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Thermo Gravimetric Analyzer (TGA)

Operation Instructions

Read before Operation

Before operation this machine, please read this manual thoroughly, and keep a copy with the machine for future reference. This manual is to be considered part of your machine.

Model: TGA-101

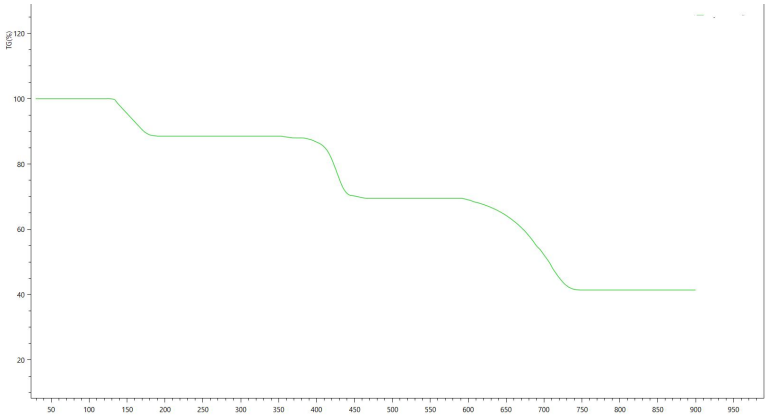
Catalogue

I. Overview and principles

Thermal gravimetric analysis (TGA) is a technique to measure the relationship between mass and temperature of a substance under programmed temperature control. When a substance is heated, physical and chemical changes occur and the mass changes accordingly.

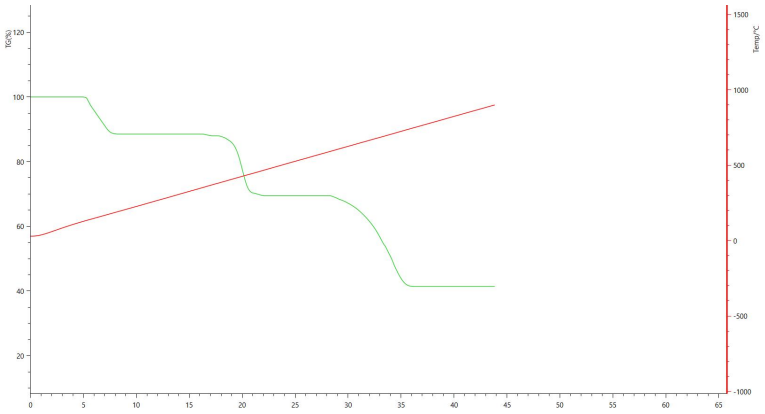
TGA testing can be performed as needed, as shown in the figure below:

The relationship between the thermal weight of the sample and the temperature



The following figure illustrates:

The relationship between the thermogravimetric (TGA) of the sample and time



Principle: When the sample and reference material are placed in the crucible, the temperature is heated at a preset rate. During the heating process, the sample undergoes volatilization and decomposition, and the weight changes during the process. The software records the relationship between the weight and time/temperature.

2. Instrument technical indicators

model	TGA-101
display mode	24-bit color, 7-inch LCD touch screen display
TG scope	0.01mg to 3g, up to 30g
TG accuracy	0.01mg
temperature range	Room temperature ~ 1250℃
temperature resolution	0.01℃
heating rate	0.1 ~ 100℃/min
Temperature control method	PID temperature control with heating and scanning, constant temperature, and cooling scanning (fully automatic program control)
programmed control	Supports five-stage temperature control with customizable parameters
Atmosphere control gas	Dual-channel automatic switching (instrument automatic switching)
gas-flow rate	0-200mL/min
gas pressure	≤0.5MPa
Constant temperature time	0 to 300 minutes can be set freely
data interface	Standard USB port
working power supply	AC220V/50Hz

3、Instrument installation and working environment

Instrument installation: Check whether all instrument parts are complete according to the packing list

Place the instrument flat on the workbench and connect the power and signal cables.

The workbench for installing the instrument has a flat surface

Operating environment: AC220V ±10V, ≤10A Work environment: AC220V ±10V, ≤10A

The ambient temperature is 20 ~ 28℃

The instrument placement workbench has a flat tabletop. There are no large machines or other vibration sources around.

The instrument is highly accurate, and the temperature fluctuation of the laboratory should be less than 2 degrees Celsius during the whole experiment (about one hour).

The doors and Windows of the laboratory should be closed and the temperature of the laboratory should be controlled 3 hours before the experiment.

The instrument should be turned on half an hour before the experiment.

Keep the instrument away from the heater and the air conditioner outlet.

4. Instrument Interface

1. Startup and shutdown interface

Initial state displays environmental temperature, sample temperature, gas selection and adjustment, and balance TG cleaning function.

