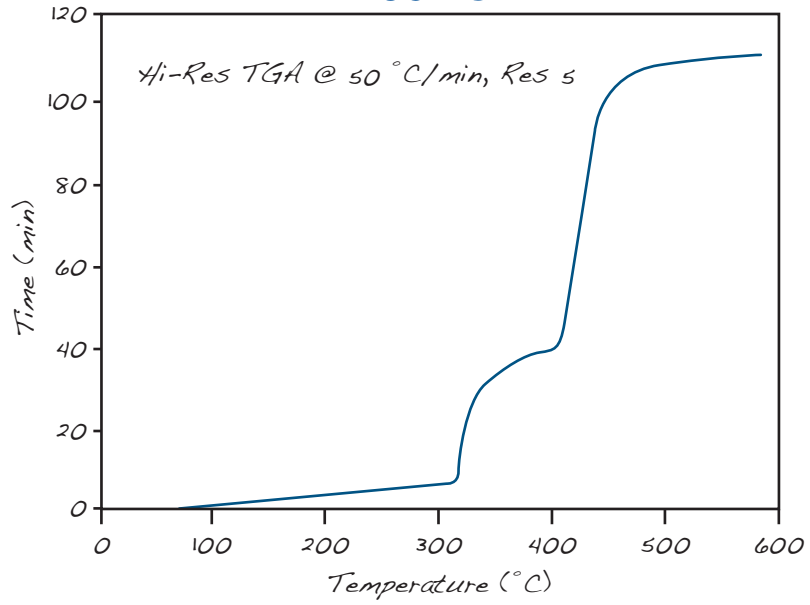
Hi-Res TGA @ 50 °C/min
Standard TGA @ 20 °C/min
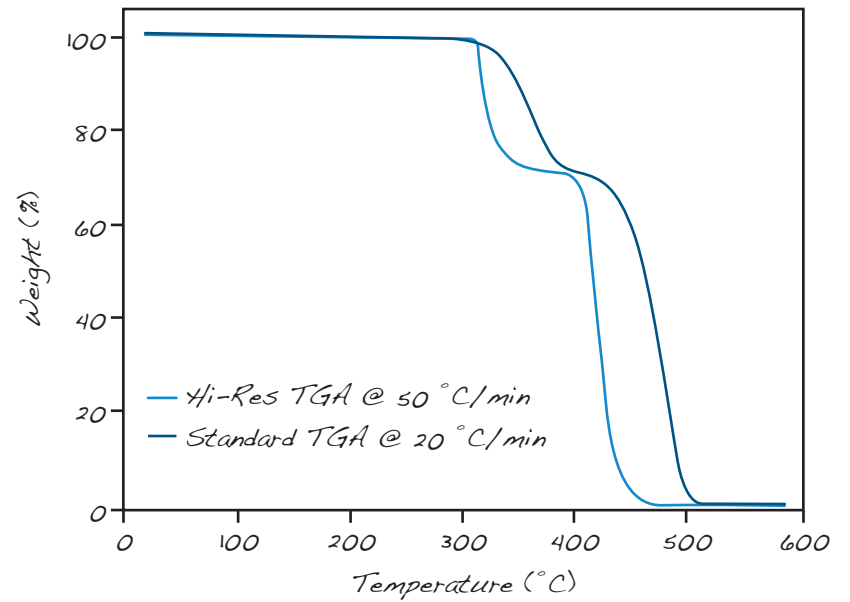
PLUS...

