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Thermal Analysis

Overview

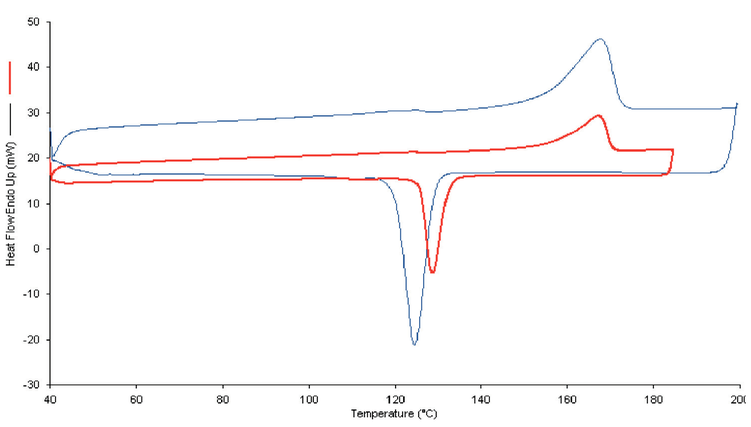
Thermal analysis may be defined as the measurement of the physical and chemical properties of materials as a function of temperature or time. Thermal Analysis instruments typically measure heat flow, weight loss, dimension change, or mechanical properties as a function of temperature. Properties characterized include melting, crystallization, glass transitions, cross-linking, oxidation, decomposition, volatilization, coefficient of thermal expansion, and modulus. This allows the user to examine end-use performance, composition, processing, stability, and molecular structure and mobility.

Technical Details

- Perkin Elmer DSC 8500; Range -90° to 600 °C; scanning rates up to 75K/min
- Perkin Elmer DSC Pyris 1; Range -55°C to 600°C
- Setaram Labsys DSC/TGA; Range 25°C to 1100°C
- Netzsch Polyma 214; Range -40°C to 600°C; scanning rates up to 500K/min
- Perkin Elmer TGA 4000; Range 25°C to 1000°C

Perkin Elmer Pyris 1 DSC

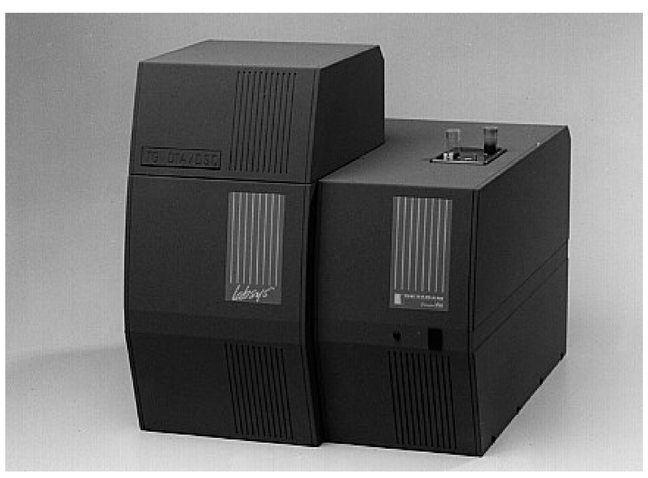
- The Intracooler allows temperature range of -60°C to + 600 °C
- An air shield to prevent moist air from settling into, and maintaining the sample holder region dry and frost–free
- Samples as small as 1 mg can be analysed at rates of up to 300°C per minute.
- Specific Heat capacity measurement
- Power compensating calorimetry



A Typical Pyris 1 DSC study of polyethylene (left). The blue curve illustrates the thermal characteristics of the parent polymer prior to processing. The red curve illustrates the different thermal properties of the reground polymer. This could affect the processing regime required to manufacture products with stable mechanical properties.

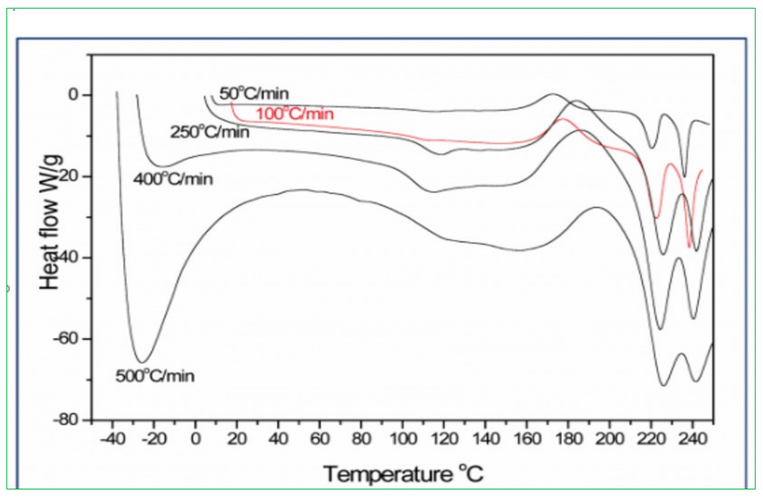
Setaram Labsys

- Temperature scanning rate 0.01 to 50°C.min
- Ambient to 1400°C (nominal)
- Interchangeable DSC and DTA rods
- TGA available on both DSC and DTA
- Heat flux calorimetry



Applications

Differential Scanning Calorimetry (DSC) measures the difference in Heat Flow Rate between a sample and inert reference as a function of time and temperature.



Different ramp rates can show how the sensitivity towards the thermal transitions of a sample is increased at high heating rates (endothermic peaks are down)

DSC can

- Identify polymorphic forms of a compound
- be used to characterize a solid dispersion system
- determine the miscibility of the components for understanding of dissolution and release kinetics
- analyse the dissolution of solid dispersions
- Study of solid-state kinetics such as accelerated stability, decomposition, and the effects of aging on different pharmaceutical formulations

In Thermogravimetric Analysis (TGA), the mass of a sample is measured over time as the temperature changes. This provides information about phase transitions, decomposition, absorption and desorption as well as chemical phenomena.

- Typical applications of thermogravimetry are the measurement of absorbed moisture and the characterisation of associated hydrates. The loss of solvents other than water may also be measured and, in addition, the degradation of samples in various purge gas atmospheres may also be recorded as a function of time and temperature. It is an especially useful technique for the study of polymeric materials, including thermoplastics, thermosets, elastomers, composites, plastic films, fibres, coatings, paints and fuels.

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