Configure system parameters to view the device's operational and communication status

"Parameter Settings" displays the basic experimental parameters we have configured, such as cutoff temperature, heating rate, constant temperature time, and gas selection.

The Device Information interface displays the device's basic information and the calibration temperature channel in the background.

The "Run Interface" displays the device's operating temperature, time, status, phase, and more.

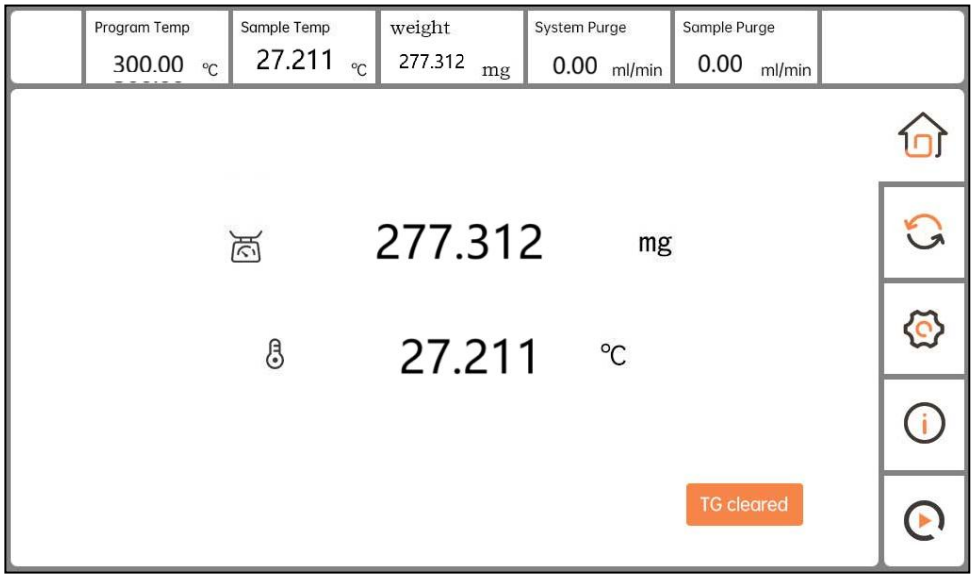


Figure 4-1 Initial state interface

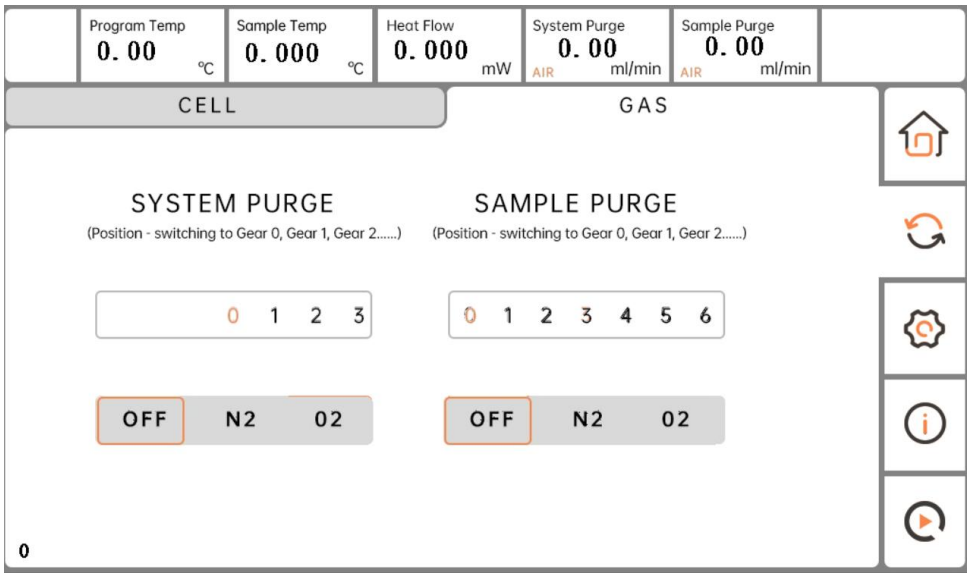


Figure 4-2 Configuration System Status Interface

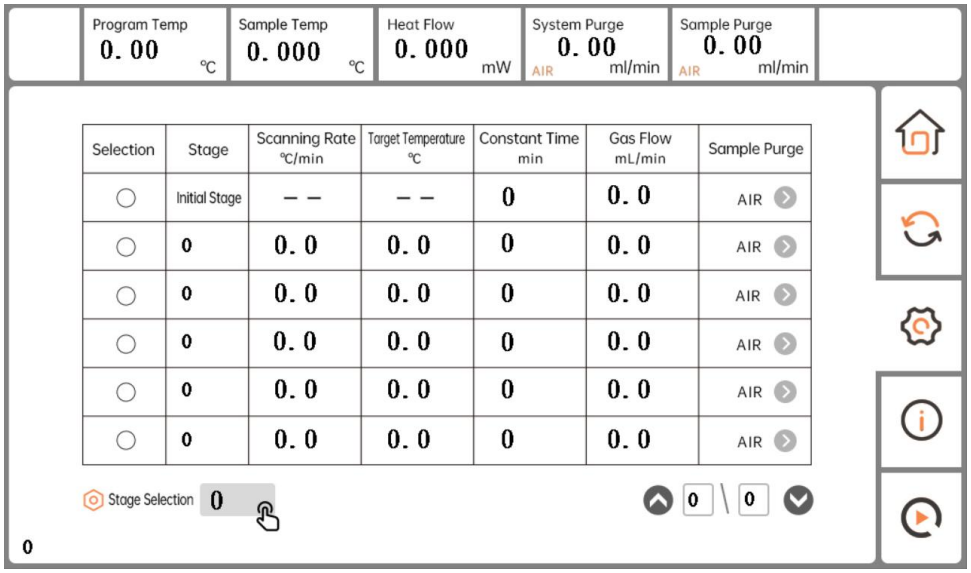


Figure 4-3 Parameter Settings Interface

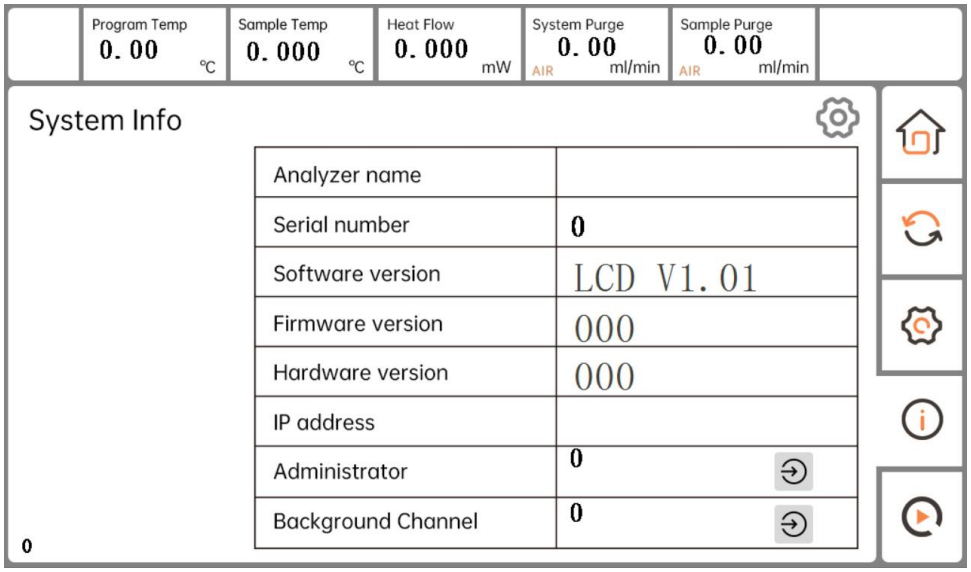


Figure 4-3 Device Information Interface

Figure 4-4 Running Interface

5. Software Description

TG Heat Analysis: Key Features Explained

- The numerical marking function performs fixed-point numerical marking analysis.

  The numerical marking function performs fixed-point numerical marking analysis.

- The quality change function allows you to select the quality change under different temperature curves. The quality change function allows you to select the quality change under different temperature curves.

- Residual mass function annotation. Click to view the residual mass and percentage.

  Residual mass function annotation. Click to view the residual mass and percentage.

- Enter temperature to view the corresponding percentage loss.

  Enter temperature to view the corresponding percentage loss.

- Enter percentage to view the corresponding temperature point in the weightless state

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- DTG annotation. Click to view the DTG weight loss rate curve.

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- DTG analysis can process and analyze DTG curves.

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1. Software shortcut bar details

Create Open Save Preview Start End Clear Temperature/Time Coordinates

2. Software interface

2.1 Software Introduction: The main interface features a new experiment creation panel where users can specify parameters including laboratory, personnel, name, crucible mass, and experimental atmosphere (select 'air' for non-gaseous environments), as shown in Figure 5-1.