The Most **FLEXIBLE** and **EFFICIENT**
ATMOSPHERE CONTROL

Horizontal Purge
Optimizes Interaction

Separate Balance
& Sample Purge

Gas Blending Module

Vacuum Tight

Balance Purge
Sample Purge
Total Purge

PLUS...
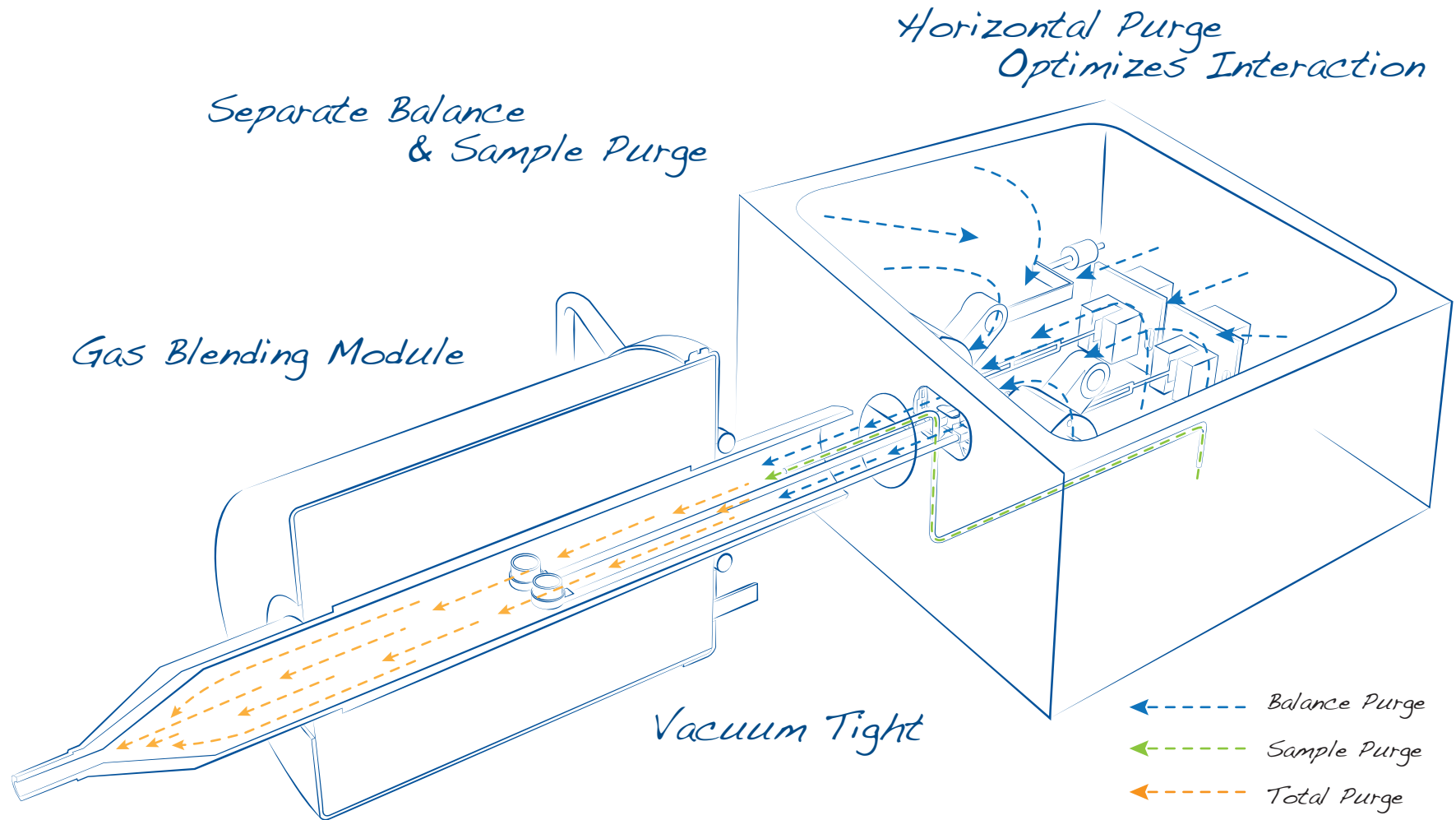
RUGGED and **RELIABLE**
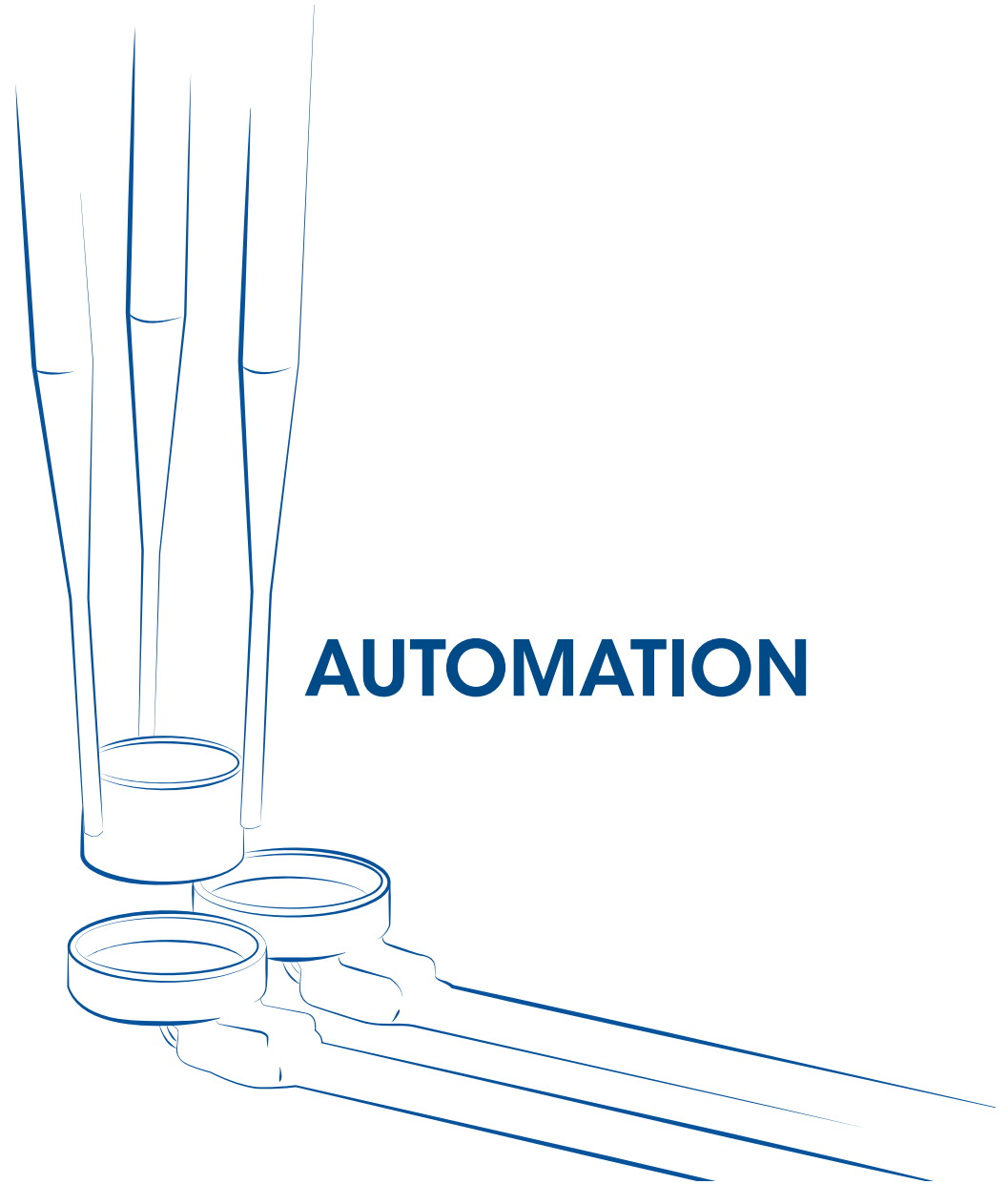
AUTOMATION

WITH...

The **MOST VERSATILE CONTROL** and **ANALYSIS SOFTWARE**

EQUALS...

SUPERIOR SDT PERFORMANCE

DISCOVERY SDT | SIMULTANEOUS DSC/TGA

TA Instruments invites you to experience the world's finest Simultaneous DSC/TGA, the **Discovery SDT 650.** Discover the advanced engineering and attention to detail that provides enhancements in every aspect of performance and a new level of user experience. Available with or without an Autosampler, the Discovery SDT is sure to meet your needs and exceed your expectations.

Features and Benefits:

