APPLICATION BRIEF

Thermographic Analysis – Mass Spectrometry

The Analysis of Ethylene Vinyl Acetate by TG-MS

Introduction

The combination of thermogravimetric analyzers (TGA) with mass spectrometers (MS) to analyze the gases evolved during a TGA analysis is a fairly well-known technique. In this application, TG-MS technology is used to determine the components of an evolved gas from the TGA of ethylene vinyl acetate (EVA). EVA is a polymer used in many industries – two common applications are in solar panels and foam for footwear.

Experimental

This analysis was performed on a PerkinElmer® Pyris™ 1 TGA using alumina pans and the standard furnace. The instrument was calibrated with nickel and iron and all samples were run under helium purge. Heating rates varied from 5 to 40 °C/min, depending on the sample under test. The furnace was burned off between runs in air. Samples were approximately 10-15 mg. Data analysis was performed using Pyris 9.0 Software.

During the TG-MS analysis, the PerkinElmer Clarus® 600 C MS was used. In the TG-MS work, a 0.1 mm i.d. deactivated fused-silica transfer line was connected directly to the MS. The transfer line was heated to 210 °C. The data analysis was performed using TurboMass™ GC/MS Software.

Results

In this example, ethylene vinyl acetate (EVA) and the components of the evolved gas are analyzed to confirm their identity. Figure 1 (Page 2) shows the thermogram from the TGA of EVA.

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The thermogram demonstrates two weight losses, the first corresponding to acetic acid and the second corresponding to fragments from the polymer backbone. The MS analysis (Figure 2) of the evolved gas confirms the identity of acetic acid with spectral data included in Figure 3.

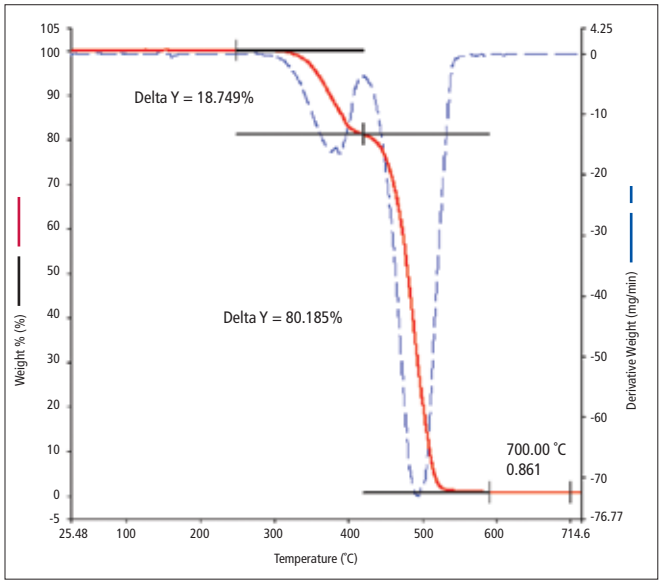

Figure 1. TGA curve generated from the analysis of EVA samples.

Conclusions

TGA analysis allows quantification of the weight loss of a material at specific temperatures. The coupling of the TGA with the MS increases the power of the technique by providing the ability to identify the species evolved during thermal analysis.

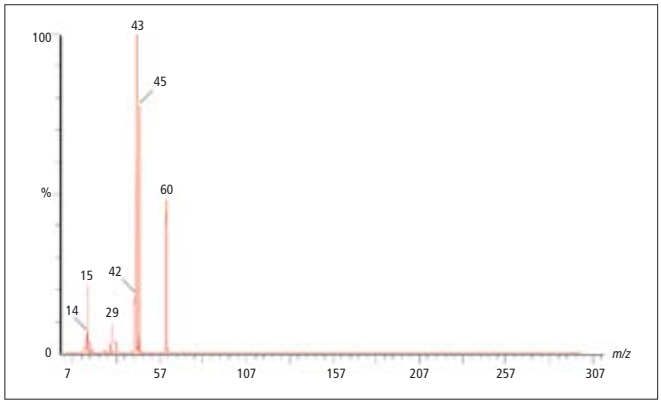

Figure 3. Spectral data verifying the identity of the evolved gas from the first transition of the TGA as acetic acid.

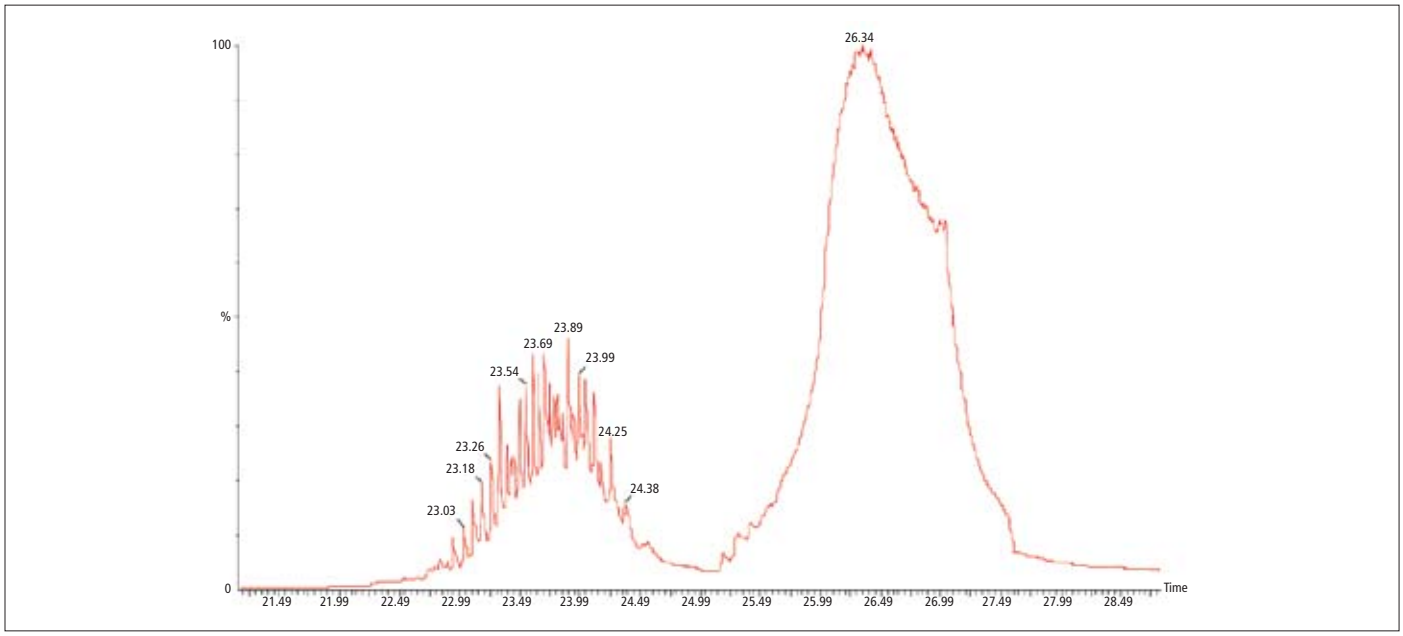

Figure 2. The MS analysis of the evolved gas generated during the TGA of EVA.

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