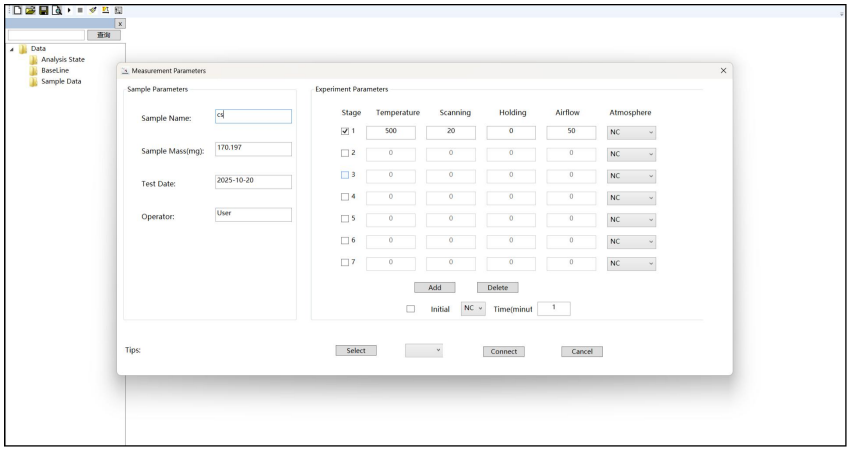


Figure 5-1 Software Main Interface

2.2 Figure 5-2 and Figure 5-3 below show the details of the [Analysis] dropdown options in the two interfaces. Left-click to select the curve to be analyzed, which will turn green for analysis.

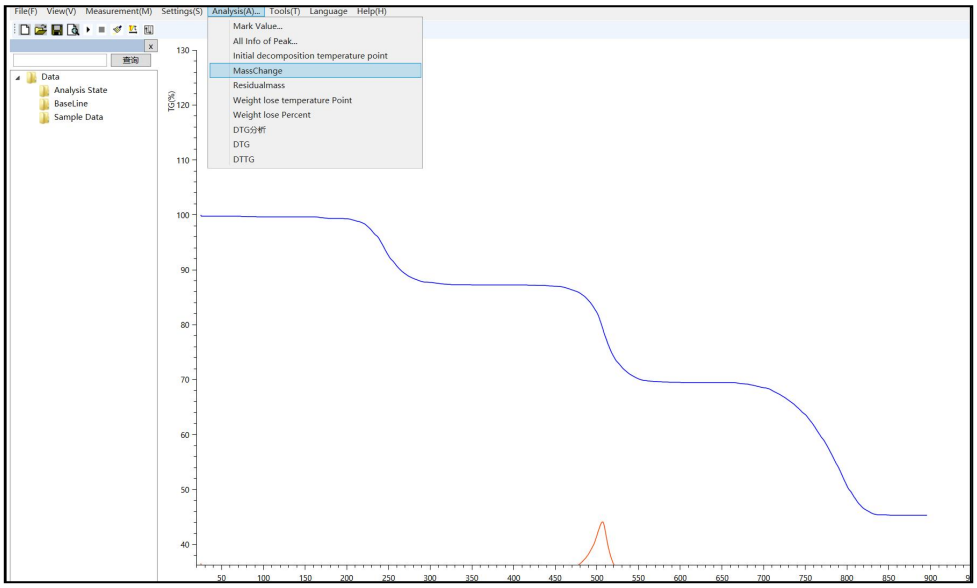


Figure 5-2: Analyze drop-down options

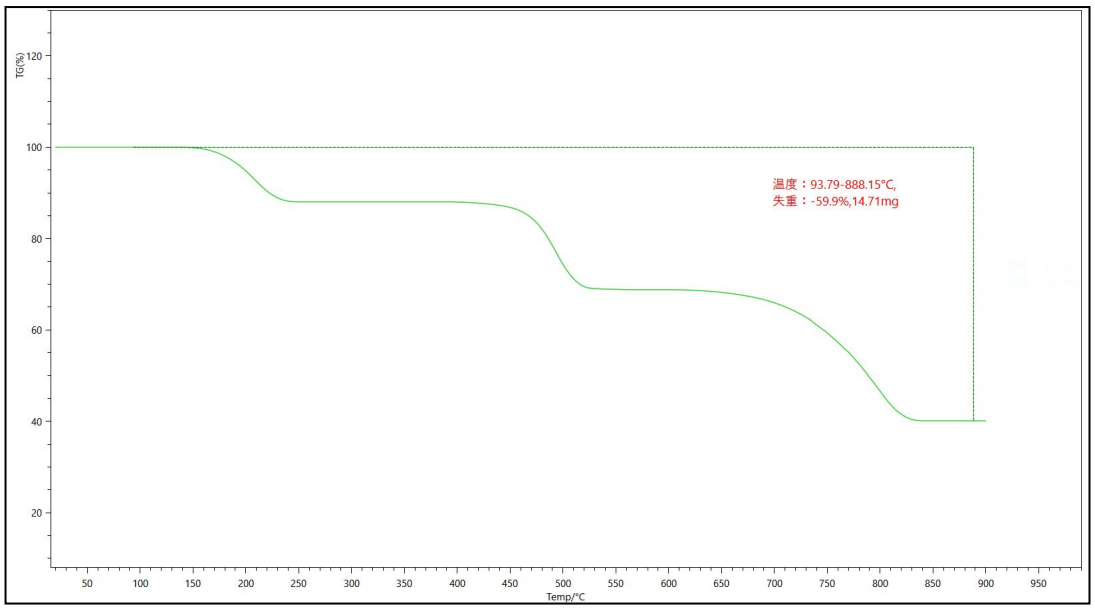


Figure 5-3: Selected spectrum example

VI. Experimental operation steps

The first experiment of the day requires an hour of preheating.

