

Thermal Analysis Instruments

60 Series





Differential Scanning Calorimeter **DSC**

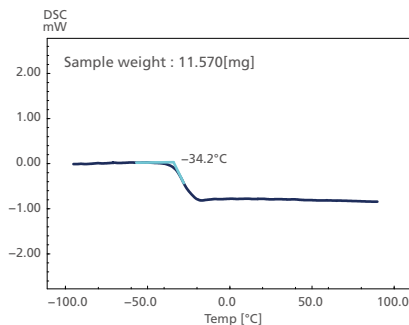
DSC-60 Plus series

DSC-60 Plus addresses a variety of DSC applications.

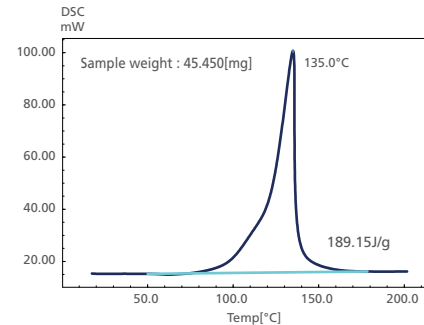
The DSC-60 Plus is an indispensable thermal analyzer for materials characterization in R&D and quality control applications in such areas as polymers, pharmaceuticals, electronic parts, foods, etc. It offers the sensitivity and easy operation required for the development of high-performance, highly functional new materials.

High-sensitivity analysis across the entire measured temperature range

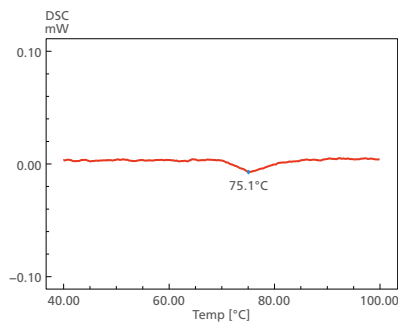
The new detector and furnace unit of the DSC-60 Plus series assure a stable baseline throughout the entire range of temperatures measured (-140 to 600 °C). Throughout the broad range of temperatures necessary in order to evaluate a wide variety of materials, complicated changes in the calorimetric value are accurately detected. This allows a DSC to offer high sensitivity and high resolution. The range of calorimetric values measured has been expanded nearly threefold (compared with previous Shimadzu models) to ± 150 mW. As a result, a dynamic range that is quite sufficient even for evaluations of the reactions of chemical substances exhibiting large calorimetric changes is now secured.



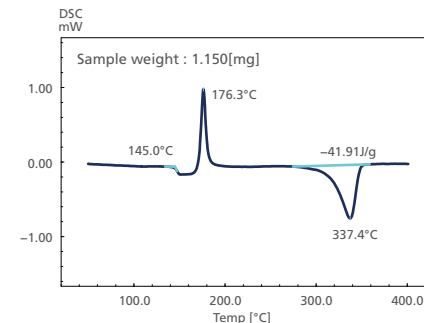
Glass Transition of NBR Rubber



Adhesive Hardening Reaction



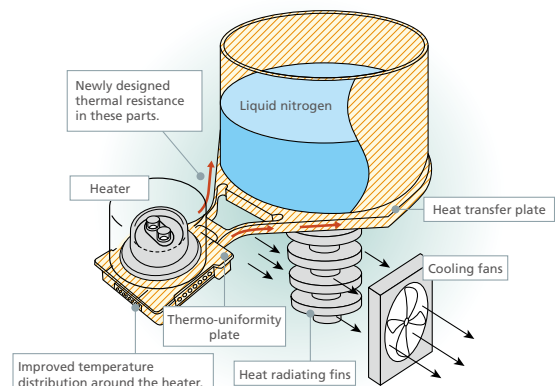
Denaturation measurement of low-concentration proteins



Measurement of Engineering Plastic (PEEK)

Structure of the DSC-60 Plus Furnace

The new detector and new unique furnace construction achieve a noise level of less than $0.5\mu\text{W}$, ensuring a stable baseline. A stable baseline and S/N performance enable the detection of a minute calorimetric change during trace analysis.



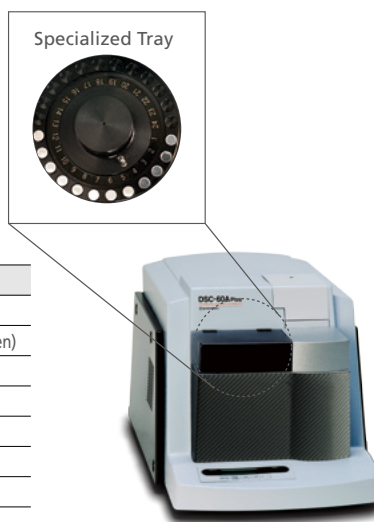
DSC-60A Plus Automatic Differential Scanning Calorimeter Capable of Continuous Unattended Measurement

The built-in compact autosampler permits automated measurement, analysis, and report printout for up to 24 loaded samples. It improves the efficiency of screening during product development and the efficiency of quality control activities.