• Horizontal dual-beam design for superior heat flow and weight measurements

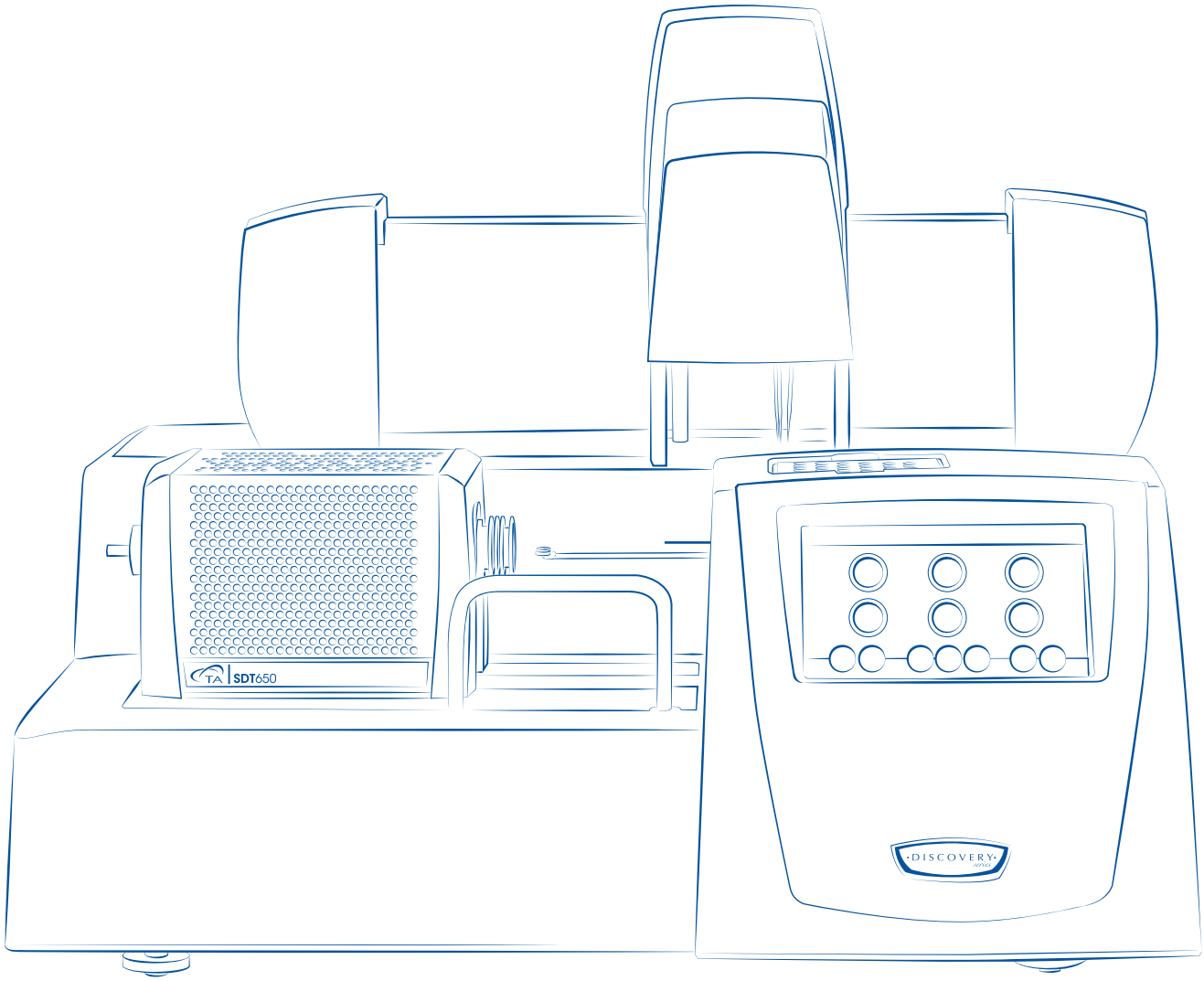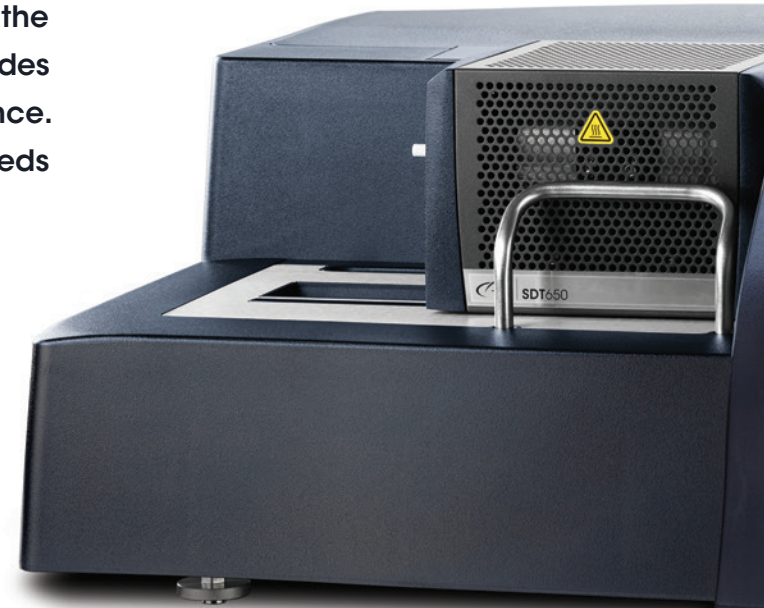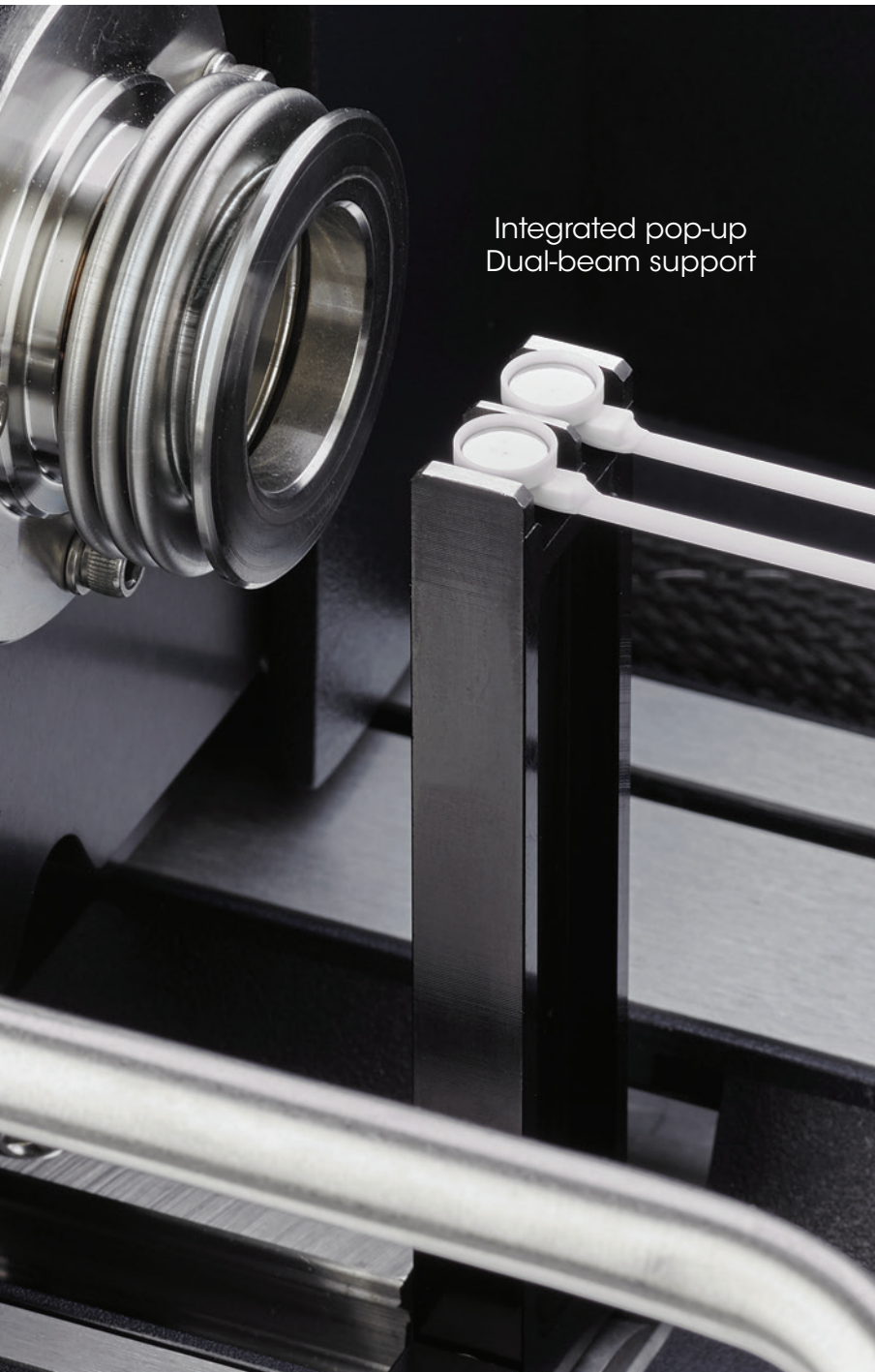• Dual-sample TGA mode for double the productivity of competitive systems.