1. Turn on the computer, plug in the instrument's power supply, turn on the switch on the back of the instrument, and connect the instrument data cable to the computer.

2、Connect the required gas. Click nitrogen and oxygen on the instrument display, and adjust the gas flow to about 100ml/min.

3. Launch the software and click the [New] shortcut in the taskbar at the top left. Enter the [Sample Name] first, and the operator can proceed. As shown in Figure 6-1.

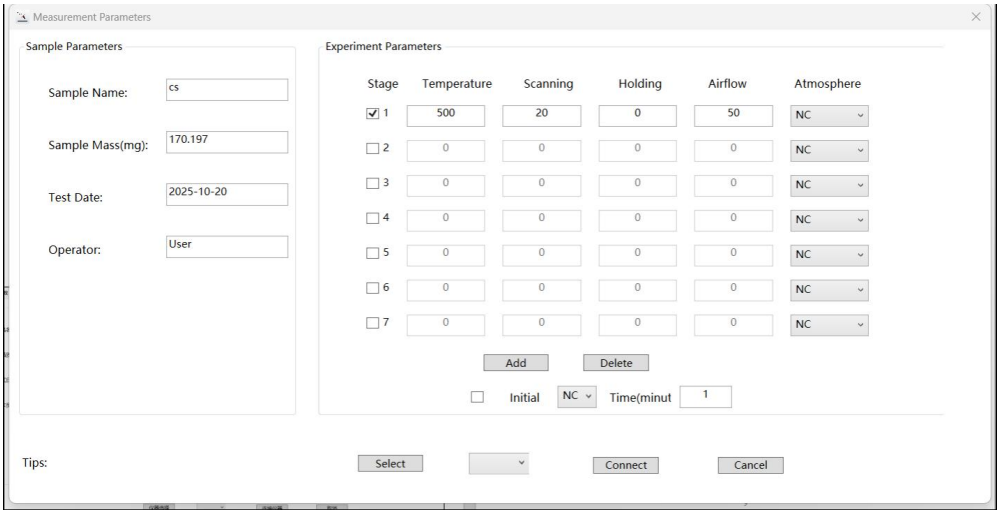


Figure 6-1 Experimental parameter settings

3、Check if the instrument's TG parameter is zero. First, reset it to zero. Then, place two empty crucibles on the sample tray and cover them with the thermal insulation lid. Wait for 3 minutes until the TG mass on the instrument stabilizes. Enter the displayed TG mass into the [Crucible Mass] field in the software above, then click [Connect Instrument]. As shown in Figure 6-2 below.

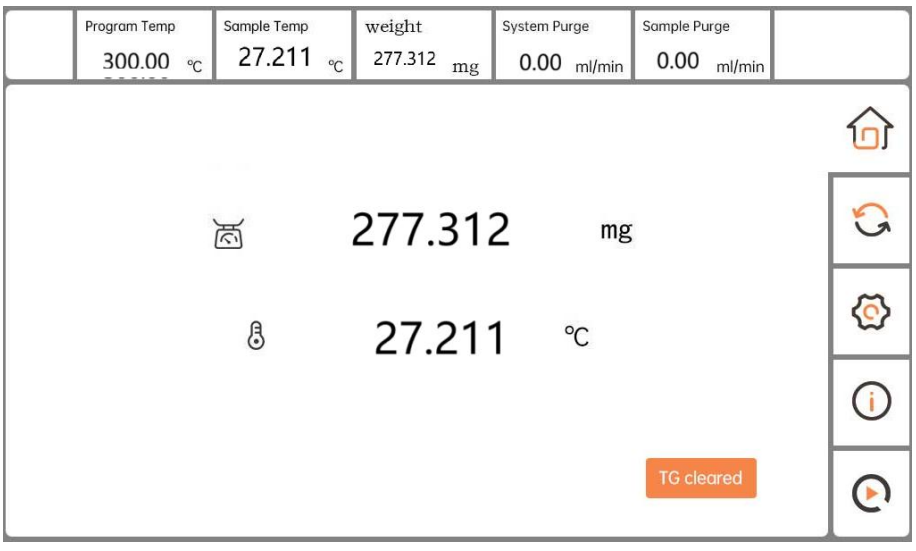
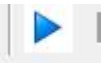
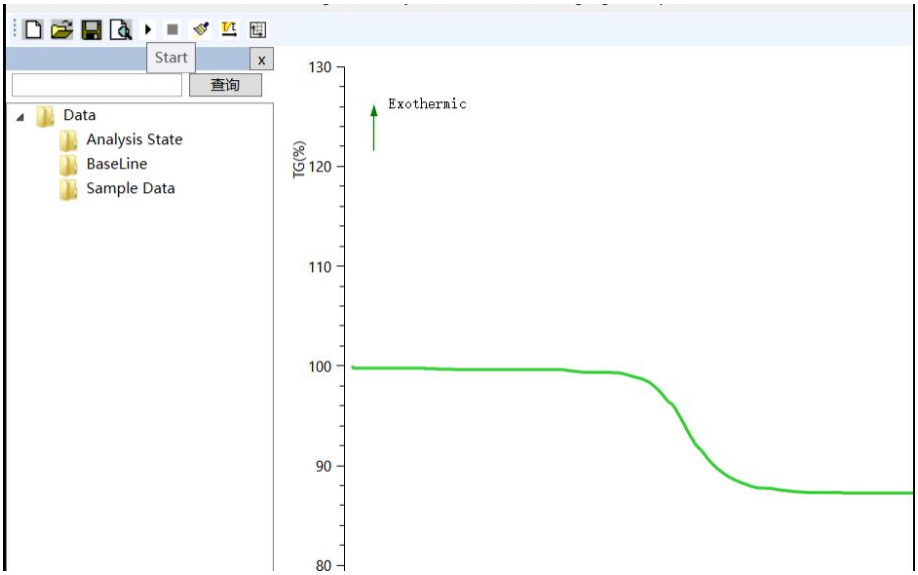