Specifications

	DSC-60 Plus	DSC-60A Plus
Measurement principle	Heat-flux type	
Temperature range	-140-600°C (With standard cooling chamber and using liquid nitrogen)	
Calorimetric measurement range	±150mW	
Noise level	Less than 0.5µW (RMS, when held at 150°C)	
Atmosphere	Nitrogen, inert gas, dry air gas flow	
Autosampler	-	24 samples/tray
Size	W 320 × D 500 × H 290 mm	
Weight	28kg	31kg
Power supply	AC100V, 120V, 230V 50/60Hz MAX 800VA	

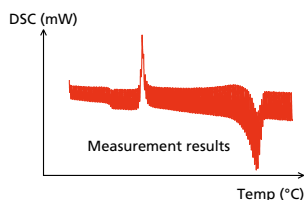
Detailed brochure C160-E013



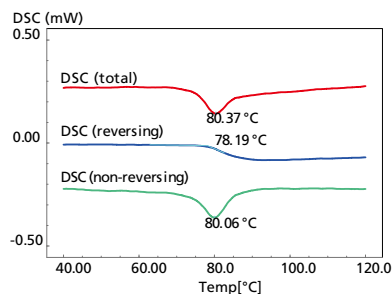
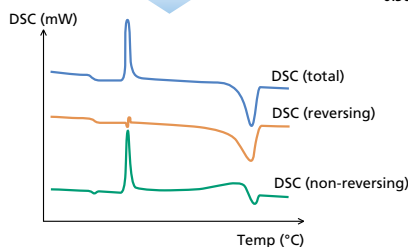
Options

Temperature Modulated DSC (TM-DSC)

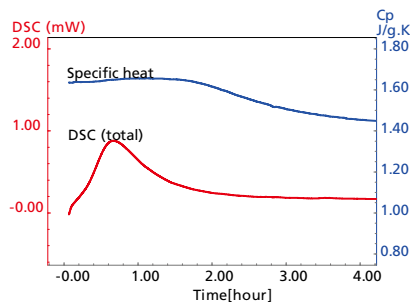
By overlaying temperature-modulated results onto results obtained by increasing the temperature at a constant rate, TM-DSC can easily measure specific heat, or can measure multiple phenomena that could not be separated using standard DSC systems. If glass transitions, enthalpy relaxations, and other reactions overlap, separation is impossible with standard DSC measurements. Using TM-DSC, however, enables separation of these phenomena.



Separation



Separation of the Heat Flow for Impact-Resistant Polystyrene



Quasi-Isothermal Measurements of an Epoxy Resin Adhesive

Liquid Nitrogen Auto-cooling System TAC-60L

Consecutive measurement with liquid nitrogen is enabled at a temperature from -130 to 500°C. The cooling capacity is -10°C/min. (at -80°C). The tank internal pressure is optimally controlled according to the residual amount of liquid nitrogen in the tank to keep the supply flow rate constant. Pulsation is reduced, and the DSC baseline remains stable even during cooling measurement.

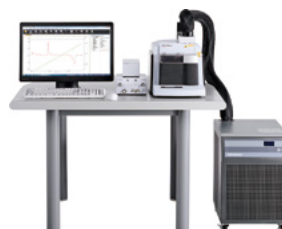
*Requires a separate FC-60A controller



Electric Auto-cooling Attachment TAC-60I

Consecutive measurement at a temperature from -50 to 500°C is enabled by connecting a commercially available immersion cooler. Since this cooling system does not use liquid nitrogen, it can be easily and safely operated. Using this cooling system together with the DSC-60A Plus enables automatic cooling measurement.

