

# Thermogravimetry/differential thermal analyzer with sample observation attachment

## Thermo plus EVO2

### TG 8121 with sample observation attachment



#### 1. Introduction

TG-DTA is a thermal analysis technique that measures the weight change of a sample (thermogravimetry, TG), and endothermic and exothermic reactions based on the difference in temperature between the sample and a reference (differential thermal analysis, DTA) during a programmed temperature change. It can measure the weight changes associated with dehydration or decomposition, and the temperatures of endo/exothermic reactions such as melting and transition.

TG 8121 with sample observation attachment, a new entry in the Thermo plus EVO2 series, allows visual observation of the sample by a CCD camera mounted directly above the specimen while performing conventional TG-DTA measurements.

#### 2. Features

##### 2.1. Visualization

With conventional TG-DTA systems, one cannot observe the visual changes of samples during measurement. TG 8121 with sample observation attachment provides images of the samples together with the TG-DTA measurement results, which allows you to visually observe the behavior of the samples during reactions, including morphological changes upon melting, any color changes associated with a transition, and foaming and volume shrinkage during the decomposition process.

By observing the visual changes in the samples, you should be able to learn more about various phenomena that were difficult to understand solely by analyzing the TG-DTA measurement results.

##### 2.2. Variable observation settings

You can capture images of the samples at a minimum interval of 1 sec and also change other image-capturing parameters, such as temperature range, time and output values.

The system records temperature and time together with the image data, so you can check the temperature at which each image was captured just by viewing the image.

##### 2.3. Analysis method

By using the Thermo plus EVO analysis software, the captured images can be played back as a movie to see the process of any changes. The playback speed can be increased, which is useful for viewing long measurement results in a short time.

You can also attach images captured at a given temperature to the TG-DTA measurement results, or display sequential images captured within a specified temperature range on the analysis screen.

The software also enables data processing, such as indicating the sample length on the image, providing color information (RGB codes) at a given point, and creating a side-by-side display of multiple images for comparison.

##### 2.4. Auto sample changer

An auto sample changer can be connected to the system to allow continuous measurement and observation of multiple samples in an unattended manner.

##### 2.5. Easy maintenance

A CCD camera and an electric furnace are provided as a single unit (sample observation attachment), which

can be readily mounted on an existing Thermo plus EVO2 TG8120 or 8121. Sample observation and measurement can be performed with a conventional TG-DTA by replacing its electric furnace with this sample observation attachment. Also, you can easily choose between available electric furnaces depending on the purpose of the measurement.

Moreover, the quartz tube can be rotated to overcome the loss of transparency problem caused by gases produced by the sample. Up to three measurements can be performed using the same quartz tube. When samples are expected to cause transparency loss to the quartz tube, a replaceable attachment can be used to protect the quartz tube.



Fig. 1. TG 8121 with sample observation attachment and an auto sample changer.

### 3. Measurement results

The results of sample observation and TG-DTA measurement of a polyethylene terephthalate sample are shown as an example.

A baseline shift in the DTA curve, caused by a glass transition, is observed at 70°C, but no morphological change can be seen in the sample.

An exothermic peak caused by crystallization is observed at 150°C; the transparent sample turns white around this temperature, as can be seen from the captured image.

An endothermic peak caused by melting appears at 250°C, at which point the sample regains transparency and becomes liquid.

After melting, the sample gradually turns yellow due to oxidation and generates bubbles. After reaching 400°C, the sample foams to produce a noisy DTA curve, and then combustion starts to occur.

### 4. Conclusion

TG 8121 with sample observation attachment enables visual observation of morphological and color changes of samples during measurement, which cannot be achieved with conventional devices. The behavior of samples during reactions, which could not be previously observed, should serve as useful information for evaluating and interpreting the measurement results.

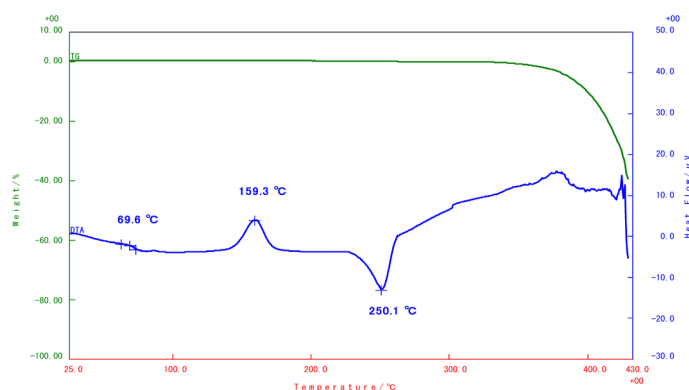


Fig. 2. TG-DTA measurement results for a polyethylene terephthalate sample.

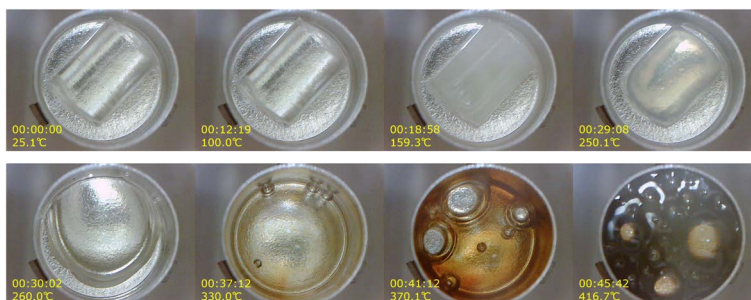


Fig. 3. Captured images of the polyethylene terephthalate sample.