Figure 6-2 Initial instrument interface

4. Take out the crucible on the right side of the tray, put the sample in it, and then put it on the sample tray, and cover it with the internal ceramic cover and metal cover.

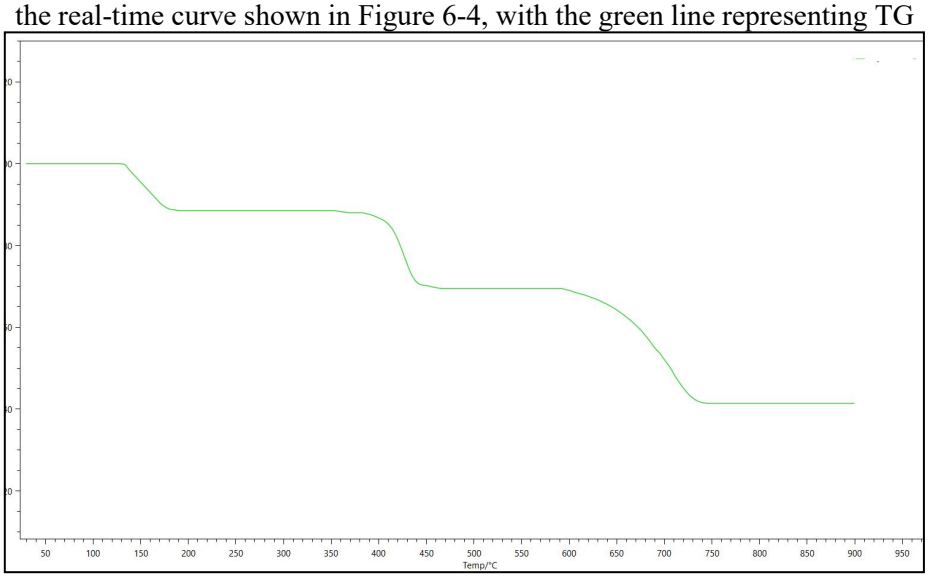
5. Then set the parameters in Figure 6-1, including the cutoff temperature, heating rate, constant temperature duration, gas flow rate, and required gas settings.

6. After configuring all parameters, select the device number via the [Instrument Selection] button in the diagram, then click Connect Instrument  . Once TG stabilizes, click [Run] in the software as shown in Figure 6-3. 



graph 6-3

7. When the preset temperature is reached, the instrument automatically stops. The software displays the real-time curve shown in Figure 6-4, with the green line representing TG



8. mass and the blue line showing DSC curve. The x-axis indicates temperature, while the left vertical axis shows mass. The experiment concludes with data saving.

Figure 6-4 Real-time curve

8. TGA curve analysis: Click the mass change curve until the spectrum color shifts from dark

green to light green, indicating successful selection. Then click [Analysis] → [Mass Change] in the taskbar, drag the left and right analysis lines to define the temperature range, and click [Apply] → [Confirm]. The weight loss ratio will be displayed, completing the analysis.