* Does not include an intracooler
* Requires a separate FC-60A controller





Simultaneous TG/DTA DTG

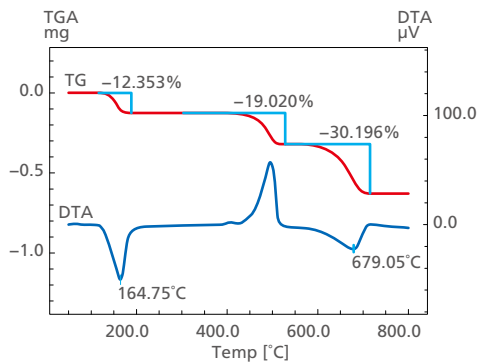
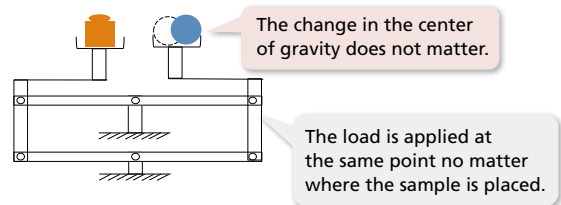
DTG-60 Series

Simultaneous TG/DTA improves ease of operation, sensitivity and analytical accuracy of conventional standalone systems.

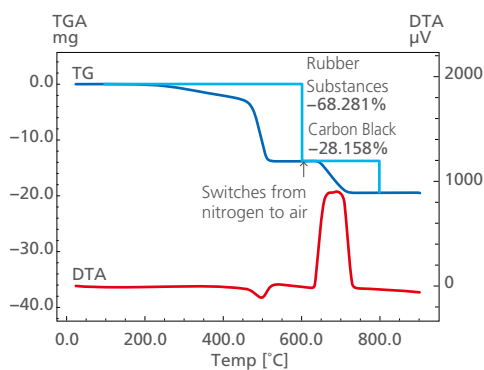
If flexibility and high performance is needed the new DTG-60/60H combines them all. Basic functions required by simultaneous thermogravimetry/differential thermal analysis (TG/DTA) measurements are improved. Atmosphere control is programmable. As in DSC, LabSolutions™ TA provides advanced acquisition, analysis and report functions which ensure comfortable simultaneous measurements.

High sensitivity and high precision of balance is equivalent to dedicated single-function instruments

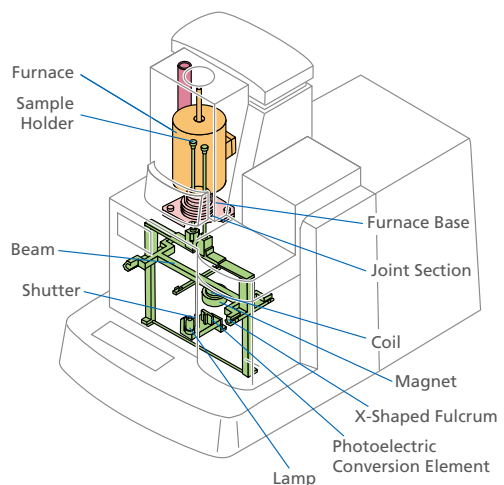
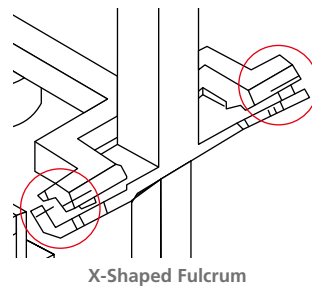
The DTG-60 series has a unique balance mechanism (Roberval mechanism) that prevents changes in sensitivity from factors such as thermal expansion and allows high-precision thermogravimetric measurements. Furthermore, the fulcrum used for the balance is made from thin alloy metal strips that have tiny thermal coefficients and are crossed to form an "X" shape. This fulcrum (X-shaped fulcrum) is lightweight and has extremely low friction and resistance. Using this fulcrum configuration allows incorporating a highly sensitive balance while attaining high resistance to vibration.



Measurement of trace CaC₂O₄

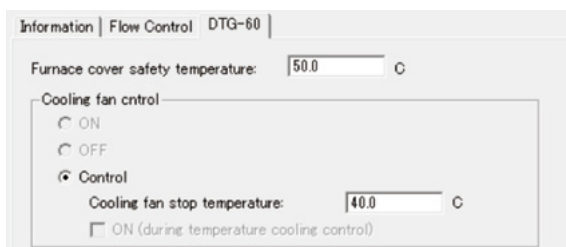


Measurement of carbon black in SBR



High sample throughput

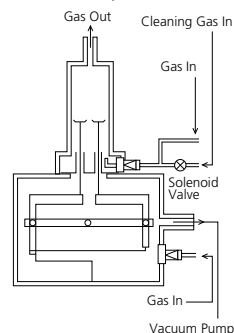
The built-in cooling fan and the low-mass furnace allow very efficient cooling times. After the completion of the measurement, the cooling starts automatically and stops when the furnace has reached a preset temperature. Now the next analysis can be started. Cyclic and cooling runs are under full instrument control.



