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Thermogravimetric Analysis (TGA) of Rubbers

Thermogravimetric Analysis (TGA) is a testing method that measures changes in weight in a material in relation to changes in temperature. It is primarily used to measure the composition and thermal stability of materials. TGA instruments are routinely used in all phases of research, quality control and production operations.

What we can do for you?

In our advanced facility, we can perform an extensive range of TGA testing for you. Performing TGA provides a continuous record of the change in a sample's weight during dynamic or isothermal heating. Various atmospheres can be used to investigate sample reactions. TGA can also be coupled with Fourier Transform Infrared Spectroscopy (TGA/FTIR) or mass spectroscopy (TGA-MS) to identify the evolved gases.

- Determine the compound composition (weight loss)
- Oxidative degradation
- Volatilisation analysis
- Stabiliser effectiveness
- Drying rate
- Reactivity with atmospheres
- Reaction kinetics.

Sample size

The measurements are performed on 5-10 mg of sample.

Determine the compound composition

Several weight loss steps can be distinguished in the TGA curves. The first derivative of the TGA curve is needed for evaluating the different steps. An example of a TGA curve of an EPDM compound is shown in Figure 1.

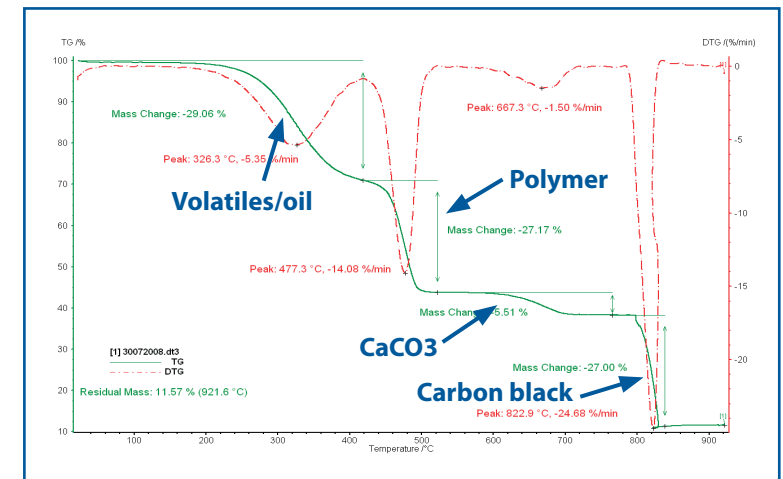


Figure 1: An example of a TGA measurement of an EPDM compound.

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Table1: Sample information and compound composition in weight %.

No	Description	Volatiles	Polymer	CO2	CaCO3*	Carbon Black	Residual
		Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
	peakX	326°C	477°C	667°C		823°C	>823°C
1	EPDM compound	29.1	27.2	5.5	12.5	27.0	11.6

* calculated from the CO2 content.

PeakX is the maximum of the first derivative of the TGA curve.

The compound composition as a result of the evaluation of the TGA curve is given in table 1

Based on the shape of the derivative and peak temperature, the polymer could be EPDM (this could be confirmed via FTIR). Most probably the compound contains calcium carbonate (based on just the weight loss pattern). This could be confirmed via X-ray fluorescence (XRF). Based on this assumption the sample contains 12.5 % CaCO₃. At the end of each TGA measurement at 925°C a certain mass remains that is called the residual mass. The residual mass is the ash content of the sample and contains inorganic components. Because the sample contains 12.5% CaCO₃ this means that the ash of the sample contains 7% CaO. The residual mass without CaO is 4.6%. More information about the residual mass can be obtained by performing an elemental analysis with XRF.

Stretch your thinking in polymers

We think about polymers differently because we understand the complete spectrum of polymers - from research and development to production and end of life disposal. Credit our decades of experience in materials analysis and processing, chemical engineering and safety testing, as well as product enhancement and polymer recycling issues. We can help you think beyond the way you're currently producing polymers.

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