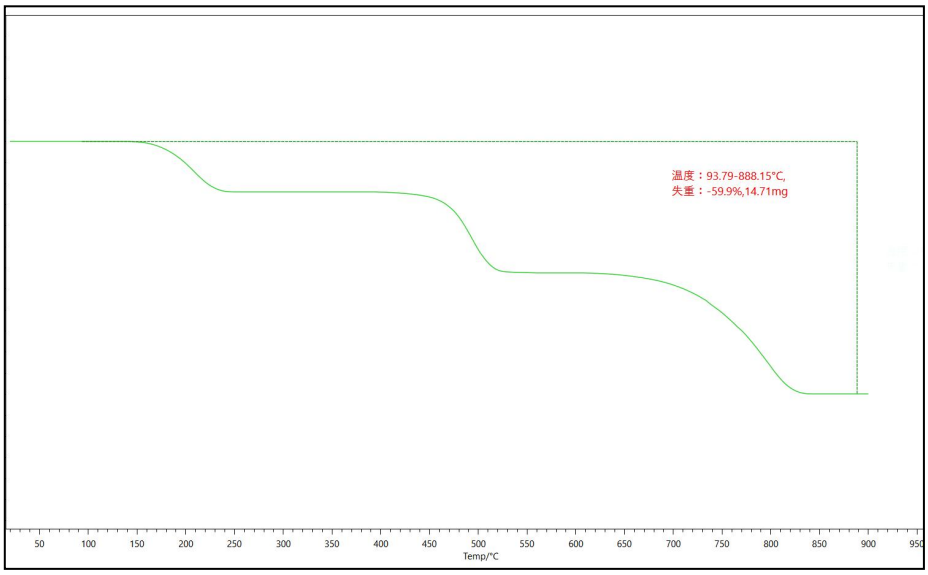
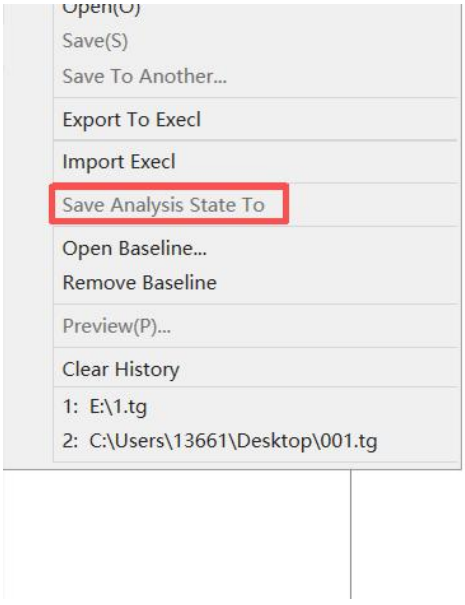


Figure 6-5 TGA Curve Analysis Interface 1

9. After completing the analysis, click [File] - [Save as Status T] to save the analysis data. See Figure 6-6.



graph 6-6

10. Finally, click the Print Preview button to view and save the experiment report.

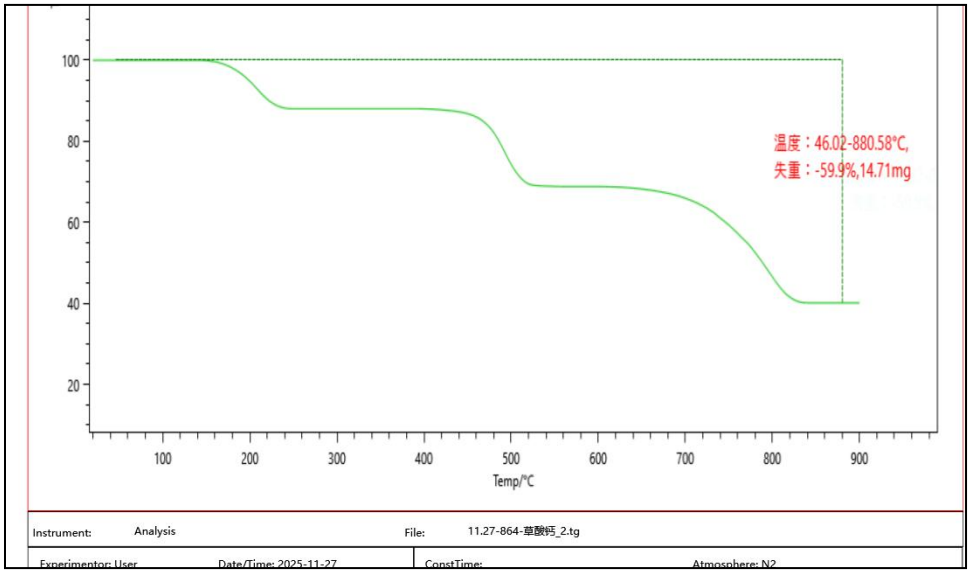


Figure 6-7 Print Preview Interface

VII. Sample preparation method

Considerations for TGA sample preparation:

1. During the preparation process, the sample should be as unaltered as possible.

2. The samples should not be contaminated during the preparation process.

3. The sample preparation method should be consistent and reproducible. Only consistent sample quantities can yield comparable TGA data.

