Injection of Liquids and Gases in Order to Quantify Evolved Species by Means of STA-FTIR

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Well-established coupling techniques such as TG-FTIR or STA-MS enable the identification of the gases that are evolved during thermal analysis experiments. The Pulse Thermal Analysis ( PulseTA® ) (fig. 1) was developed in order to enable not only the identification but also the quantification of the evolved gases. By applying well-defined volumes of the injected gas, and comparing the intensity of the resulting FTIR signal with the intensity of the evolved gas, the quantity of the latter can easily be determined. This method has so far been limited to gases such as CO₂, CO, NO and CH₄.

The new injection port (fig. 2) that has been developed together with ETH-Zürich additionally enables the injection of liquids and therefore allows quantification of such evolved gases, which are in liquid state at ambient conditions.

The gases are injected into the inert carrier gas stream before entering the STA unit. The liquids, on the other hand, are injected at the beginning of the heated transfer line (fig. 2). The thermal decomposition reactions of CaCO₃ and NaHCO₃ when injecting gaseous CO₂ and liquid H₂O are illustrated below.

![Scheme of Pulse Thermal Analysis (PulseTA®)](image1)

![Scheme of STA-FTIR transfer line including the liquid injection port](image2)

![Decomposition of CaCO₃, 3D view of IR spectra](image3a)

![Decomposition of NaHCO₃, quantification of H₂O](image3b)

![Decomposition of CaCO₃, quantification of CO₂](image4a)

![Decomposition of NaHCO₃, quantification of H₂O](image4b)