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Thermal Analysis for the Characterization of Drug Substances and Excipients

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Thermoanalytical instruments have been widely applied over the past years to create the experimental basis for a great variety of applications within the pharmaceutical and related chemical industries. The use of instruments and analytical methods in different areas, such as research units, chemical and galenic development laboratories and analytical control organizations, requires special instrumentation and tailor-made evaluation procedures.

In many cases information achieved by monofunctional techniques, measuring a single independent physical property is not sufficient for a complete characterization of drug substances and excipients. The combination of two or more measuring principles, as in simultaneous and coupled instruments becomes necessary. Typical representatives for simultaneous instruments are the combinations of thermobalances with differential scanning calorimeters, measuring weight changes and temperature and enthalpy of transitions under identical surrounding conditions very accurately.

The connection of sensitive gas analyzers, like mass spectrometry and Fourier-transform infrared spectroscopy, via appropriate interfaces to thermobalances represent up-to-date coupled systems.

"Thermoanalytical characterization of pharmaceuticals" is the title of a recently issued book, dealing with the application of various thermal-analysis-techniques for the analysis of selected drug substances and materials, widely used in pharmaceutical formulations. Most of the collated examples reveal the necessity of complementary analytical techniques for a deeper characterization of solid state properties like amorphous or crystalline structure, polymorphic transitions, eutectic purity, hydrate or solvent content and thermal stability.

The physical stability of a crystalline drug substance at the final step of the chemical production pathway, and also within the consecutive physical and mechanical production steps as well in the pharmaceutical processes is extremely important.

Gibbs free energy functions, based on DSC data for melting points and enthalpies of fusion of polymorphic forms, are applied to enable the calculation of transition temperatures on a thermodynamic level.

The identification of trapped solvents, even in low concentration of 0.1% (by weight) evolved during melting of Naftopidil, was successfully achieved by modern TG-FTIR coupling.

A selection of applications described in the new application volume will be presented and interpreted.