Setting for the cooling fan control parameter (Detector properties box)

Fully controlled atmosphere for various applications

During TG/DTA measurements, qualitative and quantitative analysis, examination of reaction mechanisms and evaluation of heat resistance are performed by studying various reactions caused by the heating of samples under active and inert atmospheres. The unique channel structure of the DTG-60 series offers the solution for these applications. While an inert gas purges the balance, reactive gases are directly connected to the reaction pan.



DTG-60A/60AH provides a compact built-in autosampler

Up to 24 samples can be set up for analysis. In addition, the weight of the empty cell and sample can be measured automatically.



High-sensitivity DTA detectors



Specifications

	DTG-60	DTG-60H	DTG-60A	DTG-60AH
Balance principle	Parallel guide differential top pan type			
Temperature range	Ambient to 1100°C	Ambient to 1500°C	Ambient to 1100°C	Ambient to 1500°C
Measurable range (TG)	±500mg			
Measurable range (DTA)	±1000µV			
Weight readability	0.1µg			
Sample quantity	1g Max. in gross weight			
Atmosphere	Air and inert gas			
Auto sampler	-		24 samples / tray	
Standard sample	-		Fixed	
Analysis / Print	Automatic analysis and automatic report printout			
Size	W 367×D 650×H 474mm			
Weight	35kg		40kg	
Power supply specifications	AC 100 V, 120 V, 230 V, 1300 VA, 50/60 Hz	AC 100 V, 120 V, 230 V, 1500 VA, 50/60 Hz	AC 100 V, 120 V, 230 V, 1300 VA, 50/60 Hz	AC 100 V, 120 V, 230 V, 1500 VA, 50/60 Hz



Thermal Analyzer

LabSolutions TA

Workstation for Enhanced Operation

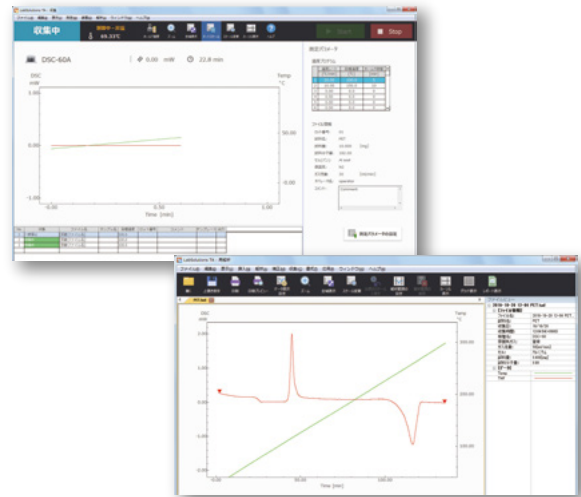
A new design and enhanced functions that can be used at a glance allow seamlessly performing the sequence of processes from measurement to analysis, and the outputting of reports.

As part of the LabSolutions family, this software is network compatible.

Comfortable Operation

- Improved operation through clear design
- Enables intuitive mouse operations
- Operational status of instruments can be checked at a glance

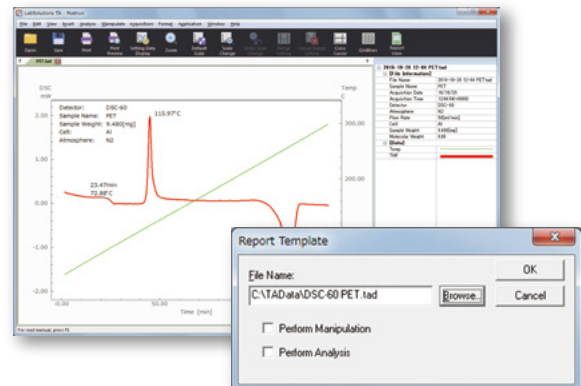
Frequently used functions are arranged as large icons above graphs. Scrolling up and down or left and right on the graph and enlarging and reducing can be performed easily by using the mouse wheel or dragging the cursor.



Improved Productivity

- Automatic manipulation and automatic analysis functions in template format
- Measurement result reports are automatically prepared

When the template function is used, manipulation and analysis can be automatically performed. By configuring the template in the acquisition program prior to measurement, automatic analysis and report preparation can be performed.



Improved Data Reliability

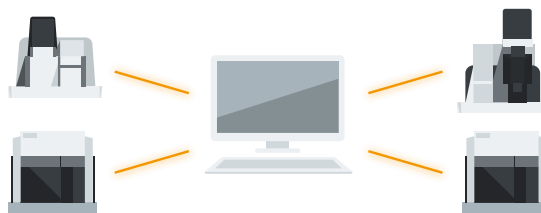
- Audit trail function for ensuring reliability of data
- Advanced security and user management functions
- Compatible with ER/ES regulations such as FDA 21 CFR Part 11, PIC/S GMP, etc.