• Ultra-low drift balance design for unrivaled performance in baseline flatness, sensitivity, and resolution.

• Modulated DSC®, (MDSC®), for the best determination of heat capacity

• Hi-Res™ TGA for the best separation of overlapping weight losses

• Modulated TGA™, (MTGA™), for increased productivity for studying kinetics

• Reliable linear autosampler with programmable tray positions for worry-free 24/7 operation, most flexible programming of experiments, and automated calibration and verification routines

• New innovative "app-style" touch screen puts instruments functionality simply One-Touch-Away™ , enhancing usability and making it easier than ever to get great data

• Commitment to quality backed by the industry's ONLY five-year furnace warranty for peace of mind

TA remains as the only thermal analysis instrument supplier to ensure the utmost in data integrity through thoughtful and innovative design. Industry-leading performance is realized without the need for lengthy pre- and post-test data manipulations prevalent in competitive offerings. The new Discovery SDT provides both novice and advanced users the highest confidence on generating superior data, while enhancing laboratory workflows and productivity.

Integrated pop-up
Dual-beam support

At the core of every new **Discovery SDT** is the exclusive **TA horizontal dual-beam thermobalance**. The integrated thermocouple design within the ceramic beams provides direct sample, reference and differential temperature measurements. This ensures superior DSC and TGA performance and unlike competitive designs, the SDT 650 gives this performance without requiring baseline subtractions and other post-test manipulation. The result is an innovative new SDT with unrivaled performance in weight drift, sensitivity and simultaneous DSC AND TGA measurements.

Dual-Beam Thermobalance Features and Benefits:

• Ultra-low drift balance design ensures accurate detection of even the smallest weight changes

• Simultaneous TGA/TGA - Our unique dual-sample mode permits independent TGA measurement simultaneously for double the productivity of any other TGA.

• Dual-beam design makes heat flow measurements intrinsically superior to that of single-beam designs.

• Quick-connect beam design with integrated pop-up beam support makes changing beams as simple as turning a screw, ensuring maximum productivity and ease of use.

QUICK and **EASY BEAM REPLACEMENT**
ensures **MAXIMUM UPTIME**

Quick-connect
beam design
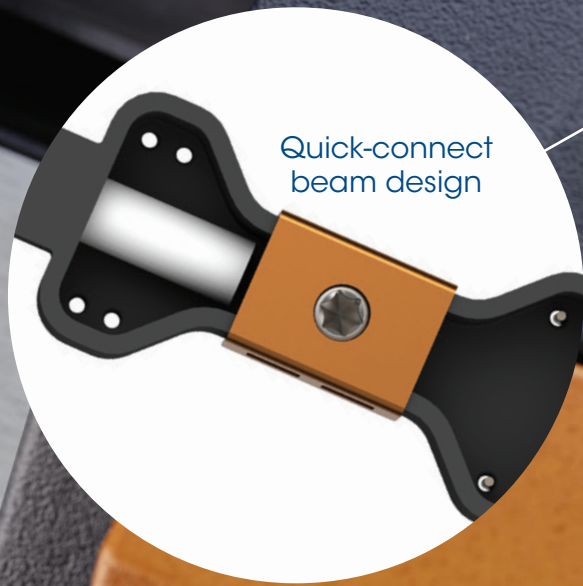
VERSATILE & DURABLE FURNACE for LONG LIFE

Every furnace on **Every** system is designed and manufactured by TA specifically for high performance DSC AND TGA measurements. This durable horizontal furnace offers better temperature uniformity than competitive systems.

Linear Control

Modulated Control

Hi-Res Control
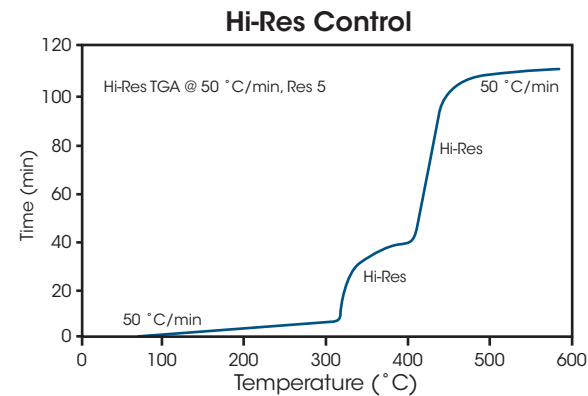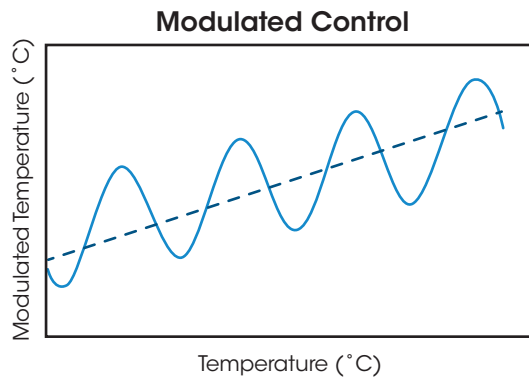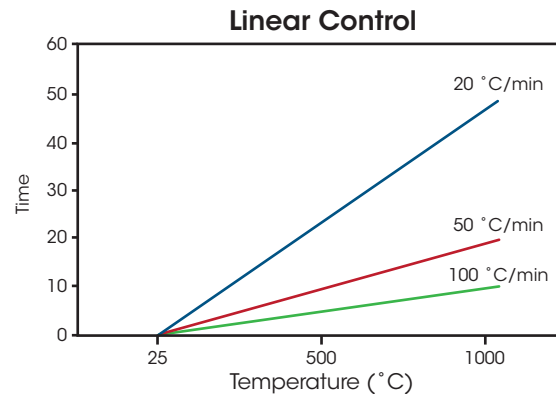
- Ambient to 1500°C with a wide range of heating rates for maximum flexibility in experimental design.

