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Quantitative calibration of spectroscopic signals in combined TG-FTIR system

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Abstract

In thermoanalytical investigations the determination of the composition of the evolved gases is very important, especially when investigating decomposition processes or gas–solid reactions occurring in multi-component systems. The potential of simultaneous techniques, enabling the qualitative analysis of evolved species, such as TG-MS or TG-FTIR has been further improved by the introduction of the pulse thermal analysis (PulseTA®). This method provides a quantitative calibration by relating the mass spectrometric or FTIR signals to the injected quantity of probe gas.

The influence of several experimental parameters such as concentration of the analyzed species, temperature and flow rate of the carrier gas on FTIR signals has been investigated. The reliability of quantifying FTIR signals was checked by relating them to the amount of evolved gases measured by thermogravimetry. In order to extend the opportunities for quantifying FTIR signals, the possibility of the injection of liquids into the carrier gas stream was studied. The linear dependence between the injected amount of liquids and the integral intensity of spectroscopic signals (peak area) enabled easy quantification of FTIR data. Systematic studies on a new method based on isothermal vaporization of liquids further widen the application range of in situ calibrations.

Keywords: TG-FTIR; Hyphenated techniques; Quantitative evolved gas analysis; Calibration techniques; Pulse thermal analysis combined with Fourier transmission infrared spectroscopy; Thermal analysis