LabSolutions TA System

Three types of data management methods are available depending on the laboratory. Network management with LabSolutions™ can also be used for thermal analysis.

LabSolutions TA

Data files are saved and managed in a folder on a PC. There is no user management. While carrying over the functionality of the TA-60WS, software operations have been improved, making it more user friendly. This software is recommended for people who would prefer the same method as before, and people who use the system only occasionally.



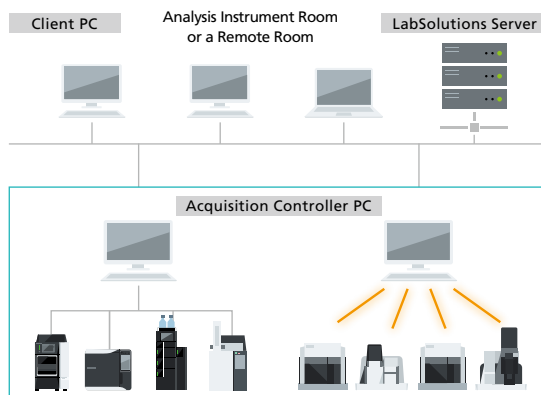
LabSolutions™ DB TA

LabSolutions DB TA, which can provide secure data management on a single PC, integrates data management functions into LabSolutions TA, and is compatible with FDA 21 CFR Part 11, PIC/S GMP, and other regulations. This configuration is ideal for customers who manage their data on a single PC. It is recommended for customers who do not require a network connection and want ER/ES compliance only for a stand-alone system.



LabSolutions™ CS

With LabSolutions CS, all analysis data is managed with a database on a server computer, so the data can be read from any computer on the network. This is recommended if there are many users, LC and GC data is managed together on a server, and the customer wants ER/ES compatibility.



Note: LabSolutions TA License for Secondary Use is required in order to read the thermal analysis data on a Client PC other than the acquisition controller PC to which the thermal analyzer is connected.

Comparison of Data Management Methods

Name	LabSolutions TA	LabSolutions DB TA	LabSolutions CS
Type	File management	Database	Client server
Data management method	Measurement data files are saved and managed in a folder on a PC.	Measurement data files are saved and managed in the LabSolutions database.	
Data browsing location	Browsing files within folders on a hard drive on a PC.	Browsing files within your PC's database by LabSolutions Data Manager.	Browsing files within the server's PC's database by LabSolutions Data Manager .
User management	Not available	Using LabSolutions user management function	
Rights management	Not available	Using LabSolutions rights management function	
Log browser	Not available	Collectively managed by the LabSolutions Log browser	
Backing up data	This function is performed for each file using Explorer	This function is performed for each project using the LabSolutions backup function	

Optional Software

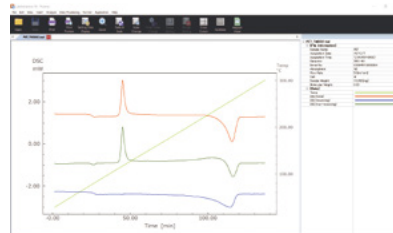
A variety of optional software is available for LabSolutions TA, providing excellent operability and functionality, and further expanding the range of applications.

Temperature-Modulated DSC Program

DSC

Using temperature-modulated DSC measurements, you can separate complex data, such as overlapping transitions and reactions, and measure specific heat. For specific heat measurements, the number of measurement cycles is fewer than with standard DSC measurements, the process is easier, and pseudo isothermal measurements, which were impossible with standard DSC, can now be performed.

PET Glass Transition Measurements

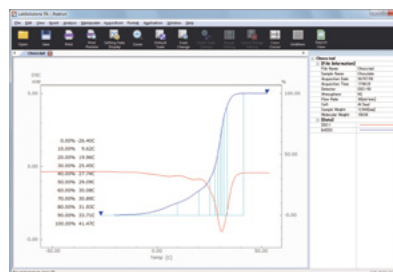


Partial Area Analysis Program

DSC DTG

This software can calculate partial fusion rates at various temperatures, and find the temperature at which the specified partial fusion rate is shown, for use as a quality control index.

Fusion of Chocolate



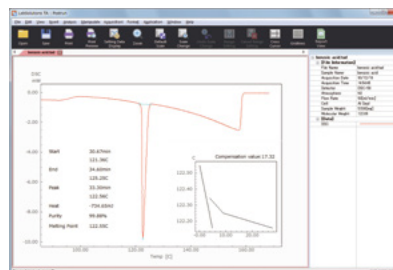
Purity Analysis Program

DSC

In measurements of purity using DSC, pretreatment of samples is not required, even for trace samples, and the purity is obtained quickly and with easy operations. It is widely used for analysis of pharmaceuticals, industrial chemicals, and reagents.