Sample quantity considerations. To achieve sufficient accuracy, adequate sample quantity is essential. This is particularly crucial for substances with minimal volatile components or non-uniform materials, where increasing sample quantity ensures precise measurements. Solid and powder samples are recommended to be between 15-20mg. Liquid, oily, or easily expandable samples should not exceed two-thirds of the crucible capacity. The diffusion rate of gases produced by sample reactions correlates with sample quantity − larger samples hinder gas dispersion.

When preparing test samples, ensure they are thinly and evenly spread close to the crucible. For materials containing moisture or volatile components, puncture holes in the crucible. However, excessive compaction hinders gas diffusion and escape during decomposition. For powder samples, after placing the sample in the crucible, gently tap it to form a uniform thin layer.

VIII. PRECAUTIONS

1. Before the experiment begins, the laboratory temperature should be controlled at 20-30° to ensure that the equipment can be carried out in the most stable and constant room temperature environment. Check whether all the connections of the instrument are correct, whether the amount of gas selected is sufficient, and whether the parameter setting is wrong.

2. To ensure safety and proper equipment operation, reduce testing of corrosive samples containing sulfides, fluorine, or explosive substances. During heating, prevent overflow by using a sealed crucible with a lid.

3. When preparing samples, do not sprinkle them on the edge of the crucible to avoid contaminating the sensor and damaging the instrument. The bottom and all outer surfaces of the crucible should not be contaminated with samples or impurities to avoid affecting the experimental results.

4. The amount of sample should be appropriate, neither too much nor too little. The solid sample is generally about 20mg. The liquid sample should not exceed two thirds of the crucible capacity.

5. Inorganic samples can be ground and sieved in advance; polymer samples should be as uniform as possible; fibers can be made into the same length of 1~2mm; powder samples should be compacted.

6. The crucible should be fixed in the support. When the sample amount is small, it should be evenly spread on the bottom of the crucible and not piled on one side. If the sample is granular, it should be placed in the center of the crucible.

7. The temperature rise rate is generally selected at 10~20℃/min. Too large will cause the curve to drift and reduce the resolution; too small will take a long time to measure.

8. When the sample holder is severely contaminated, the following parameters can be set: set the cutoff temperature to 600℃, the heating rate to 20℃/min, and the constant temperature time to 30min. Introduce gas for air-burn test. Do not put any crucible in the instrument. The purpose of high temperature is to volatilize the pollutants.

9. Avoid obvious vibration around the instrument during the experiment, and do not open the lid. After the experiment, the temperature should be reduced to below 500° before opening the furnace cover to avoid burns and damage to the furnace cover.

10. Do not adjust the purified gas flow during data collection, as minor changes in gas flow may affect the DSC curve.

11. Before disconnecting the data cable and turning off the instrument, you must first shut down the software to prevent online or communication errors.

产品保修卡
Product Warranty Card

用户资料 User Information

单位或个人名称 name：_____

详细地址 Address：_____

_____

电话 Tel：_____ 传真 Fax：_____ 邮编 P.C.：_____

维修服务记录
Repair Service Record

产品名称 Product		产品型号 Model		产品编号 Product No.	
发票号 Invoice No.		购买日期 Date of purchase		免费保修期 Period of Warranty	
日期 Date	记录 Description				维修人 Serviced by

User Guide

In order to ensure the interests of users, I have established a quality assurance system, with free warranty service by card.

1. Please carefully fill in the user information in the product warranty card.
2. Fee structure: Free repairs during the warranty period. After the warranty expires, repair fees will be charged (covering only the cost of repairs). We provide lifetime maintenance for our products. For damages caused by improper use or human error, additional charges may apply.

Quality Assurance

Ⅰ 、The guarantee period is twelve months (consumer goods and travel cost are not included).

Ⅱ、The main quality warranty maintenance certificate

1. Please keep this guarantee letter, if you lost it, please connect with us in a month.
2. If this guarantee letter has been altered or it has no our stamp, it is useless.

Ⅲ、The following conditions need to pay reasonably even in the assurance period.

1. Natural reasons
2. Operating mistakes
3. Voltage is not fit for our operation instruction
4. Repack it without our guides
5. Damaged for borrowing to others
6. Damaged for authorized machine modification
7. Damaged for authorized calibration
8. Authorized transshipment mistake
9. Serve for long distance area

Ⅳ、Notes:

1. Where the original in Guangdong province installation of our products, if the product moved to outside Guangdong-area use, whether or not within the effective warranty period, the transportation and travel expenses of the service personnel should be paid by the client.
2. All customers outside of Guangdong province, whether or not in the warranty period, the service of transportation and travel expenses paid by the customer.