- Horizontal design for excellent evolved gas results without chimney effects of competitive systems.

- Cooling from 1500 °C to 100 °C in under 40 min for quick sample turnaround.

All TA furnaces are covered by the industry's ONLY 5-YEAR WARRANTY

Discovery SDT's are designed with superior atmosphere control to meet the most demanding applications. Whether maintaining an inert atmosphere, switching to an oxidative purge, or maintaining a high vacuum the Discovery SDT is up to the task.

Atmosphere Control Features and Benefits:

• Innovative Gas-Delivery manifold design minimizes potential leak points from tubing and hardware connections ensuring the most consistent, repeatable atmosphere.

• Integrated software-controlled gas switching for experiments requiring dynamic or reactive atmospheres

• New Gas blending and switching module allows inputs of up to 4 gases for flexibility and widest range of applications

• Separate balance and sample purge ensures efficient gas switching and minimizes purge times

• Horizontal design for optimal purge gas/sample interactions and superior evolved gas measurements

• Vacuum tight to ensure inert, oxygen-free atmospheres

Total Purge · Sample Purge · Balance Purge
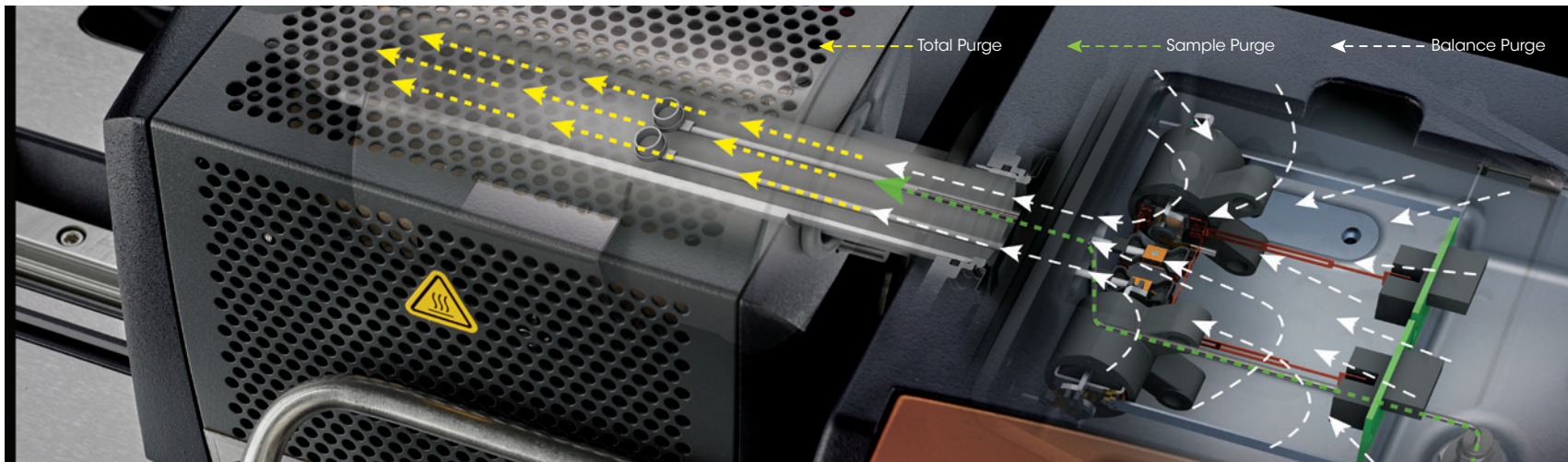
The most EFFICIENT
SAMPLE-ATMOSPHERE INTERACTION

The NEW Discovery SDT features our 30-position autosampler to optimize productivity. Based on our proven Discovery DSC design these rugged autosamplers are cycled extensively in our factory to ensure worry-free operation.

Autosampler Features and Benefits:

- Scheduled and unattended experiments, calibrations and verifications give scientists more time for research.

- Innovative dual-sample mode doubles throughput over any other TGA.

- New TRIOS software makes it easier than ever to manage and run a large and diverse sample queue. The Design view and Running queue allow for quick and efficient autosampler programming.

- For optimum flexibility, sample and reference pans may be assigned to any combination of the available 30 positions.

Touch Screen Features and Benefits:

- Ergonomic design for easy viewing and operation

- Packed with functionality to simplify operation and enhance user experience. The apps-style touch screen includes:

• Start/stop runs	• Test and instrument status
• Real-time signals	• Real-time plot
• Active method viewing	• Advance method segments
• Autosampler calibration	• Loading/unloading and taring pans
• System information	

The app-style touch screen, powerful new TRIOS software, the robust and reliable autosampler with automated calibration and verification routines all work seamlessly to dramatically improve laboratory workflow and productivity.

ITS NEVER BEEN EASIER TO GET GREAT DATA!

TECHNOLOGY | TRIOS SOFTWARE

Discover powerful TRIOS software that delivers exceptional user experience in a combined package for instrument control, data analysis, and reporting for thermal analysis and rheology. New features such as multiple calibration sets, real-time test method editing, and inter-laboratory data and test method sharing provide unmatched flexibility, while One-Click analysis and custom reporting raise productivity to new levels.