With this program, the purity can be calculated accurately, even for materials that degrade during fusion.

Purity of Benzoic Acid



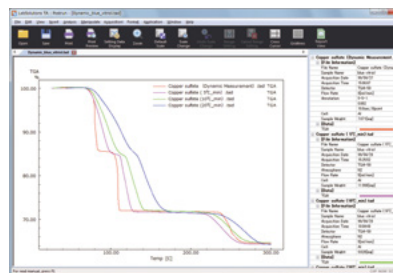
Dynamic Temperature Control Program

DTG TMA

Controls the temperature that switches between high and low rise speeds in a temperature program, corresponding to the rate of change of the TG weight signal and the TMA displacement signal.

In comparison to measurements in which the temperature rises at a constant rate, the software is useful for improving the resolution with multi stage changes in TG, and for sintering conditions for ceramic materials in TMA.

Dehydration of Copper Sulfate (Dynamic/Temperature Increases at a Constant Rate)



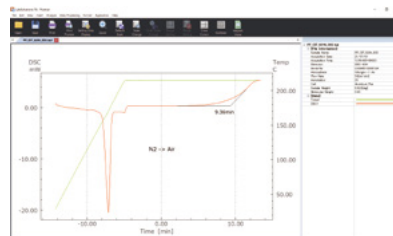
OIT Automatic End Program

DSC

By measuring the oxidation induction time (OIT) with DSC, the effect of antioxidants contained in polymer materials, such as rubber and plastic, resistance to heat and light, and degree of deterioration can be evaluated.

In this program, the measurement is automatically finished after the detection of a peak due to oxidation, and the oxidation induction time can be automatically analyzed from the rise start time of the peak.

OIT Measurement of Polypropylene



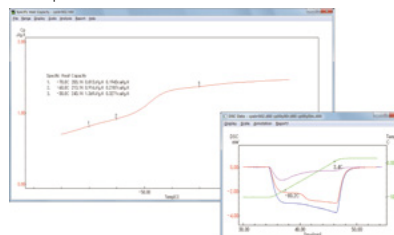
Specific Heat Analysis Program*

DSC

To measure the specific heat of samples using DSC, a comparison of the calorific values of three measurement results (a blank, a standard, and the sample) is calculated.

With this program, the above-mentioned calculations are automated, so finding the specific heat is easy. In addition to determining the desired specific heat at each temperature, the program can also calculate the specific heat simultaneously at preset temperatures (up to 15 temperatures).

SBR Specific Heat Measurements



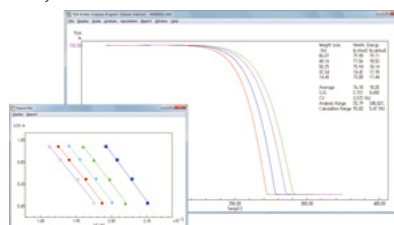
Reaction Rate Analysis (TG) Program*

DTG

This software analyzes the data from the decomposition reaction of a sample, obtained from thermogravimetry, using the Ozawa method. It then obtains the activation energy, the frequency factor and other reaction rate parameters. It is applied to estimations of reaction mechanisms, evaluation of the thermostability of materials, and estimations of material operating life.

It can be used for a wide range of samples, including high molecular weight materials, electrical insulation materials, thermally stable polymers, composite materials, and pharmaceuticals.

Analysis of the Reaction Rate of Nicotinamide

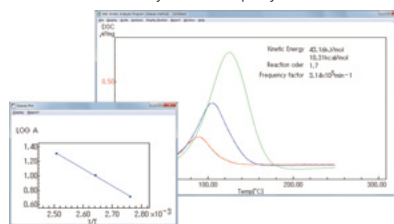


Reaction Rate Analysis (DSC) Program*

DSC

This software is applied to the analysis of reaction rates for chemical reactions (such as the curing of epoxy resins) without changes in weight. As when using TG, the analysis is performed via the Ozawa method. Using the DSC data measured by changing the heating rate, an Ozawa plot is charted, and the activation energy, frequency factor, and other reaction rate parameters are obtained. As an example, the figure shows a reaction rate analysis of the curing reaction for an epoxy resin. The relationship between the curing temperature, curing time, and degree of curing can be simulated based on the parameters obtained.

Reaction Rate Analysis of an Epoxy Resin



* Not compatible with LabSolutions DB TA and LabSolutions CS

Options

Flow Controller FC-60A (P/N 346-67995-92: for 120V, -93: for 230V)

The FC-60A flow controller is used to control the flow rate of atmosphere gases (of two channels). Since the gas ON/OFF control is performed according to a temperature program, the atmosphere can be automatically changed during a measurement.



