

Compositional Analysis of Complex Materials with TGA-GC/MS

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ABSTRACT

Compositional analysis with thermogravimetric analysis (TGA) provides precise quantitative data about the composition of complex materials such as e.g. polymers. General content data such as the amount of volatiles, total polymer and carbon black, and the total inorganic residue can be obtained with simple thermogravimetric measurements.

To obtain more detailed qualitative information, often so-called evolved gas analysis (EGA) is performed. With evolved gas analysis, the decomposition products from the TGA measurement are transferred into a gas analysis instrument such as a mass spectrometer or an infrared spectrometer. TGA-MS or TGA-FTIR data provide detailed information about the decomposition products released during the TGA analysis at certain times or temperatures [1, 2].

A significant drawback of these techniques, however, is that they are not able to separate decomposition products. Especially with polymers usually several compounds are evolved simultaneously. This complicates the analysis of FTIR as well as MS data considerably. In fact, it is virtually impossible to identify individual decomposition products.

This problem can be remedied by separating different compounds before their identification. This can be achieved by combining e.g. GC and MS. In this contribution we will present a novel approach to combine TGA with GC/MS [3, 4]. We propose to use a dedicated, heated interface allowing collection of up to 16 gas aliquots at predefined temperatures during the course of a TGA experiment. The gas aliquots are then injected one by one into the GC. In the GC the different compounds in the gas sample will be separated and subsequently identified by MS. The power of these TGA-GC/MS measurements will be illustrated with several application examples.

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