TRIOS Features:

- Control multiple instruments with a single PC and software package

- Overlay and compare results across techniques including DSC, TGA, DMA, SDT and rheometers

- One-Click analysis for increased productivity

- Automated custom report generation including: experimental details, data plots and tables, control charts and analysis results

- Convenient data export to plain-text, CSV, XML, Excel®, Word®, PowerPoint®, and image formats

- Optional TRIOS Guardian with electronic signatures for audit trail and data integrity

Ease of Use

TRIOS software makes calibration and operation of the Simultaneous Thermal Analyzer SDT650 simple. Users can easily generate multiple calibration data sets under varying experimental conditions (e.g. different heating rates or gas selections) and seamlessly switch between them to match the experimental conditions used for sample testing. Real-time signals and the progress of running experiments is readily available, with the added capability of modifying a running method on the fly. TRIOS software offers a level of flexibility that is unmatched in the industry.

Complete Data Record

The advanced data collection system automatically saves all relevant signals, active calibrations, and system settings. This comprehensive set of information is invaluable for method development, procedure deployment and data validation.
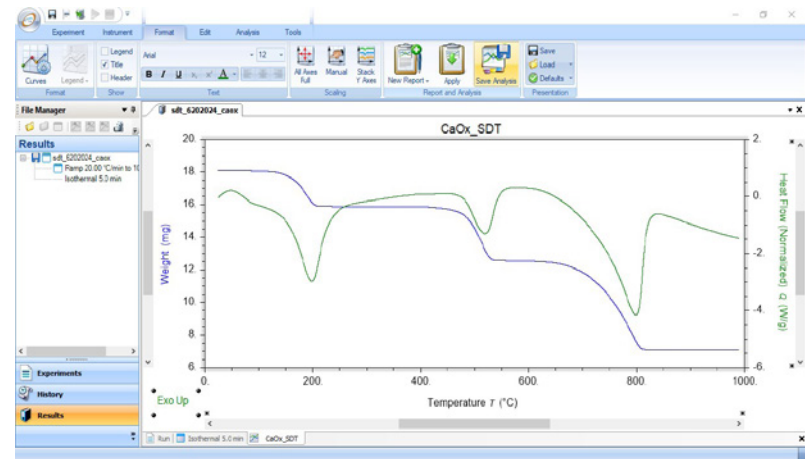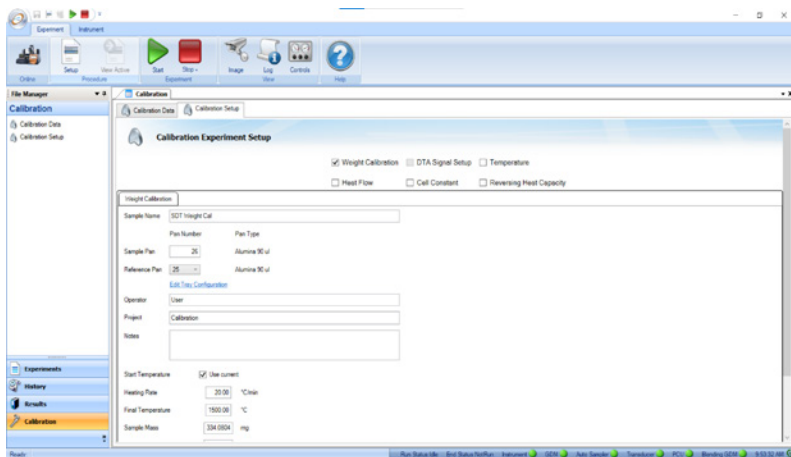
The Most **VERSATILE CONTROL** and **ANALYSIS SOFTWARE**

Complete Data Analysis Capabilities

A comprehensive set of relevant tools are available for real-time data analysis, even during experiments. Gain actionable insights into your material's behavior through a powerful and versatile set of features seamlessly integrated into TRIOS.

All Standard SDT Analyses:

- Weight change (absolute and as a percentage)
- Heat flow
- 1st and 2nd derivatives
- Weight and weight loss at a specified time or temperature
- Glass transition, oxidative onset, and induction time
- Enthalpy of fusion and solidification
- Peak height and area
- Temperature at peak maximum
- Onset and endset analyses
- Step transition analysis
- Easily import and export data with TRIOS

Advanced Analysis Capabilities (Standard Features):

- Activation energy determination with Modulated TGA™
- Separation of broad and overlapping weight losses with Hi-Res TGA™
- Direct measurement of heat capacity Cp in a single run with MDSC®.
- Advanced custom analysis with user-defined variables and models
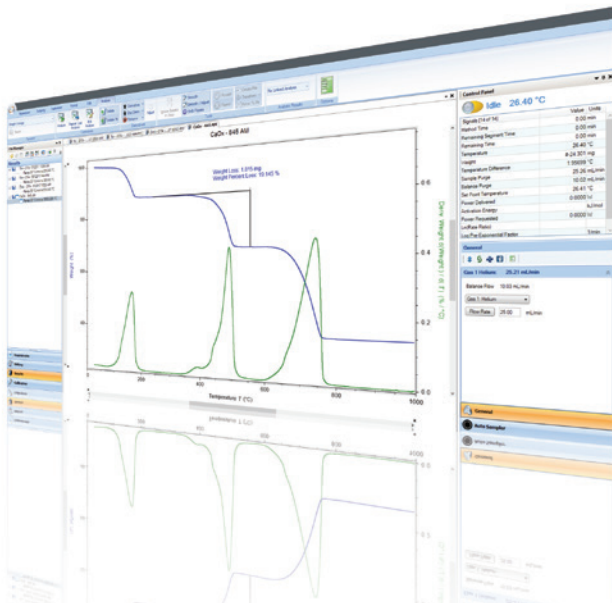

TRIOS JSON Export Feature

Powerful human- and machine-readable data in an open standard

Unlock the power of your Dynamic Vapor Sorption (DVS) data with the TA Instruments™ TRIOS JSON Export Feature, designed to revolutionize data management and utilization. This powerful new capability seamlessly integrates TRIOS Software data with data science tools, automation workflows, and lab systems such as LIMS, making data handling more efficient and accessible than ever before.

Key Features:

- **Seamless Integration:** Convert your TRIOS data into the open standard JSON format, JSON is available:
  - Automatically on every save (enabled in options)
  - Through manual export dialogs
  - As part of the "Send to LIMS" functionality
  - Via the "Batch" processing dialog or from the command line
  - In TRIOS AutoPilot
- **Data Consistency:** Our publicly available JSON schema helps ensure a consistent data structure, allowing you to write code once and apply it almost universally across most of your data files.

- **Python Library:** Open-sourced Python Library, TA™ Data Kit (available at github.com/TA-Instruments/tadatakit), to simplify your data ingestion or learn how to take advantage of the power of our data with our code examples.