Specifications

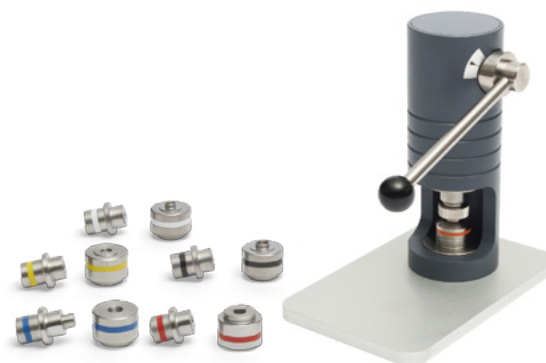
Primary pressure	0.6MPa max.
Flow rate	PURGE side: 0~500ml/min (calibrated for N ₂) DRY side: 0~500ml/min (calibrated for N ₂)
Flow line	PURGE: 2 IN, 1 OUT DRY: 1 IN, 1 OUT
Size and weight	W 180 × D 200 × H 90mm, approx. 3kg
Power supply	90~130V AC or 210~230 V AC, 100VA

Sample Sealing Crimp Press SSCP-1 (P/N 222-13130-91)

Samples are prepared with various types of pans for Shimadzu thermal analyzers by using the SSCP-1 in combination with the attachment specified for the pan to be used (sold separately).

Attachments

Pan to Be Used	P/N	Description
*1 201-52943 Al crimp pans	222-13053-91	Crimp attachment
*2 346-66963-91 Al crimp pans	222-12821-91	Crimp attachment (for autosampler)
*3 201-53090 222-13175-93 Al hermetic pans	222-12826-91	Hermetic attachment
*4 222-13175-94 Ag hermetic pans	222-12826-92	Ag hermetic attachment
*5 346-68518-91 Al hermetic pans (for the DSC)	222-12809-91	Hermetic attachment (for the DSC autosampler)
*6 346-68796-91 Al hermetic pans (for the DTG)	222-12804-91	Hermetic attachment (for the DSC autosampler)
*7 222-13073-91 Al pressure-proof pans	222-12915-91	Al pressure-proof pans attachment



10-ton Hydraulic Press (P/N 206-33547)

Used to press stainless steel (SUS) pressure-proof pans.



Sealer Adapter for Stainless Steel (SUS) Pressure-proof Pan (P/N 222-01875-91)

Used to seal 5 MPa Stainless steel (SUS) pressure-proof pans.



Sample Punch

Used to cut out film samples (in 5 mm diameter) to match the size of the sample pans for thermal analyzers.

▶ Cutting Die (P/N 222-13586-91)

The sample to be used is about 50 to 300 μm thick for PET films.



▶ Press Cutting Die (P/N 222-13740-91)

The sample to be used is about 10 to 100 μm thick for PET films.



Pt pans Fairing Stand (P/N 222-13881-91)

Used to fix deformed Pt pans (201-51976 and 201-53843).



Sampling Kit for Thermal Analysis (P/N 222-14746-92)

This kit includes Funnel for Thermal Analysis, tweezers, a spatula, and a cell stand.



Funnel for Thermal Analysis (P/N 222-14746-91)

Used when sampling powder samples into the sample pans.



Note: Funnel for Thermal Analysis cannot be used with ⑭Al hermetic pans for the DSC autosampler, ⑮Al hermetic pans for the DTG autosampler, ⑯Al pressure-proof pans and ⑰Stainless steel pressure-proof pans.

Sample Pans

1 Al (Aluminum) Pans

- ① 201-52943 Al crimp pans 6 mm dia. x 1.5 mm (50/set)*1

► For Autosampler

- ② 346-66963-91 Al crimp pans 6 mm dia. x 3 mm (100/set)*1
 346-66963-92 Al open pans 6 mm dia. x 3 mm (100/set)
(Same as -91, with lids not included)

► When Large Volume Is Tested

Al pans can be used in the autosampler.

- ③ 201-57268-90 Al macro pans*4 6 mm dia. x 5 mm (50/set)

► Pan lid with pin-hole

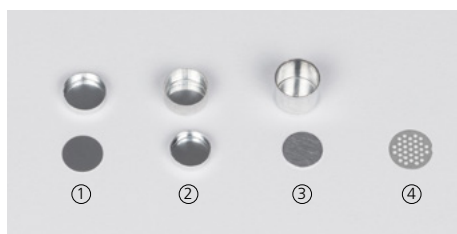
Old type (Hole diameter 0.2 mm)

- 201-56586 Al pan lid with pin-hole (6 mm dia. x 0.05mm) (100/set)

New type (Hole diameter 0.48 mm)

- ④ 222-10957-91 Al pan lid with pin-hole (6 mm dia. x 0.1mm) (100/set)

The new type improves robustness and gas permeability.



