

**A new method for analyzing the decomposition gases of polymers by thermogravimetric solid-phase extraction thermal desorption gas chromatography mass spectrometry (TGA-SPE/TDS-GC-MS)**

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The common method for analyzing the decomposition gases of polymers are thermogravimetry coupled with Fourier transformed infrared spectroscopy or mass spectrometry (TGA-FTIR/MS). The disadvantage of both methods is the difficulty in identification of complex hydro-carbon molecules because of overlapping signals. Thus only small molecules like CO<sub>2</sub>, NH<sub>3</sub>, H<sub>2</sub>O etc. can be identified and quantified with a high certainty. Therefore, a new method was developed which trap the gaseous thermal decomposition products out of the TGA on solid-phase adsorber: twister (TGA-SPE) [1]. The twister were desorbed by thermal desorption gas chromatography mass spectrometry (TDS-GC-MS). By this the compounds are separated through the chromatographic column and can be easily identified by mass spectra comparison with MS libraries. This method shows a good repeatability and even semi quantitative and quantitative measurements were carried out. Comparison measurements with pyrolysis gas chromatography mass spectrometry (Py-GC-MS) show that the qualitative results are almost the same. In contrast to TGA-FTIR/MS and Py-GC-MS the problems through impurities are reduced, because of the separation of adsorption and desorption process. No time consuming cleaning cycles are necessary before the next measurement. However, the TGA-SPE/TDS-GC-MS shows a limitation for compounds with a boiling point lower 110 °C (heating temperature of the TGA interface). Therefore, this method is a perfect addition to TGA-FTIR/MS where predominately small molecules can be identified and quantified.

[1] E. Duemichen, U. Braun, R. Senz, G. Fabian and H. Sturm, *J. Chromatogr. A*, **1354**:117-128 (2014).