With the TRIOS JSON Export Feature, you're not just collecting data – you're unlocking its full potential. Experience streamlined workflows, reliable results, and a community-driven approach to Dynamic Vapor Sorption (DVS) analysis.
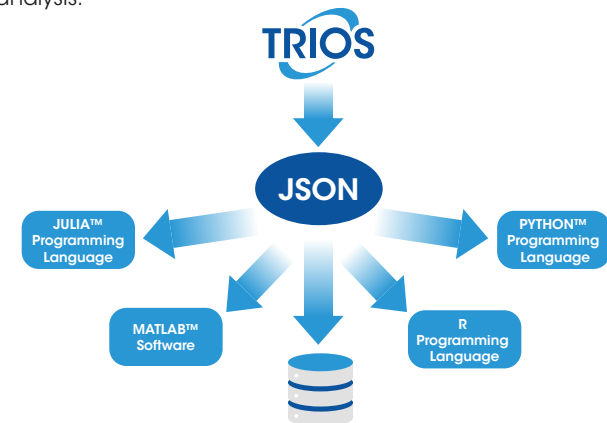

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DISCOVER
more about your
MATERIALS

In TA Modulated DSC, a sinusoidal temperature oscillation is overlaid on the traditional linear ramp. The net effect of this on a DSC/TGA instrument is that Heat Capacity (Cp) can be measured directly in a single run. TA invented MDSC and understands it like no other company. Modulated DSC is standard on EVERY Discovery SDT model.

Benefits of MDSC include:

• Direct measurement of heat capacity in a single run.

• Most accurate and repeatable measurement of Cp up to 1500 °C.

• Can measure changes in Cp isothermally to look at structure changes vs time.

* U.S. Patent no. 6.113.261 and 6.336.741
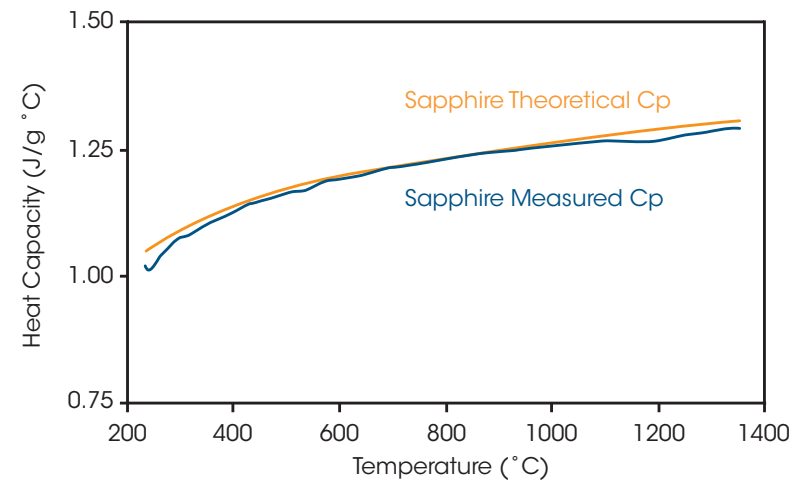
In Hi-Res TGA the heating rate is controlled by the decomposition rate of the sample. The Discovery SDT 650 design is ideal for these measurements with a furnace designed for precise temperature control, and sensitive thermobalances designed to quickly detect small weight changes.

Benefits of Hi-Res TGA include:

- Separation of broad and overlapping weight losses.
- Increased productivity with better resolution.
- Rapid survey over wide temperature range with excellent resolution.
- Simple method setup.

Standard TGA Ramp vs Hi-Res TGA Ramp

TA's patented MTGA™ is another TA Instruments innovation that offers advantages for material decomposition studies. Developed from the proprietary heater control technology utilized by Hi-Res TGA and MDSC, MTGA produces model-free kinetic data. Activation energy can be calculated real-time and studied as a function of time, temperature, and conversion.

Benefits of MTGA TGA include:

- Increased productivity for studying kinetics.
- Model-free kinetic data.
- Can be combined with Hi-Res for better separation of overlapping weight losses.
- Direct measurement of activation energy.
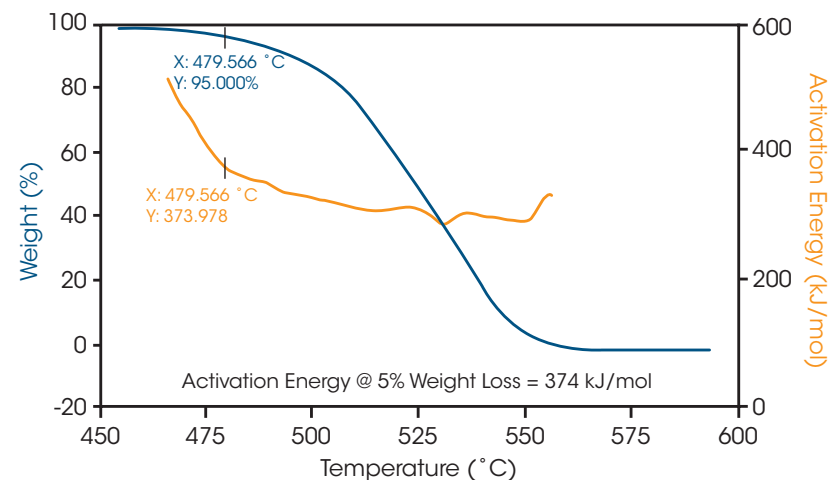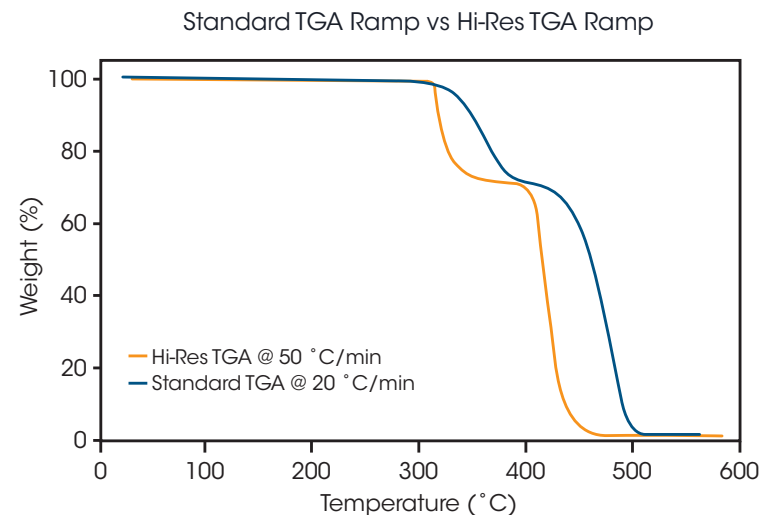
TECHNOLOGY | EVOLVED GAS ANALYSIS

Evolved gas analysis involves the qualitative investigation of the evolved gas products from an SDT or TGA experiment. These products are generally the result of decomposition, but can also evolve from desorption, evaporation or chemical reactions. Evolved gas analysis is typically performed by interfacing a mass spectrometer (MS) or Fourier transform infrared spectrometer (FTIR) to the exit port of the furnace. Through the use of a heated transfer line, the evolved gas stream is delivered to the MS or FTIR instrument, and the compositional analysis is performed in real time. TA Instruments offers a 300 amu bench-top, quadrapole mass spectrometer with a heated capillary interface, with an instrument specific interface kit. A variety of FTIR suppliers provide gas cells and interfaces.

