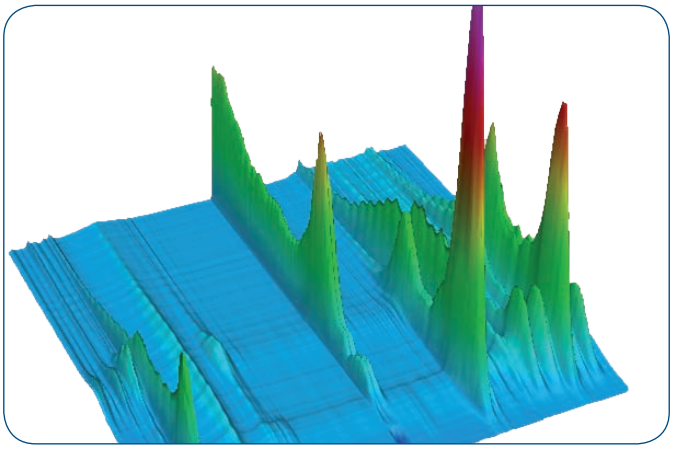


Application Note AN M10

TG-FT-IR Analysis

Netzsch Thermal Analysis and Bruker Optics offer the integrated TG-FT-IR coupled system.

TG-FT-IR

- Easy-to-use, powerful, integrated software
- Optimized low volume design
- Vacuum compatible to remove oxygen, eliminate carryover, and lowering boiling points
- Easy maintenance of gas cell and transfer line
- Optional 64 position automatic sample changer

Thermogravimetric analysis (TG) follows changes in mass of the sample as a function of temperature and/or time. TG gives characteristic information about the composition of the measured sample, in particular the amounts of the various components and their thermal behavior. In addition, further measurements are possible such as kinetic analysis of thermal decomposition. An identification of gases released directly from the sample or during thermal treatment cannot be performed just by thermal analysis. For this purpose, coupling a spectroscopic method such as Fourier-Transform-Infrared (FT-IR) spectroscopy is an excellent solution. IR spectroscopy is a classical technique, which depends upon the interaction of infrared radiation with the vibrating dipole moments of molecules. It gives, with the exception of homonuclear diatomics and noble gases, a characteristic spectrum for each substance.

A 588 TG-FT-IR module consists of a stainless steel gas cell, which has been designed for optimal IR beam geometry. It has an optical path length of 123 mm. The very small active volumes of the thermal micro balance (2.4 ml), the transfer line (4.5 ml) and the gas cell (8.7 ml), a very low transfer gas flow can be used. This leads to a high concentration of the evolved gases transported into the gas cell. Because of the vacuum-tight construction of the thermal micro balance Fig. 2 and the gas cell, both systems can be evacuated together. The much smaller amount of residual gases minimizes their influence on the decomposition process and their reaction with the released gases.

TG-FT-IR Application Areas

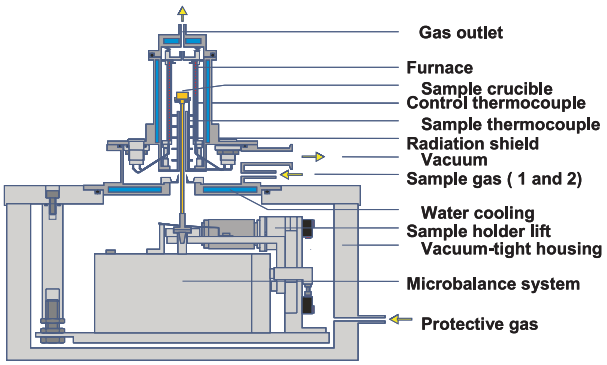
- Outgassing of Materials
- Detection of Residues
- Analysis of Additives
- Analysis of Aging Processes
- Competitive Analysis
- Characterization of Natural and Raw Materials
- Desorption Behavior
- Analysis of Synthesis Processes
- Analysis of Decomposition Processes

Optimized TG-FT-IR Gas Cell

The TG-FT-IR Fig. 2 interface has been engineered so that cleaning is no longer a time consuming process requiring expert knowledge. The cell features easily removable ends which can be unscrewed for the cell for maintenance purposes, and the transfer line is a disposable Teflon tube which can be easily replaced.

The nature of IR spectroscopy, which is a non destructive method, means that single components can be analyzed from the spectra of mixtures. The evaluation of gas phase IR spectra is simplified because there is only minimal molecular interaction. Therefore IR spectra of gas mixtures can be resolved into their single components by subtracting away library spectra of the corresponding pure compounds. Large libraries of infrared spectra of gases and vapors are available, simplifying identification of components.

Fig. 1 Internal view of TG 209C Iris



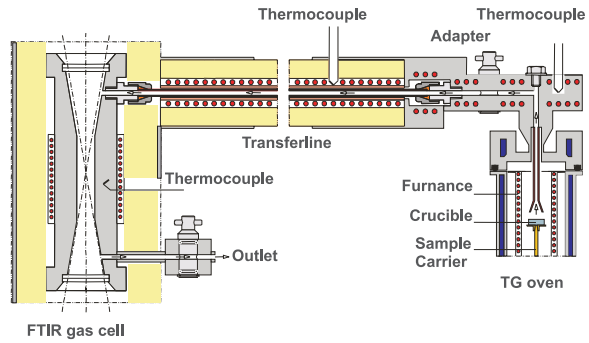


Fig. 2 (see text)

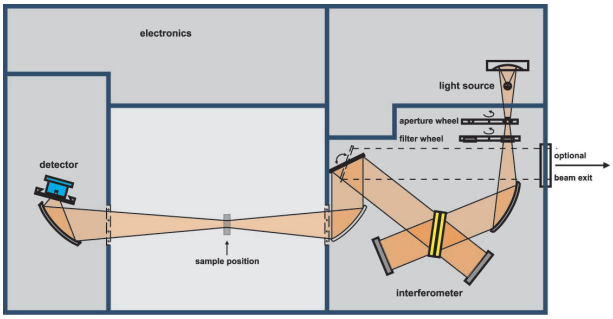


Fig. 3 Beam path in the TENSOR 27

TG-FT-IR is based on a coorperation with
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