2 Pans for Use at High Temperatures

Lids are not provided with pans for use at high temperatures. These pans can be used in the autosampler:

► Pt Pans (Up to 1300 °C*)

Deformed Pt pans can be fixed using the fairing stand. (See the back page.)

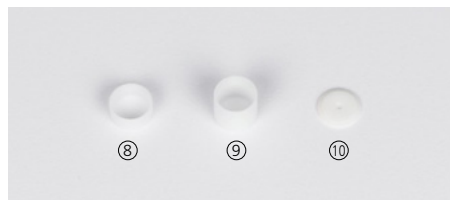
- ⑤ 201-51976 Pt pans 6 mm dia. x 2.5 mm (1 pc.)
 ⑥ 201-53843 Pt macro pans 6 mm dia. x 5 mm (1 pc.)
 ⑦ 201-56927 Pt pan lid 6 mm dia. (1 pc.)



► Alumina Pans (Up to 1500 °C)

For samples that react with Pt

- ⑧ 201-54321 Alumina pans 6 mm dia. x 2.5 mm (1 pc.)
 ⑨ 201-54321-01 Alumina macro pans 6 mm dia. x 5 mm (1 pc.)
 ⑩ 222-13027-91 Alumina pan lid 6 mm dia. (1 pc.)



3 Hermetic Pans

Hermetic pans can be used at temperatures at which the pressure reaches 0.3 MPa or up to 300 °C.

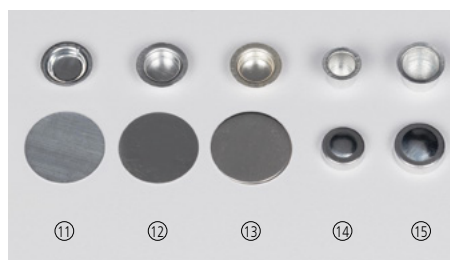
- ⑪ 201-53090 Al hermetic pans 6 mm dia. x 1.5 mm (50/set)*1
 ⑫ 222-13175-93 Al hermetic pans (Deep type) 6 mm dia. x 2.3 mm (50/set)*1
 ⑬ 222-13175-94 Ag hermetic pans 6 mm dia. x 2.3 mm (50/set)*1

► For DSC Autosampler

- ⑭ 346-68518-91 Al hermetic pans (for the DSC autosampler) 4.4 mm dia. x 4 mm (100/set)*1

► For DTG Autosampler

- ⑮ 346-68796-91 Al hermetic pans (for the DTG autosampler) 6 mm dia. x 4 mm (100/set)*1



4 Pressure-Proof Pans

Pressure-proof pans can be used in the autosampler. These pans can be used at temperatures at which the pressure reaches 5 MPa or up to upper limit temperatures.

► Upper Limit Temp. of 300 °C

- ⑯ 222-13073-91 Al pressure-proof pans 6 mm dia. x 5 mm (50/set)*1

► Upper Limit Temp. of 500 °C

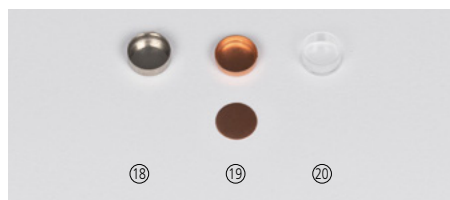
- ⑰ 222-02067-92 Stainless steel (SUS) pressure-proof pans 6 mm dia. x 5 mm (50/set)*3



5 Other Pans (Pans Made of Other Materials)

Contact us for details on how to use them. Pans cannot be used in the autosampler.

- ⑱ 201-53102-84 Ni pans 6 mm dia. x 2 mm (50/set)
 ⑲ 201-58294-90 Cu pans*4 6 mm dia. x 1.5 mm (50/set)
 ⑳ 201-54439 Quartz pans 6 mm dia. x 2.5 mm (1 pc.)



Remarks

- *1: SSCP-1 and the attachment specifically for the pan to be used need to be prepared separately. See the back page for details.
 *2: Platinum cells may adhere to the detector at temperatures above 1100°C. The maximum temperature for auto sampler measurement should be 1100°C or less.
 *3: 10-ton hydraulic press (206-33547) for stainless steel (SUS) pressure-proof pans and the sealer adapter (222-01875-91) are required.
 *4: Use the attached lid to cover the sample. Not for crimping.

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