The Discovery SDT is the ideal platform for evolved gas analysis studies. A horizontal purge stream over the sample and a short path to the exit port eliminates dead volume in the furnace, thereby reducing product dilution and optimizing EGA sensitivity.

TA Instruments TRIOS software supports the importation of MS (trend analysis) and FTIR data (Gram-Schmidt and Chemigram reconstructions), allowing DSC/TGA and EGA data to be displayed on a common axis of temperature and/or time.
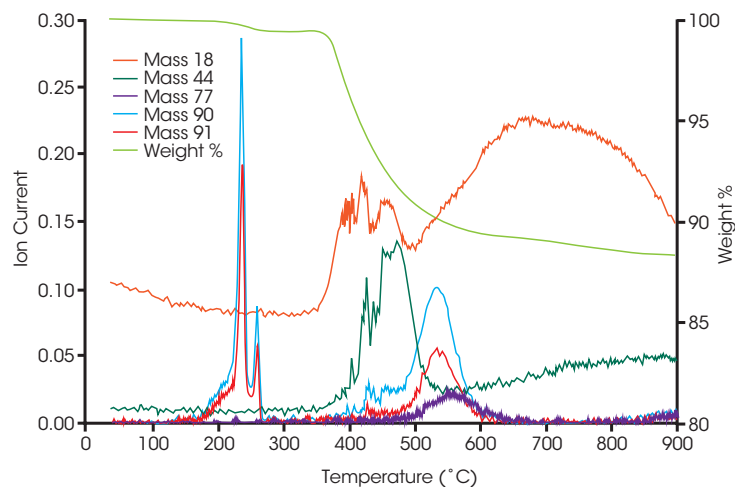
EGA Features and Benefits:

• Identification of decomposition products.

• Additional information for the interpretation of the reactions during DSC/TGA scans.

• Exact control of the furnace atmosphere before and during experiments.

Design Features and Benefits of the Discovery SDT for EGA Analysis:

• Horizontal purge stream over the sample for optimal sensitivity.

• Low volume furnace to eliminate dead volume, reducing dilution.

• Powerful TRIOS software allows importation of MS or FTIR data for improved data interpretation.

The Pfeiffer MS is a benchtop quadrupole mass spectrometer, designed and optimized for evolved gas analysis. It features industry-standard technology configured for the efficient transfer and rapid detection of offgas from the SDT furnace. Parts per billion (ppb) sensitivity is ensured with the state-of-the-art quadrupole detection system, including a closed ion source, a single mass filter, and a dual (Faraday and Secondary Electron Multiplier) detector system. This analyzer configuration is selected to optimize sensitivity and long-term stability performance.

Control of the experimental parameters and analysis of the mass spectral data is achieved through a user-friendly, recipe-driven software interface. Data collection can be triggered directly from the SDT software, and the resulting MS data can be combined with the corresponding SDT results for direct overlaying and comparison.

Parameter	Performance
Mass range	1-300 amu
Mass Resolution	>0.5 amu
Sensitivity	< 100 ppb (gas-dependent)
Ionization Source	Electron Ionization
Detector System	Dual (Faraday and Second Electron Multiplier)
Sample Pressure	1 atm (nominal)
Bar Graph and Multiple Ion Detection	Bar graph and Peak Jump
Scanning Speed	
Bar graph Mode	>500 amu/s
Multiple Ion Detection	>500 channels/s
Transfer Line Temperature	200 °C
Transfer Line	2.0 meters, flexible
Filaments	Dual, customer changeable
Capillary	Quartz, changeable
Capillary size	I.D. = 0.15 mm
Inputs	Data collection controlled by TGA Trigger

TECHNOLOGY | FEATURES & SPECIFICATIONS

Features

Standard

Modulated DSC

Hi-Res TGA™

Modulated TGA™

Dual Sample Mode

Auto-Stepwise TGA

Color App-Style Touch Screen

EGA Furnace Capable

Dual Input Gas-Delivery Manifold

Temperature Calibration Curie Point (ASTM E1582)

Temperature Calibration Melting Point Standards

Options

30-Position Autosampler

4-Gas Blending Module

TGA/MS Operation

TGA/FTIR Operation

Specifications

Temperature Range	Ambient to 1500 °C
Dynamic Temperature Precision	±0.5 °C
Heating Rate (Linear)	0.1 to 100 °C/min
Calorimetric Accuracy/Precision	±2% (based on metal standards)
Heat Capacity Accuracy	±5%
Sample Weight Capacity	200 mg
Weighing Accuracy	±0.5%
Weighing Precision	±0.1%
Weight Baseline Drift[1]	<50 µg to 1000 °C & <50 µg 1000 to 1500 °C
Vacuum	50 µTorr

[1] Without baseline subtraction

SDT650

TA | SDT650   Status: Idle

SYSTEM INFO

SIGNALS

SETTINGS

Cell Flow
Temp
Heat Flow

AMERICAS

New Castle, DE USA

Lindon, UT USA

Eden Prairie, MN USA

Chicago, IL USA

Costa Mesa, CA USA

Montreal, Canada

Toronto, Canada

Mexico City, Mexico

São Paulo, Brazil

EUROPE

Hüllhorst, Germany

Eschborn, Germany

Elstree, United Kingdom

Brussels, Belgium

Etten-Leur, Netherlands

Paris, France

Barcelona, Spain

Milano, Italy

Warsaw, Poland

Prague, Czech Republic

Solna, Sweden

Copenhagen, Denmark

ASIA & AUSTRALIA

Shanghai, China

Beijing, China

Tokyo, Japan

Seoul, South Korea

Taipei, Taiwan

Guangzhou, China

Petaling Jaya, Malaysia

Singapore

Bangalore, India

Sydney, Australia

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www.waters.com